



Measuring government sector productivity in New Zealand:

a feasibility study

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Preface

There has been growing interest in gaining a better understanding of the performance of government services, not only in New Zealand but around the globe. This growing importance of measuring government services is reflected in a variety of international publications, notably the *Atkinson Review 2005* and the *Stiglitz-Sen-Fitoussi Report of the Commission on the Measurement of Economic Performance and Social Progress 2009*.

The performance of government services is multi-faceted, with many different aspects that could be measured. One important aspect is productivity, which compares change in the volume of services produced with change in the volume of resources used in producing those services: providing the same amount of services for fewer inputs, or providing more services with the same amount of resources means greater productivity and vice versa.

This *feasibility study* is part of Statistics New Zealand's response to the growing interest in the measurement of government services. It draws on the best practice guidance provided by other countries and international institutions, and interprets this for the New Zealand situation. The *feasibility study* shows that it will be possible to estimate productivity change for government health care and education services using statistical methods that are at least as good as the best methods used by other countries.

This report has benefited from the extensive understanding of the health care and education systems, and the accompanying data sources from a number of people. I am grateful for the advice received from the external advisory committee for this project, and for the invaluable assistance from the Ministries of Health and Education. Additionally, I wish to thank the authors, Phillip Lee and Jodi York.

Statistics NZ welcomes feedback from users on the methods and sources presented in this report.



Geoff Bascand
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Standards and further information

Source

All data are compiled by Statistics New Zealand, except where otherwise stated. Both administrative and survey data has been used in this report.

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1 Overview

This is a report from Statistics New Zealand's *feasibility study* into how change in the productivity of government services in New Zealand might be measured. The *feasibility study* has focused on the measurement of government health care and education productivity as these are perhaps two of the most important government services as far as many people are concerned. Furthermore, these are the services which receive the highest public expenditure, and which have been studied the most by other countries and international organisations.

The main conclusion from the *feasibility study* is that it will be possible to estimate change in the productivity of government health care and education services in New Zealand according to the best current practice worldwide. Indeed, the statistical quality of existing estimates of health care and education services is already as good as that of many other countries.

The *feasibility study* notes that there are some big challenges for the compiler, the main ones being:

- (i) **Scope:** There are a number of different ways of looking at what constitutes the scope for government productivity estimates. The three main ones being: the **industry** perspective (how much does the health care or education industry contribute to total economic output?); the **public /private** perspective (how do publicly-owned parts of the health care and education systems contribute to the economy?); and the **financing** perspective (how well are taxpayer funds, or government controlled funds, being used in delivering health care and education?) Dealing with this challenge requires the establishment of what the question(s) is (are) for users with an interest in government productivity estimates. A first step should be to address the industry perspective to provide estimates of government productivity that are consistent with Statistics NZ's existing market sector productivity estimates.
- (ii) **Defining government output and dealing with quality change:** it is generally acknowledged that measuring change in services (for example, legal and banking services) is more difficult than measuring change in goods (for example, bread and motor vehicles). Government tends to produce services rather than goods. And while there are many sources on the number of health care and education services, there is a relative dearth of systematically-available information on how the quality of those services is changing over time (and how the different aspects of quality can be drawn together into a single whole). This *feasibility study* concludes that estimates of change in the quality of services should not be combined with estimates of change in the quantity of services, until there is an international consensus on how this should be done.
- (iii) **Lack of prices:** In the government sector, there are either no prices, as services are typically provided for free, or the amounts paid do not reflect the relative value given by the price in a competitive market (due, for example, to subsidisation). An alternative method for placing a relative value on government services is needed. Consistent with international guidance, this *feasibility study* concludes that the costs of production are the most suitable way of establishing the relative value of those goods and services for which there are no prices.

2 Guidance for the reader / how to read this report

The authors of the *feasibility study* expect there to be different audiences reading the report. This section provides guidance for those different audiences in how to read the material.

This main report from the *feasibility study* has been organised in a way that should allow readers with different levels of interest to pick and choose what is read. A guiding principle in organising the material has been to focus on the needs of the main target audience for this *feasibility study*. This main target audience is expected to be future compilers of estimates of government output and productivity. As such, several sections provide a formidable amount of information, all of which are necessary for future compilers, but may be of lesser importance to a less involved reader, who may wish to skip these sections. The main examples of this are section 5 on concepts and sections 9 and 10 on data availability.

This main report is in three parts: the first part, covering sections 1 – 4 sets the scene for measuring government productivity, and introduces the main concepts and issues. The middle part, covering sections 5 – 8, provides detailed concepts, discusses application of the concepts for health care and education, and draws together the recommendations from throughout this main report. The last part, covering sections 9 – 11, presents the data sources that have been identified during the *feasibility study*, and sets out the current international practices for compiling health care and education output and productivity estimates.

Table 1 sets out guidance for the three main types of reader, with a cross indicating items of interest and a double cross indicating that reading is essential for that audience.

Table 1 Guidance for different audiences on reading this *feasibility study*

Section	Type of reader		
	Future compiler	Less involved reader	Casual reader
1. Overview	X	XX	XX
2. Guidance for the reader	XX	XX	X
3. Context	X	X	X
4. Introduction to measuring productivity	X	X	
5. Concepts	XX		
6. Health care	XX	X	
7. Education	XX	X	
8. Data availability: health care	XX		
9. Data availability: education	XX		
10. Implementation around the world	XX	X	
11. Recommendations	XX	X	

In parts of this report, some of the text is shaded in grey. This signifies that the text forms either a recommendation, a hint or a cautionary note. Recommendations have been identified with a letter (G for general, H for health care, or E for education, respectively).

3 Context

In 2003/04, Statistics NZ received funding under the government's Growth and Innovation Framework (GIF) for five years to begin the long-term development of productivity statistics. In the first quarter of 2006 the first official measures of annual labour, capital and multifactor productivity covering the 1988–2005 years were released. This first series excluded: government administration and defence; health; education; business services; personal and other community services; commercial and residential property services; and ownership of owner-occupied dwellings.

Further funding was provided in 2006 following feedback from our key users who required a longer time series, industry level productivity and public sector productivity measures. To date that funding has provided the following developments:

- In October 2007, Statistics NZ published its first official series, backdated to 1978 with 'growth cycles' published to enhance analysis.
- In March 2008, Statistics NZ published an official series with an expanded measured sector (including business services, and personal and other community services) backdated to 1996. This brought the measured sector coverage up from 63 percent to 73 percent of the whole economy.
- Following the successful outcome of a *feasibility study*, Statistics NZ produced an official series of quality-adjusted labour measures. This was published on 3 December 2008 and is now produced on an annual basis.
- Statistics NZ is currently developing industry-level labour, capital and multifactor productivity statistics for the measured sector. These are due to be published this year and will be updated on an annual basis.

A comprehensive *feasibility study* exploring the measurement of government services output was also requested by key users. In 2008, we were able to second Mr Phillip Lee from the UK Office for National Statistics. Mr Lee has extensive expertise in the area of measuring health care output and worked with Sir Tony Atkinson producing the *Atkinson Report*. Along with Dr Jodi York, a senior staff member with Statistics NZ, he has worked closely with the Ministries of Education and Health to produce this report.

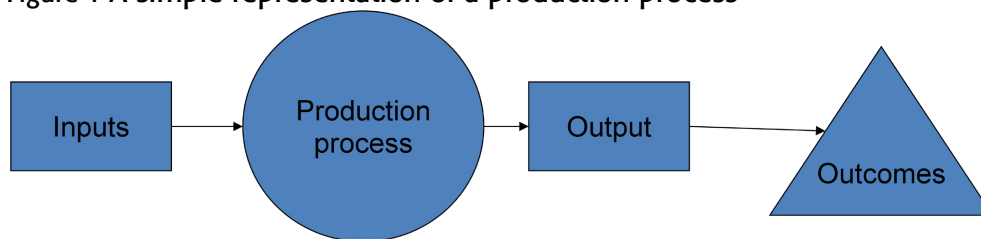
4 Introduction to measuring productivity

This section provides a brief introduction to what productivity is and, perhaps just as importantly, what it is not. This section also covers the most important challenges facing the compiler. The idea is to provide a brief overview for the casual reader. For those interested in greater technical detail of the concepts and definitions, this detail can be found in section 5.

4.1 What is productivity?

As the name implies, productivity is a measure associated with production. Productivity is defined to be the ratio of output to inputs. Further information on the different ways of calculating this ratio can be found in section 5.3.7. Figure 1 is a representation of a simple production process. This shows in a simple form that inputs are used in a production process to produce output, which is consumed in order to achieve one or more outcomes.

Figure 1 A simple representation of a production process



To illustrate what these terms signify, here is a health care example: a person breaks a leg, which turns out to be an incomplete, closed fracture (the bone is not separated into two parts and the skin is not broken). These are the individual activities that make up the typical production process:

- NZ emergency services deal with call and send out ambulance
- Ambulance provides first aid and delivers person to hospital
- Accident and Emergency ward evaluates the injury
- Movement of the leg is restricted, using either a splint or cast
- Medications are prescribed to reduce pain and inflammation
- Recovery is monitored, either in primary care or outpatients
- The splint or cast is removed after the healing process

Inputs are divided into three factors of production: labour, capital, and consumables (in economic accounting, consumables are referred to as intermediate consumption).

In the example above, labour includes the time spent by a number of different health professionals, including the ambulance staff and those working in accident and emergency. This also includes administrative staff, including the person staffing the emergency telephone and all of the support staff.

Intermediate consumption includes the medical supplies such as the splint and the medication, as well as all other kinds of consumable such as electricity, building rental, petrol for the ambulance and so on.

Capital includes the buildings that are owned (not rented) and the ambulance.

The production process consists of the different activities listed above.

The output is a whole course of treatment for the patient (see section 6.2.1 for further information on this definition).

The outcome is that the person can return to work and enjoy their social life with full mobility and no pain.

An absolute measure of productivity is in itself not interesting: it is only meaningful as part of a comparison. The type of comparison that is the object of this *feasibility study* is a time-series comparison, that is, how is productivity changing over time. The other type of comparison is a spatial comparison, that is, how is productivity different between, for example, countries. This *feasibility study* does not specifically address the measurement of spatial comparisons of productivity, but the principles set out in this *feasibility study* are as apt for this as for time series comparison.

The focus of this *feasibility study* is therefore on how productivity is changing over time. Change in productivity is defined as the ratio of the change in the volume of output to change in the volume of inputs. For the equivalent in mathematical notation and a discussion of different types of productivity equation, please refer to section 5.3.8.

Change in productivity can be thought of as a residual: what is left over when changes in measured output and measured inputs are controlled for. When looked at in this way, it can be seen that this productivity residual is a compound of a number of different possible factors:

- Any error in measured inputs (for example not taking full account of the substitution of part-time for full-time work).
- Any error in measured output (for example not taking into account quality change).
- Any bias introduced in distinguishing between price and volume effects over time.
- The introduction of new technology to the production process which reduces the resources required for producing the same output
- Changing technical efficiency of a production process.
- Changing allocative efficiency associated with the range of different production processes in an economy.

Arguably, the more interesting components are the latter three, but clearly any measurement error due to the first three will show up in the productivity residual, and the statistician's task is to minimise the impact from these sources of measurement error.

4.2 And what is productivity not?

Those interested in the performance of government services may be interested in productivity performance as one aspect of performance, but there are other indicators of use beyond productivity. As part of a package of indicators that might be useful to those wishing to understand the economic performance of government services, three other high-level indicators are typically studied, each of which is slightly different, and are thought of as the ‘three Es’: economy, or value-for-money, efficiency, and effectiveness. Whereas productivity and efficiency tend to have fairly well accepted definitions, there is a lack of consensus in the definitions of economy and effectiveness. Each takes on slightly different meanings depending on the context:

- Technical efficiency is about minimising the resources used in producing a particular output.
- Allocative efficiency is about choosing the right mix of inputs and output given their relative prices.
- Economy, or value-for-money tends to refer to a measure of cost per output or cost per input.
- Effectiveness tends to relate outcomes to either inputs or output.

Irrespective of these different concepts and the relationships between them, this *feasibility study* concerns the measurement of productivity change and not to economy, efficiency, or effectiveness per se. That is not to say, though, that these other concepts are any less or any more important. Productivity estimates should be distinguished from performance measures. Productivity estimates provide insight into the drivers of economic growth by breaking down growth into growth of inputs, growth of output, and changes in productivity. Tracking the volume of services provided and the resources required to do so is a subset of performance measurement, and says little about the value to final users or how the services are being provided. Stevens, Stokes, and O'Mahony (2006) found almost no relationship between labour productivity and the star ratings assigned in hospital performance management systems in the UK, so caution is strongly urged.

Cautionary note G1

Change in productivity, or change in the ratio of output to inputs, is one of many indicators that may be of interest to those wishing to understand the performance of (or parts of) the economy. Productivity is one measure of how efficiently the economy is using inputs to produce output. Other indicators of performance include, for example, economy, value-for-money, and effectiveness.

4.3 Why government productivity and why health care and education?

This study is about the feasibility of measuring change in government productivity for a number of reasons. Government expenditure and production are sizeable proportions of the total economy, so gaining an understanding of government productivity performance would lead directly to an improved understanding of the productivity performance of the whole economy. Furthermore, understanding government productivity is useful in its

own right as part of a response to an increasing interest in accountability of public expenditure. Taxpayers have a right to understand how their tax contributions are used in providing essential services to the population at large.

A major report commissioned by the President of France, Nicolas Sarkozy, and published last year by Professors Joseph Stiglitz, Amartya Sen and Jean-Paul Fitoussi (Stiglitz 2009) repeats these messages, dwelling on the importance of “improving the measurement of government-provided services”, and stressing the need to use economic measures of performance, such as productivity, alongside other measures that are important in order to get a broad view of performance.

This study does not cover all government services, however. It focuses on health care and education as these are perhaps two of the most important services as far as many people are concerned. Additionally, health care and education services are the services which receive the highest government expenditure, and their measurement has been studied the most by other countries and international organisations.

Subject to the availability of resources and priorities, it would be possible to extend any analysis to other government services: many of the issues and potential solutions for health care and education discussed in this study are also apt for other types of government service. Indeed, other countries have published estimates of the productivity of other government services. The United Kingdom, for example, has also published articles on the police (ONS 2009), children’s social care (ONS 2008a), social security administration (ONS 2008b), the criminal justice system (ONS 2008c), defence (ONS 2008d), and adult social care (ONS 2007).

4.4 Main challenges in measuring government productivity

This sub-section sets out what the main challenges are in measuring government productivity. These challenges mainly relate to the measurement of output: the measurement of inputs is relatively straightforward, although far from trivial.

Before that, it is important to point out that it would be possible to measure change in government health care and education productivity in New Zealand according to best practice worldwide. Indeed, the estimates of health care and education output that are currently produced (see sections 6.2 and 7.2) are as good as those produced by many other countries. Only a small number of incremental improvements would need to be made to the sources and methods employed in compiling these estimates to bring the estimates up to the very best worldwide practice.

The first challenge relates to the definition of scope for any government productivity measure: determining what the coverage is in terms of the output and inputs. The second challenge concerns the measurement of quality change in government services, and how to incorporate estimates of quality change into (the relatively easy-to-compile) estimates of quantity change.

The third main challenge is about establishing the relative value or importance of the different services provided by government. In competitive markets, prices convey this information on relative value. There tends not to be the equivalent of market prices for

government services so a different method is needed for establishing the relative value for government services.

Other issues associated with government productivity measurement, beyond these main challenges, are set out and discussed in section 5.

4.4.1 Scope

A key question which needs to be addressed concerns the scope, or coverage, of government productivity measures for health care and education. There are a number of perspectives from which productivity performance is of interest, and from each perspective the question, and therefore the answer, is not necessarily the same.

From the National Accounts perspective, as well as the economy-wide productivity performance perspective, the question would be, 'how much does the health care or education industry contribute to total economic output?' Here the scope is defined by **industry** (according to the ANZSIC classification). A first step should be to address the industry perspective to, provide estimates of government productivity that are consistent with Statistics NZ's existing market sector productivity estimates.

From the perspective of those in charge of public sector service provision, one of the economic questions might be, 'how do publicly-owned parts of the health care and education systems contribute to the economy, and how is the associated productivity changing over time?' Here the scope is defined by whether the production is carried out by the **public or private sector**.

From the perspective of taxpayers, the question might be, 'how well are taxpayer funds, or government controlled funds, being used in delivering health care and education?' Here the scope is defined by the **source of financing**. Variations on a theme are provided by whether this question is narrowly defined to cover only Ministry of Health or Ministry of Education funding, or other parts of the public sector – such as the Accident Compensation Corporation, Ministry of Social Development, prisons and the armed forces – incurring expenditure on health care and education.

These scoping questions matter, as the information requirements differ and perhaps more importantly the end results will also differ.

This feasibility study does not offer a single answer to these particular scoping questions, but rather sets out how sources and methods can be combined for whichever of the different measures is required. Scoping issues specific to health care and education are discussed in greater detail in sections 6 and 7.

Recommendation G1

Any implementation of this study should be clear what the question(s) associated with any requested productivity measure is (are), with particular emphasis on the perspective of the measure.

Recommendation G2

A first step in implementing this study should be to address the industry perspective, to provide estimates of government productivity that are consistent with Statistics NZ's existing market sector productivity estimates.

4.4.2 Defining government output and dealing with quality change

While the equivalent of competitive market prices for government services is not available, information on what public services are provided is relatively plentiful. Information exists on, for example, the number of operations performed in hospitals, or the numbers of pupils taught in schools.

Output, however, subsumes the above concept of quantity (that is, how many...?) and the concept of quality (that is, how good...?). Change over time in, for example, the volume of hospital services, should include both the change in the number of activities performed in hospitals, as well as change in the quality of those activities.

What is problematic in deriving output volumes for government services is how to measure the way in which quality is changing. Quality is acknowledged to be multi-dimensional (speed, success, comfort, and so on) and it is not always the case that information on all of the dimensions is available. Further, there is little agreement about how these dimensions should be added together amongst the countries and international institutions that are expert in this area.

It should be noted in passing that, even in the market sector, output is sometimes just as hard to define, usually because the output is not in the form of goods, such as bread and motor vehicles, but in the form of services, such as banking or legal services.

Further detail on this is in section 5.3.2.

4.4.3 Lack of prices

In the non-market sector, there are no prices paid, as services are typically provided for free or at prices that do not reflect the relative value given by the price in a competitive market. This lack of prices compounds the difficulty of defining what output is in the non-market sector.

Prices are essential for the calculation of the volume of output. According to economic theory, prices are set in competitive markets at the level where the marginal value to the consumer equals the marginal cost of production. The price, therefore, conveys information about the relative value, or relative importance, to the consumer of each and every good and service that is bought on competitive markets. The price, or relative value, is used in economic accounting in a simple re-arrangement of the equation that says expenditure is price multiplied by volume:

1. In some cases, growth in the volume of output is calculated by taking out the effect of changing prices (inflation) from expenditure on goods and services.
2. In other cases, growth in the volume of different goods and services is aggregated into total volume of output, using prices as the measure of relative importance.

In order to create estimates of change in the volume of government output, an explicit relative value must be discerned as a replacement for the price.

The international consensus on what is the best way to deduce the equivalent of a price is to calculate the costs of production for each of the goods and services provided, and use these as the measure of relative value.

Further detail on this is in section 5.3.4.

5 Concepts and compilation challenges

Section 4 provided an overview of what productivity is, and briefly covered what the main compilation challenges are. This section discusses these challenges in more detail, as well as covering the other challenges that have come up during the *feasibility study*.

This section starts with an overview of what is internationally considered to be best practice in measuring change in government output and productivity. It then discusses in all of the challenges for measuring output and productivity (including the main challenges already set out in section 4): there is one sub-section for more general challenges, and another sub-section for those challenges that are specific to measuring government services.

5.1 Developments in best practice

Much progress has been made recently around the globe in improving measures of non-market output. Little specific attention has been paid to non-market inputs, due to the fact that markets for the inputs do exist (although there is a debate about the impact on labour markets of monopsony employers, for example) and prices which are more-or-less market prices are available. Accordingly, the measurement issues for constructing estimates of non-market inputs are no more difficult than for the market sector.

Over recent years, various publications have incrementally improved the guidance available to those wishing to construct estimates of non-market output. Table 2 presents a list of the publications with international guidance on the measurement of non-market output and productivity.

Table 2 International guidance on measuring non-market output and productivity

Publication	Organisation(s) responsible	Type of guidance on measurement of government output	Status
<i>System of National Accounts, SNA</i> (1993), new version SNA 2008 under preparation	UN, OECD, World Bank IMF, and European Commission Document prepared by Inter-secretariat Working Group on National Accounts. Approved by UN Statistics Commission	High level guidance	International standard
<i>European System of Accounts ESA</i> (1995)	Eurostat	Fully consistent with SNA 1993, more focused on the circumstances and	A legal basis to ensure strict application, providing

		data needs of the European Union	harmonised statistics
<i>Eurostat Handbook on Price and Volume Measures in National Accounts</i> (2001 edition)	Eurostat	Expansion of ESA 1995 guidance distinguishing activities, output and outcomes. Introduces A/B/C score for methods of Member States	Develops ESA 1995 to ensure harmonised price and volume data, now legally mandated
<i>OECD Manual Measuring Productivity</i> (2001)	OECD	Comprehensive guide to productivity measurement	No formal status, but indicates desirable properties of productivity measures
<i>Atkinson Review: Final Report Measurement of Government Output and Productivity for the National Accounts</i> (2005)	Sir Tony Atkinson	Comprehensive guide to measuring output and productivity for non-market government services	Accepted by the UK's National Statistician; the basis for Eurostat and OECD thinking on how to measure non-market output

Source: modified from Table 3.1 of Atkinson Review: Final Report

Due to be published in 2010, the OECD has been writing a manual on the measurement of non-market health care and education output. It is understood that this manual draws on all of the existing guidance listed in table 1, and is evolutionary rather than revolutionary. In particular, on the vexed question of quality measurement, the manual is expected to draw the conclusion that there is as yet no international consensus on how quality change in health care and education should be measured, and how such measures should be incorporated with the existing quantity estimates of output.

5.2 Scope of government productivity measures

This section is repeated from section 4.4.1 in order for section 5 to comprehensively cover all challenges and issues..

A key question which needs to be addressed concerns the scope, or coverage, of government productivity measures for health care and education. There are a number of perspectives from which productivity performance is of interest, and from each perspective the question, and therefore the answer, is not necessarily the same.

From the National Accounts perspective, as well as the economy-wide productivity performance perspective, the question would be, 'how much does the health care or education industry contribute to total economic output?' Here the scope is defined by

industry (according to the ANZSIC classification). A first step should be to address the industry perspective to, provide estimates of government productivity that are consistent with Statistics NZ's existing market sector productivity estimates.

From the perspective of those in charge of public sector service provision, one of the economic questions might be, 'how do publicly-owned parts of the health care and education systems contribute to the economy, and how is the associated productivity changing over time?' Here the scope is defined by whether the production is carried out by the **public or private sector**.

From the perspective of taxpayers, the question might be, 'how well are taxpayer funds, or government controlled funds, being used in delivering health care and education?' Here the scope is defined by the **source of financing**. Variations on a theme are provided by whether this question is narrowly defined to cover only Ministry of Health or Ministry of Education funding, or other parts of the public sector – such as the Accident Compensation Corporation, Ministry of Social Development, prisons and the armed forces – incurring expenditure on health care and education.

These scoping questions matter, as the information requirements differ and perhaps more importantly the end results will also differ.

This feasibility study does not offer a single answer to these particular scoping questions, but rather sets out how sources and methods can be combined for whichever of the different measures is required. Scoping issues specific to health care and education are discussed in greater detail in sections 6 and 7.

Recommendation G1

Any implementation of this study should be clear what the question(s) associated with any requested productivity measure is (are), with particular emphasis on the perspective of the measure.

Recommendation G2

A first step in implementing this study should be to address the industry perspective, to provide estimates of government productivity that are consistent with Statistics NZ's existing market sector productivity estimates.

5.3 General issues relating to output, inputs, and productivity measurement

This section sets out and discusses the particular issues associated with the measurement of output, inputs and hence productivity, and suggests possible solutions. This section's main focus is on issues relating to the measurement of output, because this is the topic which presents the most difficulty, mainly relating to the lack of prices but also the fact that what is produced is almost exclusively services rather than goods which are inherently more difficult to define and measure. The measurement of government inputs, in contrast, is little different from the measurement of market inputs.

5.3.1 Terminology: quantity and quality

The terminology used in this report is consistent with that used in other major reports on the topic, for example the SNA and the Atkinson Review.

Extra care is taken to distinguish between the quantity and quality components of the volume of output (and inputs, for that matter) to help avoid ambiguity and confusion, and ensure consistency in use:

- Quantity relates to the number of units being measured; for example, number of hospital operations or GP appointments; and
- Quality relates to change in the set of characteristics of the units being measured; for example, that the hospital operations are more effective or the GP appointments are more convenient.

Recommendation G3

Consistent terminology should be adopted and consistently used to avoid ambiguity and confusion. In this *feasibility study*, the term 'quantity' refers to the number of units being measured whereas 'quality' refers to change in the set of characteristics of the units being measured.

5.3.2 Combining distinct measures of quantity and quality

Measuring changes in quantities of output using a system of disaggregation and differential weighting, such as is used in casemix weighting means that elements of quality change are captured implicitly (although not all – changes in quality within any of the casemix groupings will still not be captured). The term casemix refers to the blend of different types of treatment provided in hospital. In New Zealand, as in many other countries, the classification used to identify changes in casemix is the Diagnosis Related Groups (DRG) classification. For each type of treatment in the DRG classification, an average cost is calculated which can be used as a weight. Differentiation between various types of output is the National Accounts' main tool for incorporating quality change alongside quantity change.

Two further techniques are available:

- adjusting the existing measures of quantity change using a measure of quality change; and
- defining the measure of output in terms of quality.

The difference between the two techniques can be seen through an illustration. If the quantity measure of output is number of hospital operations, and the associated quality measure is success of those operations, then a model which combined the two measures (for example, a multiplicative model which valued proportionate change in both quantity and quality equally) is an example of the first technique.

If the unit of output is taken to be success of hospital operations, then this is an example of the second technique (note that this latter technique could incorporate a quantity element if not limited to, for example, 'average' degree of success but total success across all patients).

Countries which have been examining the extent to which existing quantity measures of non-market output can be improved using methods for quality adjustment have adopted a cautious approach, given the lack of a consensus at the international level on how best to carry out this adjustment (see sections 6.2.1 and 7.2.1).

Recommendation G4

A cautious approach should be taken in combining measures of quantity and quality change in health care and education output, with wide and transparent discussion of options and careful building of a consensus before decisions on methods are adopted. Until then, quality change should not be incorporated into measures of quantity change in output.

5.3.3 Level of disaggregation for the measure of output

What constitutes a suitable level of disaggregation for the measure of output? The level of disaggregation can matter a great deal. For example, an increase implemented in 2004 in the level of disaggregation used in the UK's health care output measure (designed to capture changes in casemix better) impacted directly on estimates of total UK GDP growth. This change, along with a few other improvements to the health care output methodology, had such a large impact that it altered the official estimate of total UK economic output (which grew by an extra 0.1 percentage points in 2002 and 2003).

In deciding on the level of disaggregation, there are two criteria. The practical criterion is that the level of disaggregation should not be too fine: too many categories and calculation becomes burdensome. Also, with increasing levels of disaggregation, the risk of having categories with no activity count also increases: a zero in the current year means an infinite decrease (which is calculable but undesirable) and a zero in the base year means an infinite increase (which is not calculable at all). As an aside, the method for dealing with new output is for it to be subsumed within existing categories until it is important enough to be separately identified.

The conceptual criterion is that the taxonomy should distinguish between homogenous and heterogeneous activities: activities within a category of the classification should be similar in terms of the characteristics which are of value to the consumer, and there should be as many categories as there are different combinations of characteristics. When considering what the characteristics that consumers value are when purchasing a car, the answer may include: speed, colour, fuel efficiency, sound insulation, equipment specification, brand, durability, length of warranty, and many other factors besides. The answer is no less simple in the field of health care, where the characteristics may include, for example: diagnosis, treatment, complexity, comorbidity, severity, speed of access, convenience, cleanliness of premises, availability of choice, and so on.

The idea of substitutability should ideally enter into the definition of what constitutes homogenous output, whereby treatments that have the same outcome for patients should appear in the same category. For example, grouping together psychotherapy and drug therapy where they are substitutes should mean that any gains in efficiency through substitution will be captured in the productivity index. However, such grouping on the basis of substitution has not been implemented anywhere in the world as yet, although there are specific examples of its impact in limited areas. See, for example, *Price indexes for the treatment of depression* (Frank 1999), *Measuring the value of cataract surgery* (Shapiro 2001), and *Measuring health care output in the UK: a diagnosis based approach* (ONS 2004).

A further complication concerns whether or not to take into account differences in the mix of people going through the health care or education system. For example, if in one

year the cohort of children beginning school has a higher starting point in terms of educational status, all other things being equal the school might need to do less to get the same exam scores. Or the school might provide the same level of service as for the previous cohort, but the children achieve better exam scores simply because of their different starting point. Ideally, such differences in the mix of patients, schoolchildren, and so on, ought to be taken into account in the measure of the school's or hospital's output. In practice, this would be very data intensive.

Typically, the decision on the level of disaggregation is based on what information and classifications are already available, rather than on purity of concept. DRG style classifications are being adopted by those countries which have implemented such classifications, and is currently the approach in New Zealand. It would be worth comparing the results from different levels of disaggregation and use of different classifications to understand what impact casemix and other factors have on output estimates.

The existing Ministry of Health care productivity methodology uses the DRG classification to differentiate between different types of hospital activity, whereas the Ministry of Health's system for reimbursing hospitals for their activity also uses, for example length of stay as well as DRG. This reflects different purposes: financing versus productivity measurement. The financing purpose requires the disaggregation method to distinguish on the basis of different costs, while the productivity purpose requires the disaggregation method to distinguish between types of activity. What is appropriate for one purpose may not be appropriate for the other.

Recommendation G5

Statistics NZ and the Ministries of Health and Education should explore further what level of disaggregation is most suitable in the New Zealand context, to understand the impact on estimates of output and productivity, and to inform the choice of this level. The choice of which to adopt should be reached after wide discussion and consensus building.

5.3.4 Cost versus value weights

The index number methodology (which is discussed later in this report, see section 5.3.8) requires that the growth rates of different types of output are weighted together in a way that reflects their relative importance.

In a perfect market equilibrium situation, marginal cost equals marginal price, with this market-clearing price reflecting the fact that both consumer and producer place equal value on the good or service at the margin. This equilibrium price is the measure of relative importance to be used as weights for combining the growth rates of different types of output.

In reality, markets are not perfect for a number of different reasons, including for example the fact that consumers and producers do not have perfect information (about differential price levels, product specifications and so on), and the amount paid by the consumer is not the amount received by the producer due to the existence of taxes and subsidies and so on. In a non-market situation, there is no market-clearing mechanism, and it cannot be taken for granted that the consumer and producer both place the same value on any particular good or service. Indeed, in the health care and education sectors,

there are very few meaningful prices at all: where payments are made, these are usually heavily subsidised.

A main purpose for subsidising some types of goods and services is to boost demand: more people will consume goods and services at relatively lower prices. Therefore, the amounts paid by the consumer for subsidised goods and services cannot be seen as reliable estimates of the value of those goods and services relative to other things that consumers choose to spend their money on. Total costs – the sum of the costs borne by the consumer and those costs borne by the institution paying out the subsidy – is a more reliable valuation of the goods and services that can be interpreted as the value from the perspective of the society as a whole (including both government and individual consumer).

An alternative to using costs as the means for measuring relative importance is to assign value on the basis of final outcomes, such as changes in life expectancy associated with a health care treatment or changes in educational status. An immediate problem with using this type of valuation is that it is not monetary (as used elsewhere in economic accounting): the units of measurement would be in terms of health or educational status, which cannot be added together directly. Any conversion would mean placing a money value on health and education status, for which there is little experience in economic accounting. One (future) means of arriving at a monetary valuation might be provided by ongoing work to measure 'human capital'. The idea is that in order to live full and happy lives, people need to invest in different aspects of life, including health care and education. This perspective lends itself to capital-style accounting, and hence the term human capital. Human capital is understood to have many components, and there is as yet no consensus on definitions and measurement.

A further problem is that final health and education outcomes are influenced by factors other than the services provided by either the health care or educational system. These factors are many. To improve their health, people may begin going to the gym regularly, quit smoking, eat more healthily, and so on. To increase the chances of their children getting the best out of their education, parents may spend more time helping their children with homework. Increases in health and education status due to external factors such as these should not be included as part of the output of hospitals and schools.

Ideally, when using final outcomes as the valuation method, it is the final outcome for the marginal consumer that should be used. According to economic theory, it is only at the margin (that is, for only one consumer) that the consumer's valuation matches the producer's costs of production: for all other consumers, the price that the consumer would have been willing to pay is either higher than the price set by the market (giving rise to consumer surplus) or it is lower (in which case the consumer would not have made the purchase).

Information on final outcomes for the equivalent marginal customer (the one for whom the benefit in terms of, for example, improved health or education status matches exactly the costs of production) are not available. Instead, only the average final outcome would be available. This valuation would therefore incorporate any consumer surplus and it may indeed incorporate any 'producer surplus', where the gain is less than suggested by the cost of production. Therefore, the average final outcome may not be a good estimate of the equivalent of the equilibrium market valuation. As already discussed in section 4.2, efficiency may not be the only criterion used when judging

whether or not to provide the service. For example, providing equity of access to health care and education services for the whole of the population may mean that the efficiency of providing some services in rural settings is less than that in urban settings.

The international consensus on how to combine different types of health care and education output is that cost weights are appropriate. This is not for reasons of conceptual purity, but the fact that, typically, costs are systematically available for most, if not all, types of health care and education provided, whereas other types of weight are not. It is important to note that cost and other types of weight reflect different valuations from different perspectives and none is 'wrong' or 'right' in the context of measuring change in non-market sector output. Instead, they should be interpreted as they are; that is, reflecting the different perspectives of producer and consumer.

Costs of production are a reflection of the value placed on the good or service by the producer. It is possible to take the perspective of the consumer, and imagine how a set of relative weights might be formed. One way could be to collect information on consumer preferences, asking how much consumers might be willing to pay. Given the information asymmetries that typically exist in the market sector, this may not be a good solution.

A joint project by the University of York and the National Institute of Economic and Social Research in the UK, *Developing new approaches to measuring NHS outputs and activity* (York 2005), recommends that the ideal set of weights for combining different types of health care output is one which identifies the relative health benefits of treatment, measured in terms of QALYs (quality adjusted life years). Putting aside the fact that QALYs only take into account the health benefits dimension of what patients value (and ignore much of the patient experience dimension), the key problem with any other set of weights than cost weights, such as QALY weights, is that they are not systematically available.

The set of costs weights should reflect the total costs of producing the good or providing the service. The key point about weights is that they are relatives: they should demonstrate the relative importance of one type of good or service to all others. Note that a benefit of making the weights total cost weights (weights that sum to total expenditure rather than simply cost relatives or ratios that do not sum to total expenditure) is that total expenditure on all output will sum to total expenditure on all inputs: this relationship is a good check on the statistical quality (in terms of the comprehensiveness of coverage) of the output measure.

Recommendation G6

In order to weight together the growth rates of different types of health care and education in a composite measure of total output, the relative weights should be total cost weights. Examining the impact of other types of weight may be useful in understanding different perspectives, for example in cost / benefit analyses.

5.3.5 Comprehensiveness and representativeness

In measuring the productivity of the health care and education sectors, it is important to comprehensively include in the measure all health care provided to patients, and education provided to pupils, given whatever scope is decided (see section 5.2). Without comprehensive coverage of all relevant activities, assumptions would have to be made about the relative growth rates of those activities which are not included in the

measure, and this will introduce bias if the actual growth rates differ from what is assumed. (Alternatively, the labelling of any partial measure would need careful crafting.)

Recommendation G7

Any measure of output should be as comprehensive as possible in terms of the coverage of the types of health care provided to patients or education provided to students.

If comprehensiveness is not possible, then the second best solution is to strive for representativeness: growth in some types of health care or education activity, for which figures are available, may be considered to be representative of the growth rates for other types of health care activity for which figures are not available (although there is still a requirement for some kind of evidence of growth of the latter).

There may well be types of health care and education for which there is neither quantitative nor qualitative information about change over time. The usual practice adopted in such cases is to assume that growth in unmeasured activity is the same as growth in measured activity.

Recommendation G8

Where quantitative information on change over time is not available for some types of services, there may be qualitative information about change which can be used to make informed decisions about the use of proxy measures (for example, growth in some types of activity for which figures are available may be considered to be representative of the growth rates for other types of activity for which figures are not available). For those types of services for which neither quantitative nor qualitative information on change over time is available, growth should be assumed to be the same as growth in measured activity, or labelling would need to be clear about how partial the measure is.

Hint G1

The extent of coverage of all health care and education activities, (in terms of measured activity as a percentage of total activity) is one measure of the statistical quality of the output measure (see section 5.4.1).

5.3.6 The 80:20 rule

International development experience has shown that there are some aspects of measurement that take little resource and have large impact (whether that be on the estimates or on perceptions of statistical quality), while there are others which consume large amounts of resource and lead to little improvement. A good example of the former is improving the level of disaggregation (see section 5.3.3) and of the latter researching how to measure quality change (see inter alia section 5.41). This is not to say that development effort should be concentrated on the former, but that it is important to manage and review development activity, trading off quick wins against longer-term projects.

Recommendation G9

A staged approach to implementation is recommended, giving higher priority to those areas of measurement that take little resource and have large impact.

5.3.7 Different forms of the productivity equation

The basic specification of a productivity equation, as the ratio of the volume of output and the volume of inputs, does not specify how output or inputs are defined.

The main choice for the measure of the volume of output is whether to use gross output or value added. Taking bread making as an illustrative example, the output of the baker would be the bread, the value added can be thought of as the value added to the flour and other materials purchased by the baker. In basic terms, the value added is defined as gross output less intermediate consumption.

The main choice for the measure of the volume of inputs is whether to take a measure of total inputs (in which case the productivity measure is referred to as 'total factor productivity'); a measure of only a single factor of production (ie labour productivity or capital productivity); or a mix of labour and capital inputs (referred to as multifactor productivity).

Looking at a health care productivity measure, if interest lies in understanding the marginal extra value added by the health system (for example, the fact that medications are typically bought in and not produced by the government health sector, so are not part of its value added), then a value added single or multifactor productivity methodology should be constructed. If interest lies in understanding the total output of the health system, then a productivity measure based on gross output should be constructed.

Statistics NZ's currently published estimates of productivity change for the measured sector use value added, rather than gross output, and are confined to labour and capital as the inputs. The reason for using value added and not gross output is that the published Statistics NZ National Accounts do not include volume estimates of gross output and intermediate consumption.

To complete its current suite of official productivity estimates, Statistics NZ requires a value-added multi-factor productivity approach. This *feasibility study* takes no stance on which is the appropriate measure for Statistics NZ to produce beyond that, but instead sets out how the various data sources and methods can be brought together to form any of these versions of the productivity methodology.

Recommendation G10

Statistics NZ should garner user views on the relative priorities of the productivity-specific questions and decide which one(s) should be answered over and above those required to expand its current industry-based suite of official productivity estimates.

5.3.8 Index number methodology

The current index number methodology used in Statistics NZ's productivity estimates differs for the numerator and the denominator:

- The numerator, a volume index of output change over time, is taken directly from the National Accounts and is used without modification, as are all measures of output change in the Statistics NZ productivity series. This avoids possible user confusion with having more than one (official) measure of output change. The New Zealand National Accounts measure of output volume change, as is the case in many countries, takes the form of a chained Laspeyres volume index.

- The denominator, a volume index of inputs change, is constructed as a chained Tornqvist index, as recommended in, for example, the OECD's *Measuring productivity*, (OECD 2001a), the productivity expert's bible.

There seems to be no literature available internationally that recommends using different index number methodology for the numerator and denominator of the productivity equation. The history within Statistics NZ suggests that the rationale for having different index number methodologies for the numerator and denominator of the productivity equation lies in wanting to balance the desire to have output data that are consistent with the National Accounts and to employ the best index number methodology. This could be reviewed, particularly in the light of Statistics NZ's recent work investigating the index number methodology for volume change in output, which concluded in favour of no changeover from the Laspeyres to the Tornqvist methodologies.

Recommendation G11

Statistics NZ should review the desirability of using different index number methodologies for the numerator and denominator of the productivity equation.

The index number methodology adopted in this *feasibility study* for both the output and inputs indices will be chained Laspeyres volume indices, at least in principle (data availability may mean that complete chaining is not possible). This is for a number of reasons:

1. Use of the same conceptual weights (based on previous years' prices) for the numerator and denominator is desirable, due to the valuation of the different output and inputs being in the same time period;
2. The chained Laspeyres volume index is as used in the National Accounts;
3. The valuation basis for the different output and inputs is straightforward, and therefore simple to explain to users;
4. The information required to construct the chained Laspeyres volume index is similar to that required for other indexes, including the Fisher and Tornqvist indexes.
5. The main disadvantage of Laspeyres over, say, Fisher or Tornqvist is that by fixing weights in the base period, they do not take into account changes in the mix of products over time (Fisher and Tornqvist have symmetric weights, and therefore fully take into account changes in product mix). This disadvantage is minimised by chaining: various empirical studies have shown that the difference in results between the use of chained Laspeyres and Fisher or Tornqvist is small.

The index number methodology used in this *feasibility study*, whether for output or for inputs then, is as follows:

$$\frac{\sum_i p_{it-1} v_{it}}{\sum_i p_{it-1} v_{it-1}} \quad (i)$$

Where p and v are the price and volume components, t is a subscript denoting time, and i is a subscript denoting the categories used in the classification for disaggregating.

An alternative, sometimes more easily computable, form of equation (i) is:

$$\sum_i w_{it-1} \frac{v_{it}}{v_{it-1}} \quad (\text{ii})$$

where w_{it-1} is the share of total expenditure on product i in time period $t-1$ (previous year).

Of course, while the prices and volumes for the individual components within the overall output and inputs indexes differ, in the non-market sector there is a (forced) relationship between total current price expenditure on inputs and total current price expenditure on output (more correctly for the latter, total current price costs). In the National Accounts, non-market output in current prices is defined to be the sum of input costs. There is, therefore, a quality check implicit in the productivity calculations: something is wrong if total output expenditure does not sum to total inputs expenditure.

Hint G2

As current price expenditure on non-market output is valued according to input costs, a quality check on the productivity measure calculation is to check that the sum of output expenditure values used as weights equals total expenditure on inputs.

5.3.9 An additional note on chaining

The main benefit of chaining (in a Laspeyres volume index, this means using previous years' prices for every pair of years being compared, rather than prices that are fixed in some base year – for further detail, see paragraph 16.31 of SNA 1993) is that it allows changes in relative prices to feed correctly into the price / volume breakdown. A further benefit is that the index number series is constructed as a series of pairs of years. This means that the basket does not need to be the same as time progresses. Given the increasing availability of data over time for, say health care output, this property means that whatever information that is available could be used without disturbing the weighting structure.

While this is useful for dealing with the lack of availability of historical data, there comes a point in time where the coverage falls below what could be considered a crucial level. Care needs to be exercised in deciding on this cut-off point to ensure that relatively low coverage levels do not introduce too much bias into the productivity calculation for early years.

Cautionary note G2

Care needs to be taken in deciding how far back in time to calculate productivity measures, especially when coverage rates are relatively low.

5.4 Issues relating to government output, inputs, and productivity measurement

This section sets out and discusses the particular issues associated with the measurement of non-market output and productivity, and suggests possible solutions.

5.4.1 Measurement error and 'fitness-for-purpose' of resulting estimates

Development of health care and education output and productivity methods continues to be carried out in a number of countries and by international organisations including OECD and Eurostat. As is set out in the section on international practices (see section 10), different countries have reached different states of play, but no country has a perfect measure, or set of measures, of health care and education output and productivity. As for any statistical estimates, especially those that are under development, it is particularly important to ensure that users are given sufficient information on the statistical quality, and how any figures should and can be interpreted. Given the great interest in and sensitivity of these output and productivity estimates, particular care should be taken to ensure users are informed clearly and transparently, and that the quality of any estimates (relative to other official statistics) is clear. Use of 'experimental' labels, and the like, can help.

As part of the information users may need to help them understand the statistical quality of health care and education output and productivity estimates, as well as how to correctly interpret any changes over time, it would be useful to show, where possible and available, any indicators of statistical quality. This may be in the form of quantitative information, such as coverage rates for output estimates (see section 5.3.5), or it may be in the form of qualitative, or descriptive, information, such as that published in the UK's *Health care quality report* (ONS 2008b).

The experience in the UK, as for many other countries, has been that it is difficult to summarise the statistical quality of these output and productivity estimates. This is mainly because the estimates are the result of a complex set of calculations involving many different data sources, methodologies and assumptions. The UK's solution to this is to provide users with as much information on statistical quality as possible, including publication of a detailed *Sources and methods report* (ONS 2008a), a report on quality of the estimates according to the statistical quality framework *Health care quality report* (ONS 2008b), as well as summaries within the main articles *Public service productivity: health care* (ONS 2008c) and *Public service productivity: education* (ONS 2005).

The European Union has enacted legislation that requires the reporting of the statistical quality of the methods for compiling estimates of government output in the National Accounts. The reporting method involves ascribing one of three levels of quality to published methods, as follows:

A methods – these involve an output indicator approach where the indicators satisfy the following criteria:

- a) cover all services provided;
- b) weighted by the cost of each type of output in the base year;
- c) as detailed as possible; and
- d) quality adjusted.

B methods – these involve an output indicator approach where the criteria are not fully satisfied: for example, the level of detail could be improved or the measure does not take into account changes in quality.

C methods – if input, activity, or outcome is used (unless outcome can be interpreted as quality-adjusted output) or if coverage of output method is not representative.

This would also be a reasonable, and simple, way to inform users of the statistical quality of any estimate produced in New Zealand. Adopting such a system would mean some comparability in reporting with European Union countries.

Recommendation G12

Statistics NZ should consider how best to inform users of the statistical quality of any government productivity measures it publishes, bearing in mind both quantitative and qualitative means.

User confidence in the developing measures of health care and education output and productivity in the UK has also been bolstered by an ongoing discussion between the statistical office and users, involving occasional workshops, conferences, media presentations, and consultations.

Recommendation G13

Statistics NZ should consider what are the appropriate ways for ensuring an ongoing dialogue with users, to ensure that the statistics provide (at least part of) an answer to specific user questions, and that any external expertise and experience can be drawn on to improve the development work.

5.4.2 Co-production

Section 5.2 discussed some of the ways that the scope of a government output or productivity measure can be defined. If the scope does not correspond with the usual scope for a production function, then extra care needs to be taken in matching inputs and output, and in distinguishing between gross output and value added.

For example, if the definition taken of the unit of output corresponds with the health care pathway (that is, the unit of output is 'a patient treated'), this poses a problem if the scope of the output and productivity measures is public hospitals, and the health care pathway traverses primary and secondary care (co-production): how does one distinguish between the value added by the (private sector) general practitioner, the (public sector) outpatient appointment, and the (public sector) inpatient day care or inpatient stay? Of course, there are many other permutations of the pathway through the various public and private sector entities within the health care system, of which this is just one example.

In the market sector, value added is distinguished from gross output according to the prices paid when businesses purchase intermediate consumption items (raw or unfinished goods and services) from each other.

Generally speaking within the health care sector, there is little empirical data that helps distinguish which part of the health sector is responsible for what proportion of the care. The fall-back solution will be to use whatever information is available to approximate these proportions (in terms of both the number of treatments, as well as any change in the quality of those treatments): in a lot of cases, costing information will be available, but this will not always be the case. Where no costing data are available, the only solution may be qualitative, drawing on expert opinion to arrive at a set of reasonable assumptions.

Cautionary note G3

Care needs to be taken in determining value added when a service is delivered by a number of different providers. In some cases, costing data may be available which can be used to derive an approximation for value-added. Other solutions may include basing assumptions on expert opinion.

5.4.3 Co-financing

A further complexity arises from the fact that, for some parts of the health care and education systems, there is co-financing, or co-funding. For example, the cost of an appointment with a general practitioner is covered both by patients paying a fee-for-service payment out of their own pockets, as well as a contribution from government funds. Tertiary education is likewise paid for with a combination of student fees and government funding.

If the scope of the productivity measure is defined according to who is paying, a question arises about how to deal with these services: how much of the output should be associated with government financing, and how much with private financing? Of course, this problem is not confined to general practitioner appointments and tertiary education; there are other health care and education activities which have multiple sources of financing.

Production functions do not lend themselves to this type of analysis. In the UK, a practical solution to this problem has been adopted. The production function is effectively split in proportion to the sources of financing. If the government contribution to total costs is 40 per cent, then 40 per cent of each of the inputs and 40 per cent of output is classified as government output.

A major benefit of this approach is that it deals well with changes in the relative size of the government contribution to cost, compared with other contributions. For example, if nothing changes other than the government contribution to the cost of a general practitioner appointment increasing from 25 per cent to 50 per cent, output and productivity change should remain the same. By also forcing government inputs to change from 25 per cent to 50 per cent, the ratio of government inputs and output remains the same. Any other assumption would mean that the ratio of government output to inputs would change, and therefore would have an impact on overall government productivity.

There are concerns with this assumption. For example, it presumes that the services provided by a single producer to households whether they are funded by households only, government only, or households and government together, are the same and that there is no cross-subsidising. This may not be realistic.

Recommendation G14

In order to deal with complications associated with separating between government output and private sector output if the scope of the productivity measure is defined according to who is paying, then the distribution by source of financing should be used to calculate how much of the inputs and output are government and how much are private.

5.4.4 Complementary statistics

The *Atkinson Review* highlights the benefits of comparing and contrasting productivity measures with independent evidence to improve quality, aid interpretation of results, and provide commentary on underlying data issues: The *Atkinson Review* introduces the term triangulation for this, although this *feasibility study* prefers the term complementary statistics. This process can also shed light on the performance questions that productivity estimates are not designed to answer; such as, equity, effectiveness, and economy. Later sections of this report highlight some complimentary indicators that might prove useful.

Hint G3

Complementary indicators help various users interpret government productivity estimates in context of the outcomes that most interest them.

5.4.5 Matching output and inputs

The scope of inputs must match that of output in the productivity equation; the labour, intermediate, and capital services used in the production of output should feature as the inputs to production. In practice, apportioning and correctly weighting some of the inputs can be difficult. How to deal with policy and administration work is a case in point.

Education administration and policy takes a variety of forms. Some are clearly identifiable as associated with a particular sector, such as the Tertiary Education Commission, while others target overall long-term educational strategy or are designed to link up the work of other parts of government, such as the Department of Labour or the Ministry of Social Development. Even resources that are targeted at a particular sector, such as ECE, have flow-on effects for other sectors of the educational system.

Typically, there is scant data available that might be used to apportion these resources. Because of the difficulty inherent in apportionment of this work to various sectors, spreading the cost across the industry on a pro-rata basis may be a desirable alternative.

Recommendation G15

The scope of inputs must match that of output in the productivity equation. Where apportionment is not feasible, inputs should be spread across the industry on a pro-rata basis.

5.4.6 Non-market and market consistency

Conceptually, the measurement of health care and education services should be consistent however the services are provided and/or funded. In order to accomplish this, the same definition of output quantity and quality should be used, and ideally the same methods and similar types of sources.

Recommendation G16

Measurement of productivity for the government sector should follow as closely as possible that of the market sector where data sources and user needs allow.

In practice, output estimates for market services tend to be compiled by using price deflators in conjunction with information on current price expenditure, whereas for non-services there are no actual prices, so methods tend to be direct volume measures. Given the 'expenditure = price * quantity' identity, it is clear that the principles for

achieving high quality estimates of market and non-market estimates are the same, bearing equally on the direct output volume indices and to the price deflators and expenditure information.

Where information exists, for example on the market sector side, it may be informative to compile alternative sets of estimates based on the deflated-expenditure and direct volume approaches, and compare and contrast differences. This should help to improve statistical quality.

Recommendation G17

To help improve statistical quality, where information exists to compile output estimates using both deflated expenditure and a direct volume approaches, the sources, methods and results should be compared and contrasted, with the better quality aspects of both approaches being drawn on to form a single best method.

5.4.7 Rate of return used in calculating the user cost of capital

For the purposes of productivity measurement, capital services are estimated from a measure of the capital stock, and assuming that the flow of capital services is directly proportional to the underlying stock of the capital being considered. The relative weight of capital services is given by the user cost of capital. The user cost of capital can be seen as an imputed rent: it is the rent that the owner of the capital might notionally charge themselves for use of the capital. In some cases, there may be fully functioning capital rental markets and the imputed rents may be inferred from equivalent actual rents. For many assets, though, there are no fully functioning capital rental markets, and the imputed rent has to be calculated indirectly. The user cost of capital can be seen as being made up of two basic terms: the cost of financing and the change in the value of the capital. The cost of financing is made up of two further parts: an estimate of the interest payment on a loan to purchase the capital, and the cost of depreciation.

The OECD's *Measuring productivity* (OECD 2001) sets out the methodology and concepts. Implementation for market sector industries in New Zealand is set out in *Productivity statistics: sources and methods* (Statistics NZ 2009).

A key principle adopted in this *feasibility study* is that, where appropriate, the measurement of productivity for the government sector should follow as closely as possible that for the market sector. While this principle holds for the most part in the measurement of government sector capital services, there is one aspect of calculating government sector capital services that may warrant a different treatment: what is the appropriate way to estimate the cost of financing?

For the government sector, it may be more appropriate to adopt a risk-free long-run real rate of interest, perhaps the average interest rate for New Zealand Government bonds, or the rates at which capital is financed, which are specific to the different parts of the government sector.

Recommendation G18

Statistics NZ should consider what the appropriate rate of return should be for calculating the user cost of capital used in the government sector.

6 Health care

This section discusses the availability of data for measuring change in health care output and inputs, along with the issues associated with these data sources for those interested in measuring change over time in health care productivity. Separate sub-sections are devoted to output quantity, output quality, output weights, labour inputs, capital inputs and intermediate consumption. However, before launching into these descriptions, here follows a brief description of the health care system in New Zealand, followed by a summary of concepts and a description of the existing analyses in New Zealand of health care output (along with critiques of their sources and methods).

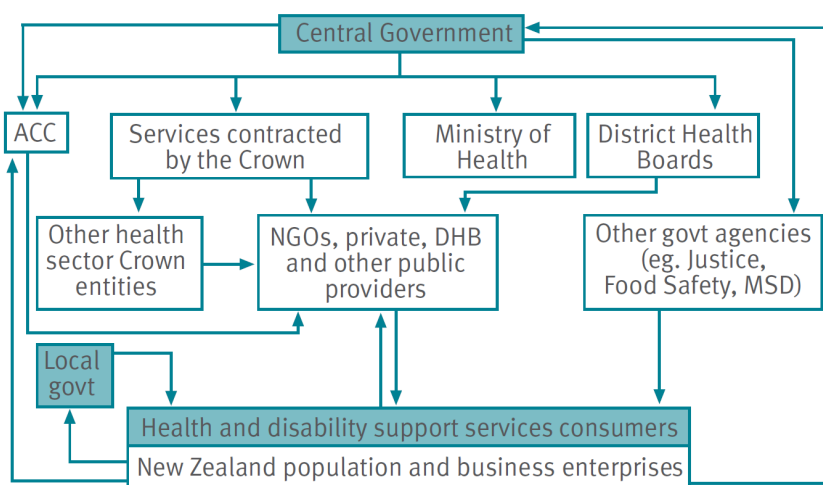
6.1 The health care system in New Zealand

Possibly the single most important question to be decided before work on government productivity could move forward is that of scope. Economic statistics published by Statistics NZ such as Gross Domestic Product and productivity are produced on an industry basis, without regard to the finance of those industries. Health care output estimates consistent with the System of National Accounts are required to expand Statistics NZ's existing suite of industry-based official productivity estimates. Users may also wish to answer questions about productivity with regard to government expenditure on and/or delivery of health care services. The selected scope has implications for data requirements, compilation methods, and coverage. Refer to section 5.2 for discussion of scope as it relates more broadly to government sector productivity measurement.

This section describes the health system in New Zealand to help the reader understand, for example, the scoping issues as well as the general context for any ensuing productivity measure.

Figure 2, from the Ministry of Health's *Health and independence report 2008* (MoH 2008), presents the structure of the health system in New Zealand.

Figure 2 Structure of the health system in New Zealand



Source: Health and Independence Report 2008

The New Zealand Public Health and Disability Act 2000 established 21 District Health Boards (DHBs), governed by boards of directors that include locally elected members and ministerial appointees. The 21 DHBs are responsible for planning, funding and delivering most publicly funded health services to New Zealanders. DHB providers offer most secondary and tertiary hospital services, including for all acute and most elective cases. Private hospitals offer elective services on contract to DHBs and on a private basis, generally for those cases that do not meet the need thresholds established by DHBs.

The first primary health organisations (PHOs) were introduced in 2002 as the cornerstone implementation of the Primary Health Care Strategy. There are now 82 PHOs with more than 4.04 million enrollees (more than 95 per cent of the New Zealand public), involving the vast majority of general practitioners and practice nurses. Governed by non-profit boards of directors, PHOs contract with DHBs to offer a range of preventive and curative services, as well as an increasing array of population health services. From 1 July 2007 all New Zealanders enrolled with PHOs could benefit from low or reduced-cost primary care services.

Much of the health care in New Zealand is delivered by non-government organisations (NGOs). These include providers with national contracts, such as the Royal New Zealand Plunket Society, and providers who contract with their regional DHBs, such as community-based NGOs providing services to people with experience of mental illness.

Overall, 77 percent of health expenditure is funded by the public through taxes, 5 percent by private health insurance premiums, and less than 1 percent by non-profit organisations; the remainder (17 percent) is paid directly by those receiving the service. In addition to programmes funded by the Ministry of Health and District Health Boards, the other main public funder is the Accident Compensation Corporation (ACC), which pays providers to treat New Zealanders who suffer from accidents or injuries.

The Ministry of Health is a policy advisor to the Minister of Health, an agent of the Minister for monitoring and overseeing DHBs, a funder of DHBs and national services such as national screening services, and a provider of regulatory and other functions (eg public health).

6.2 Health care output

6.2.1 Summary of concepts

The basic framework for measuring health care (and other non-market) output is set out in the SNA 1993. It recommends that current price consumption of those goods and services for which prices are not economically significant, or indeed zero, should be measured as the sum of input costs (compensation of employees, intermediate consumption, consumption of fixed capital, and taxes less subsidies), taking into account all sources of finance. Measuring change in output according to change in inputs in this way is referred to in this *feasibility study* as the 'output=inputs' method.

The SNA 1993 goes on to encourage measurement of the actual volume amounts of goods and services produced and consumed (referred to in this paper as the direct volume method), but acknowledges that the use of deflated expenditure on inputs is an option; that is, the 'output=inputs' method.

The other main publications available, listed in section 5.1, provide further detail on implementation. As each publication has appeared, from the Eurostat Handbook to the Atkinson Review and most recently to the OECD's forthcoming manual, the guidance has been incrementally improved and refined, each publication building on what has gone before.

The common thrust in these publications suggests a growing international consensus on what would constitute a conceptually pure method of measuring change in the volume of health care output over time. However, the literature acknowledges that measuring health care output according to this ideal is a tall order. Table 3 sets out this possible conceptually pure method, as well as the acknowledged limitations.

Table 3. Aspects of a conceptually pure method of measuring change in the volume of health care output over time, and corresponding limitations

Aspect of conceptually pure method	Limitations
A. Health care output should be defined from the perspective of the consumer: a unit of output covers a whole course of treatment for a particular condition or disease, rather than the individual activities that make up a treatment.	A.1 Typically, countries' health information systems do not readily provide information on the whole course of treatment, in particular joining up activities in primary care (including appointments with a general practitioner) with those in secondary care (including day care appointments and inpatient operations and stays).
	A.2 Even where information systems do provide such joined-up information, there are significant conceptual issues that need to be addressed for defining the unit of output for large parts of the health system. While it is relatively simple to define the whole course of treatment for curative care (typically 'one-off' type treatments, including treatment for broken leg and heart attack), this is not the case for other types of treatment, for example, what is the whole course of treatment for those with mental health problems, with chronic health conditions, with multiple health problems (co-morbidity); what is the output of preventative care?
	A.3 This concept cuts across the usual National Accounts methods, which distinguishes between the value added provided by different parts of the economy. In the case of health, primary care providers in the private sector are working alongside secondary care providers in the public sector – unpicking the relative contributions of each of these providers (their individual value added) is a non-trivial task.

<p>B. Any measure should be as comprehensive as possible, covering all of the different types of treatment provided by the different parts of the health system.</p>	<p>B.1 Many countries have good information on inpatient hospital stays, but relatively less information on day care, and may have almost no information on primary care treatment that is easily accessible.</p>
<p>C. The relative importance of different health treatments should be given by the marginal valuation</p>	<p>C.1 There is little conceptual basis for judging relative importance in the absence of a competitive market that allows for clearing or marginal prices:</p> <ul style="list-style-type: none"> (i) average costs provide information from the producer perspective and are generally easily available (hence this is what is recommended in the literature); use of costs can lead to what some commentators see as perverse results. For example, in the case of cheap wonder drugs 'undervaluing' significant health benefits (while this is true, it is also the case for any good or service; eg the micro-chip); (ii) revealed preference studies could provide information from the consumer perspective; (iii) measures of health status eg QALYs do not combine information on all aspects of health treatment that might be pertinent.
<p>D. Change in health care output can occur because of either a change in the number of treatments and/or a change in the quality of treatment. Some of the quality change can be picked up by differentiating between different types of treatment. Other types of quality can be picked up by examining the contribution of treatment to outcome.</p>	<p>D.1 Differentiation will not pick up quality change beyond what can be picked up in casemix.</p> <p>D.2 Quality is multi-dimensional and the choice of which dimension or dimensions are relevant depends on the type of treatment and diagnosis. For example, for invasive surgery the main dimension of quality may be survival, whereas for non-life threatening events the comfort of the patient, and the extent to which the patient is informed etc may be more relevant.</p> <p>D.3 There is no agreed method for combining two or more quality dimensions for treatments where this is appropriate: how relatively important is health improvement against, say, waiting time?</p> <p>D.4 Distinguishing the role played by a health system from other factors affecting health status (healthier lifestyles, smoking cessation, etc) is difficult and needs further work.</p>

This summary of concepts merely presents a broad picture of how health care output should be measured. Many aspects of health care output need to be dealt with in a consistent and orderly manner. The remainder of this sub-section covers the most important of these aspects, and relates mainly to a measurement approach involving individual activities as the units of measurement, rather than the health care pathway (the units of measurement for the health care pathway need further consideration at a global level).

How to deal with multiple diagnoses

Many patient records contain a number of diagnosis codes representing possible co-morbidities (multiple, concurrent illnesses) or simply providing further information on the characteristics of the single health problem that the patient has. The first in the list of diagnoses is, in principal, the 'main' diagnosis and this is the one that should be used for determining the type of health care problem.

How to deal with misdiagnoses

Occasionally, the diagnosis offered by the first physician, typically a General Practitioner, will be over-written by a specialist on referral. Ideally, the diagnosis used for the spell of illness should be the correct code as determined by the specialist, with all connected health care activities being given this correct code.

How to deal with death during treatment

Some commentators have suggested that death during treatment should be treated the same as a 'broken brick' is treated in the market sector: consumers would not pay for a broken brick; it has no value. This would be unfair for the health care sector, which is doing what it can to improve the health of patients who may have a high risk of death. A better analogy would be with the services of a lawyer: what consumers are paying for are the services of the lawyer to maximise their chances of avoiding a guilty verdict. Similarly, patients (and other funders on their behalf) are paying for the hospital and other actors to maximise the patient's chances of recovery.

How to deal with missed and cancelled appointments

These should be dealt with according to the cause. For example, if the cause of the cancellation is that the hospital had not organised the necessary resources, then it would be inappropriate to record this as an activity (but to record any use of resources, when part of the resources needed have been organised). If the cause of the cancellation is to do with the patient not turning up, for example, then it could be appropriate to record this as an associated activity (with associated inputs).

How to deal with first and follow-up appointments

Many health care problems, especially those provided in outpatient and day patient settings, require ongoing, repeated treatment. One way to deal with these is to record each activity separately. An issue arises with such an approach if the medical best practice guidance changes. For example, if the recommended periodicity of repeat appointments changes from once per month to once per fortnight; other things being equal, this would make for an apparent doubling of activity (although updating the cost weights would counter some of the effect). Another way to deal with these repeat appointments would be to aggregate them, and alter the unit of measurement from 'an individual appointment' to 'all of the appointments in a year for a patient with a

particular diagnosis'. Identifiers on patient records that distinguish between first and follow-up appointments, as well as the patient identifier on the record, can be used to group appointments in this way.

Such an approach might also be taken with repeat prescriptions, for example, as well as repeat appointments with General Practitioners, with mental health services, and so on.

How to deal with complications

In some cases, complications arise from mistakes made by the health institution. A well-publicised example of this is hospital-acquired infection. It might be appropriate to record only activity associated with the illness as presented on first contact, and record activity following on from errors only as extra resources required to treat the patient. From a productivity measurement perspective, this would make sense: reductions in, for example, hospital-acquired infection (and other things being equal) would mean the same quantity of activity but reduced inputs and therefore improved productivity.

In other cases, the complications arise from the nature of the patient and their illness. In such cases, it would be appropriate to record any extra activities as output. Indeed, hospital inpatient recording systems do distinguish between some types of activity that have complications and those that do not.

How to deal with different types of patients

There are greater risks associated with elderly patients admitted to hospital for invasive procedures compared with younger people. Where this results in more activities per person, then the activity-based measure of output will pick this up, as the greater number of activities for the elderly will be recorded. Where this results in more expensive versions of the same activities, this will not necessarily be picked up by an activity-based measure, and it would make sense to deal with this in a different way. For some inpatient treatments, the classification system does indeed distinguish between the elderly and others. Such an approach could be extended to other parts of the health system where that makes sense.

6.2.2 Existing analyses and data collections in New Zealand

This section provides a summary of the two existing, and available, methods for measuring health care output:

- the Ministry of Health compiles health care output estimates as part of its hospital productivity work, which is published annually in the *Health and independence report*, the last one being published in 2008 (MoH 2008).
- Statistics NZ also compiles information on health care output so that the National Accounts can comprehensively cover the total economy. However, Statistics NZ does not publish a separate health care output index.

Other studies have been published, most notably a study by the New Zealand Business Roundtable, *Productivity performance of New Zealand hospitals 1998/99 to 2005/06*, (NZBR 2008) but information on sources and methods have not been made available for this *feasibility study*.

6.2.3 Ministry of Health work to develop and improve measures of health care productivity: an update provided by the Ministry of Health

The Ministry of Health produces and publishes a measure of hospital productivity. This section, which describes their approach as well as potential future areas of work to improve the approach, has been written by colleagues at the Ministry of Health.

An approach to measuring national hospital productivity, based on centrally collected data to assess sector wide trends, has been developed by the Ministry of Health. The measures produced using this approach have been adopted as one of a set of headline indicators of systems performance, and have been published annually for the last three years in the *Health and independence* reports for 2007 and 2008 under 'Progress on Headline Indicators', and in the 2009 *Ministry of Health Annual Report* under 'Efficiency and Value for Money'.

The national hospital productivity measure includes two views of productivity based on medical and surgical output, labour personnel cost input growth, and labour force FTEs input growth, for medical and nursing personnel working in medical and surgical services in DHB provider-arms. A technical paper describing this productivity measurement work is available from the Ministry on request.¹

The Ministry is currently reviewing how productivity measurement could be incorporated into future work programmes. Potential areas of work to generate aggregate health system and hospital productivity measures, so that they are consistent with international best practice include:

- a first-stage expansion of the scope of the existing DHB provider-arm hospital-based measure to include maternity and neonatal, mental health, health of older people, and disability support services. This includes capturing other staff groups providing these services, including allied health personnel (for example, occupational therapists and physiotherapists), and inclusion of non-labour inputs for capital and consumables.
- a second-stage expansion of the scope to capture services provided outside of hospitals, including primary and community health care.
- review of and improving on the methodology, assumptions, and data sources used in the productivity measure, including the means of weighting output for the cost and quality or relative value of care provided.

This is a challenging piece of analytical work, reflecting the complexity and resource intensive nature of productivity measurement work, and the challenges posed by the data sources that the Ministry has to work with. The same key issues that Statistics NZ has identified in its *feasibility study* are also very relevant to Ministry productivity measurement work: namely those of scope, definitions of health sector output and quality of services provided, and the absence of prices for many services provided within the public health system.

¹ Technical documentation on the 2009 update of the Ministry of Health Performance Assessment and Management Steering Group (PAM) productivity metric, Ministry of Health, (unpublished).

Other related productivity measurement work in the Ministry of Health and work to improve hospital productivity

There are other, related, areas of work that are being conducted within the Ministry. These are:

- development of DHB-level productivity measures for accountability purposes used to assess DHBs planned delivery on productivity
- work on productivity benchmarking in DHBs
- a focus on gains in hospital productivity, including more efficient and productive wards, improved day surgery and theatre utilisation, improved workforce productivity, better use of joint procurement, and reduced cost of back office functions
- other initiatives to improve hospital performance, as set out in the *Statement of intent 2009-12*, include the Ministry working with DHBs to develop strategic partnerships with private sector providers in order to make more effective use of resources and capacity that span both public and private sectors.

6.2.4 Statistics NZ's health care output method

An implicit part of Statistics NZ's National Accounts economy-wide measure of change in output is the health care industry's contribution to output. However, this is not separately published and is used to ensure comprehensiveness of the economy-wide measure.

It is a direct volume measure, which was introduced in the late 1990s as a replacement for the previous (output=inputs) measure. It is calculated using information from three data series, which are combined using fixed weights to form an index that is used as a proxy for the whole of public sector health care production. The three data series, along with their weights, are:

- inpatient discharges, casemix adjusted (IP), 85.5%
- day patient discharges (DP), 7%
- mean length of inpatient stay (ALOS), 7.5%

An inpatient stay is defined in New Zealand as one where the patient is admitted into hospital and stays overnight. A day care patient is one where the patient is admitted into hospital, usually for more than three hours, but does not stay overnight. An outpatient appointment is one where the patient is not formally admitted and is usually in hospital for less than three hours. Note that these definitions are not necessarily shared by other countries or indeed by the OECD's classification of 'mode of production', as set out in its publication *A system of health accounts* (OECD 2001b).

(i) inpatient discharges

Up to 1993/94, casemix-adjusted data on inpatient discharges were available from the Ministry of Health. Since then, only data combining day patients and inpatients have been acquired on a casemix-adjusted basis, from the publication Ministry of Health's *Hospital throughput report*, the latest report including data for 2003/04 (MoH 2006). From 1993/94, growth in the quantity of casemix-adjusted inpatient discharges is calculated by applying the annual growth rate in the combined number of inpatient and day patients to the old series ending in 1993/94.

$$(1) \quad IP_{j,t+1}^* = \sum_j^{t+1} [\Delta_t (IP_j^* + DP_j^*) \cdot IP_{j,t}^*] \text{ for } t > 1993/94$$

where j denotes the DHB and the asterisk (*) indicates that IP and DP are casemix-adjusted. Casemix adjustment of the kind carried out on the data used by Statistics NZ means distinguishing between different types of treatment, thus allowing growth in treatments with different costs to be properly accounted for:

$$(2) \quad \Delta_t^{t+1} (IP_j^* + DP_j^*) = \frac{\sum_i (IP_{ijt+1} + DP_{ijt+1}) \cdot c_{ijt}}{\sum_i (IP_{ijt} + DP_{ijt}) \cdot c_{ijt}} \text{ for each } j$$

where i denotes the type of hospital activity and c are the mean costs of each of the different kinds of activity in each DHB.

Calculation of equation (1) is carried out by Statistics NZ.

Calculation of equation (2) is carried out by the Ministry of Health.

(ii) day patient discharges

The total number of day patient discharges, without any casemix adjustment or other breakdowns, are taken from the Ministry of Health's *Selected morbidity data for publicly funded hospitals* publication, the latest report providing data for the year 1 July 2002 to 30 June 2003 (MoH 2006b). This is the volume measure.

(iii) mean length of inpatient stay

The mean length of inpatient stay, without any casemix adjustment or other breakdowns, are also taken from the Ministry of Health's *Selected morbidity data for publicly funded hospitals* publication (MoH 2006b). This is multiplied with the number of inpatient discharges to arrive at a total number of bed-nights, which is the volume measure used.

(iv) aggregation

In order to combine the three indicators into a single health care output growth series, each indicator series (only inpatients is shown below) is turned into an index with 1996 set at 1000:

(3) Value of index for IP = 1000 for $t = 1996$;

$$= 1000 * \frac{IP_{ijt}^*}{IP_{ij,1996}^*} \text{ otherwise}$$

The aggregation method involves combining the value of each of the three indices for each year using fixed weights:

(4) Value of health care output index = 1000 for $t=1996$;

$$= 1000 * \frac{IP_{ijt}^*}{IP_{ij,1996}^*} * 0.855 + 1000 * \frac{BEDS_{ijt}}{BEDS_{ij,1996}} * 0.075 + 1000 * \frac{DP_{ijt}}{DP_{ij,1996}} * 0.07 \text{ otherwise}$$

*Issues with current sources and methods**(i) inpatient discharges*

The coverage of the 'total throughput' figures used changes over time, with the early part of the series including both inpatient and day patient activity, and the later part including only inpatient activity. The calculation takes this into account, with the changes in the later inpatient-only part of the series being used as a proxy for change in the combined inpatient plus day patients series. Information on the number of day patients is available, and could be incorporated into the calculation to improve the quality of the estimates.

Recommendation H1

The available information on the number of day patients should be incorporated into the existing method of calculation of Statistics NZ's health care output.

The year-on-year percentage changes in casemix-adjusted throughput do not match the corresponding levels of activity reported in successive annual reports. For example, the 2003/04 report puts casemix-adjusted total throughput for private providers at 25,681.2, which it says is 10.72 per cent higher than the previous year, suggesting that the total throughput in 2002/03 was 23,194.7. The 2002/03 report puts the figure at 20,251. This suggests that there may be revisions to the figures following publication. Where appropriate, these revisions should be taken into account when compiling health care output estimates.

Recommendation H2

Revisions to estimates of casemix-adjusted throughput should be incorporated into the existing method of calculation of Statistics NZ's health care output.

(ii) day patient discharges

The day patient discharges figures are not casemix adjusted, and ideally would be in order to take into account aspects of quality that disaggregation can pick up (higher cost treatment is generally higher value treatment). Day patient discharges are available with a breakdown by, for example, type of service. This should be taken into account.

Recommendation H3

Changes in the number of day patient discharges should be broken down by type of service. Along with information on average costs of these different types of service, this information will help to introduce an element of quality change into Statistics NZ's measure of day patient output.

Throughout OECD countries and beyond, there has been, and continues to be, a drive to treat patients in the most efficient setting. This means that, when patients can be treated just as effectively in a day care setting as in an inpatient setting, it makes financial sense to do so. The patient is receiving the same output irrespective of whether there is an overnight stay or not (and it could even be argued that patient experience is better). This suggests that day patients and inpatients should not be distinguished. An argument for making the distinction is that the inpatient treatment is delivered to, for example, patients who have more severe symptoms or patients who require a greater degree of care (the elderly or those with co-morbidities), in which case the output could be argued to differ. If the breakdown of day patient discharges is consistent with the

breakdown of inpatient discharges AND the breakdown distinguishes between severity of cases, then inpatient and day patient discharges should not be distinguished.

Recommendation H4

Consideration should be given to combining the number of inpatient and day patient activities, where these are substitutes, in order to improve the price / volume breakdown.

Day patient figures may also be affected by revisions, which are not being taken onboard in the National Accounts.

Recommendation H5

Revisions to estimates of the number of day patients treated should be incorporated into the existing method of calculation of Statistics NZ's health care output.

Large quantities of activities are excluded from analysis, many of which are health interventions and which are mainly of a diagnostics nature (colonoscopies, gastroscopies). The number of excluded cases in 2000/01 was 158,825. Ideally, there should be consideration of whether these excluded cases should be included in a measure of health service output.

Recommendation H6

Consistent with recommendation 5.3.5 on comprehensiveness and representativeness, consideration ought to be given to incorporating all of the available information on activities in hospitals and other settings in order to maximise the comprehensiveness of Statistics NZ's measure of health care output.

(iii) mean length of inpatient stay

Number of bed days (calculated as the product of mean length of stay and number of inpatient discharges) is a poor indicator of output. An efficiency drive in health care across the globe is leading to health care production shifting from the relatively expensive inpatient hospital setting, to outpatient and primary care settings. This is also leading to reducing lengths of stay for those people who require an inpatient stay. Where this improvement in efficiency has not lead to poorer health outcomes, this should mean that hospital output has not fallen. However, the inclusion of bed-nights in the National Accounts measure of non-market health care output means that these improvements in efficiency are leading to measured output falling.

There are two reasons for including bed-nights as an indicator of output:

- The first is that, in a static system with no changes in the number of bed-nights due to changes in efficiency etc, an increase in bed-nights would be an indicator of hospital activity. However, this effect will already be picked up in the other two measures: the number of casemix-adjusted inpatient discharges and day patient discharges.
- The other reason is that number of bed-nights might be an appropriate indicator for 'boarders' (a person who is receiving food and/or accommodation, but for whom the hospital does not accept the responsibility for treatment and/or care. However, a hospital may register a boarder. This excludes all babies born in hospital.). The extent of inclusion

of boarders is not clear from the available definitions and data descriptions. It seems likely that boarders will have long ALOS.

Recommendation H7

The number of bed-nights should not be used as part of a measure of health care output for all types of hospital patient. It might be appropriate to consider using number of bed-nights as an appropriate indicator of the volume of health care output associated with 'boarders'.

(iv) aggregation

The ratio of inpatient to day patient care expenditure from the Ministry of Health's *Health expenditure trends in New Zealand 1994-2004* (MoH 2005) is 1:18, while the ratio of the (fixed base) weights used in the National Accounts is 1:122. For aggregating growth in non-market output, international guidance states that the use of cost weights is acceptable (see section 6.2.1). As such, the weighting scheme ought to be revised to take into account the actual costs of providing these services – or the costs of the services for which these series are considered to be suitable proxies. Given the ongoing shift of health treatments from inpatient to day and outpatient care, it seems likely that the unit cost of day care and outpatient treatment will have increased (it is also likely that the average cost of inpatient care will also have increased, but more slowly). This would mean that the weighting structure has been changing as the proportion of patients treated in day care and outpatient care has increased.

Recommendation H8

The weighting scheme should be updated, possibly as frequently as annually, to reflect the changing relative costs of providing the different services.

The weights provide information on the relative importance of growth in the different quantities that comprise health care output, and are usually applied to the growth rates in those quantities. In practice, the weights have been applied to the values of the indices in individual years. To make the index number methodology more consistent with standard practice, the calculation should weight together growth in the volume indicators, rather than indices of the volume indicators.

Recommendation H9

The method for aggregating the different sub-components of the health care output index should conform to the standard method involving weighting together changes in the volume of different activities using relative weights (rather than weighting together different index series).

(v) other issues

The coverage of the health care indicators used in the measure is very partial. Many types of health care are not covered, including outpatients, mental health, preventative care, primary care and long term care. According to *Health expenditure trends in New Zealand 1994–2004*, of the Ministry's \$8.5bn expenditure on health care, only \$2.7bn (31 per cent) was spent on inpatient and day patient care. Outpatient care cost \$2.9bn (34 per cent) and long-term care cost \$1.7bn (20 per cent). As mentioned above, the global drive to deliver health care to patients in the most efficient setting may mean that these are relatively high growth areas. Extending the coverage of the health care output measure is desirable

The timeliness of data used is less than optimal. The underlying health series is based on health indicators up the 12 months ending June 2004 (after when the inputs-based figures are used to provide recent history).

6.3 Health care inputs

This section discusses the availability of data for measuring change in health care inputs, along with the issues that these data sources present for those interested in measuring change over time in health care productivity. This section focuses on the availability and quality of appropriate data, as the concepts and methods are rather less contentious than is the case for output. That said, this section does include a summary of the concepts and methods, as well as descriptions of existing analyses of health care inputs (along with critiques of their sources and methods). *Measuring productivity* (OECD 2001) covers concepts and methods more thoroughly.

This section is organised differently from section 6 on health care output, which had separate sections on quantity and quality. Instead, this section distinguishes between labour, capital, and intermediate consumption as the three types of input into production, each of which has its own sources and methods.

The concepts and methods for calculating inputs are the same, irrespective of the exact specification of the productivity equation – single, multi, or total factor productivity.

6.3.1 Labour inputs: summary of concepts

Ideally, the best measure of labour inputs to production is the number of hours (actually) worked, differentiating between different types of labour. The weights to be used to aggregate changes in the number of hours worked by the different types of labour, should be the total employment costs of the different types of labour.

Hours (actually) worked is better than simple numbers of people working because the latter ignores changes in what labour is contributing to production (for example a shift to or from part-time working, greater or lesser overtime working, and so on). It is also better than counts of full-time equivalents (FTE), as the information used to convert to FTE is not usually based on actual hours worked but on contracted hours, paid hours, or even simpler assumptions; such as, that part-time working is half full time working.

6.3.2 Labour inputs: existing analyses: Statistics NZ's measured sector labour volume data

Statistics NZ's measured sector productivity estimates draw on a wide range of labour market data. As the measure only includes the measured sector, it excludes the health care and education industries entirely (along with public administration and defence). Nevertheless, the sources used also provide information that could be used to compile measures of labour inputs for the health care and education industries.

The labour volume series is an estimate of paid hours for all employed persons engaged in the production of goods and services in the measured sector in New Zealand. Paid hours, rather than actual hours, is used because only the former is available from the *Quarterly Employment Survey*. The series is compiled using a number of data sources, from which the best characteristics of each are used for productivity measurement.

Throughout the series, there are three components that are summed to an industry level:

- employees in industries covered by employment surveys
- employees in industries out of scope of employment surveys
- working proprietors.

For each of these components, the labour volume series is constructed by multiplying together the following two variables to give total weekly paid hours for the measured sector:

- job/worker counts
- weekly paid hours per job/worker.

For the first of the three components, data from the Department of Labour (DoL) *Employment Information Survey* is used up to 1980, when it became the DoL *Quarterly Employment Survey* (QES). The DoL data was the sole source for employee counts and hours paid for this component until 1989, from which point annual Business Demography counts are rated forward by quarterly movements in employee counts from the QES. The resulting quarterly series of employee numbers is then multiplied by average weekly paid hours from the QES to achieve a quarterly series for paid hours. In 1989, Statistics NZ assumed responsibility for administering the QES. From 2000 onwards, monthly Linked Employer-Employee Dataset (LEED) has replaced Business Demography as the sole data source for employee counts, and is combined with QES data on average weekly paid hours.

The second component includes employees in the following ANZSIC industries that are omitted from the coverage of the surveys above:

- A01 – Agriculture
- A02 – Services to agriculture
- A04 – Commercial fishing
- I6301 – International sea transport
- L7711 – Residential property operators
- M813 – Foreign government representation
- Q97 – Private households employing staff.

Prior to 2000, Census of Population and Dwellings data provides benchmarks for employee counts and average weekly hours for this component. Prior to 1986, counts are interpolated using data from the Agriculture Census where appropriate. From 1986 to 2000, quarterly estimates of change from the Household Labour Force Survey (HLFS) are used to interpolate weekly hours between census benchmarks. From 2000 onwards, LEED provides monthly data on employee counts, while the average hours methodology remains unchanged.

For working proprietors, the third component, prior to 1986, census benchmarks are used to calculate both counts and average hours for almost all industries, supplemented by data from the DoL employment surveys and the Agriculture Census where appropriate. From 1986 to 2000, both hours and count data are benchmarked using totals from the census and interpolated using data from the HLFS, as in the previous

component. From 2000 onwards, LEED provides annual benchmarks for working proprietor counts, supplemented by data from the HLFS and QES. Census data continues to provide average hours benchmarks during this period.

LEED employee count data are unavailable for the last quarter of the series and LEED working proprietor count data are unavailable for the last year of the series, so the latest movement in the employee count data is estimated as the latest movement from the QES, and the latest HLFS movement is used for industries outside the QES scope. Working proprietor counts are rated forward using HLFS movements. Adjustments are made to the QES and HLFS data where necessary. Average hours worked per industry is calculated as in previous years, however the data are adjusted to account for the proportion of secondary jobs for employees in industries out of scope of the QES and working proprietors.

The labour input index

The industry volume series are aggregated to the measured sector level by means of a chained Törnqvist index. The quantity relatives in the index are two-period ratios of industry labour volumes. Industry two-period mean shares of measured sector nominal labour income form the exponential weights.

Use of LEED

LEED is the main data source of counts of employees and working proprietors from 2000 onwards. The LEED dataset is created by linking a longitudinal dataset from the Statistics NZ Business Frame with longitudinal data from administrative taxation sources. Statistics NZ sees LEED as the best available data source for measuring labour counts for the reasons outlined below.

For measurement of employees, LEED data differs to the previous Business Demography Database (BDD) in the following ways:

- LEED employee count data are monthly, whereas under the previous approach, quarterly data was used. Therefore LEED captures the seasonality of labour volume better.
- Unlike the previous approach, LEED counts are not interpolated using survey information, reducing the effect of sample error on the series.
- LEED data includes information about secondary jobs for industries outside of the scope of the Quarterly Employment Survey (QES). These jobs were previously excluded from the series.

For measurement of working proprietors, LEED data differs to the previous census or HLFS measurement in the following ways:

- The majority of the working proprietor data are based on LEED annual benchmarks, based on a working proprietor's main income source over the year, ie it is not a point-in-time estimate. It is modified to incorporate seasonality using the HLFS and QES; however, the annual average counts remain the same.
- LEED data includes information about people with secondary jobs (based on income) as a working proprietor. These jobs were previously excluded from the series.

- Under the previous methodology, census benchmarks could be extrapolated forward for up to five years before being finalised. However, LEED provides annual benchmarks and, at most, it is only the latest year which will be extrapolated forward.
- Working proprietors who pay themselves a salary can now be identified more accurately using LEED.

Composition-adjusted labour input

Composition-adjusted productivity measures account for the impact of changes in the skill composition of workers. As multifactor productivity (MFP) is measured residually, when change in skill is incorporated as part of labour input, it provides a theoretically better productivity measure, as it would otherwise be allocated to MFP.

Composition-adjusted labour is calculated by adjusting the Labour Volume Series using movements in a labour composition index, which estimates changes in skill composition using proxies for skill, namely education attainment and work experience. The labour composition index is calculated using the HLFS to estimate the proportions of each skill category of worker, while the *New Zealand Income Survey* (NZIS), an annual supplement to the HLFS, is also used to compile income shares for each of these groups.

Due to the availability of NZIS data, the series runs from 1998. For further background on composition-adjustment, and details on the methodology, see the *Accounting for changes in labour composition in the measurement of labour productivity* (Statistics NZ 2008).

6.3.3 Existing analyses: Ministry of Health's labour inputs

As a gross output-based labour productivity measure, the Ministry of Health's methodology does not include either capital or intermediate consumption as part of inputs. The labour inputs are tightly defined around doctors and nurses working in medical and surgical units. The information is sourced from returns completed by DHBs.

This measure of labour inputs is not separately published: only the calculated productivity measure is published, in the annual *Health and independence report* (see, for example, MoH 2008).

The labour measure used is based on numbers of full-time equivalents. The definition of a full-time equivalent is not standardised and would typically be based on, for example, contracted hours or possibly hours usually worked. Ideally, a measure of labour inputs should be based hours actually worked. Any changes over time in overtime worked, leave entitlements, the balance between full-time and part-time working, and so on, may not be properly incorporated in the full time equivalent measure.

The way in which contracted (as opposed to permanent) staff are accounted for in the measure may be a source of bias: whilst there is good information available on the expenditure by DHBs on contracted (temporary) staff, there is little information available to decompose this into price and volume components. In order to do this, the price and volume breakdown from employed staff is used.

The measure takes some account of the different inputs from different types of staff by distinguishing between, say, doctors and nurses and senior versus junior staff. It may be

that further differentiation between types of staff, along the lines of the analysis carried out by Statistics NZ (Statistics NZ 2008) could improve the measure further.

6.3.4 Existing analyses: Ministry of Health Financial Templates(used up to 2005/06)

The Ministry's source of information on the number of staff working in New Zealand health care, along with associated costs, for use in the published productivity measure up to 2005/06 is the Financial Templates, which are used as the mechanism for DHBs to report their ongoing expenditure to the Ministry. The Financial Templates report numbers of FTEs and costs for all salaried staff along with costs (not FTEs) for outsourced staff, although the Ministry's currently published productivity measure only focuses on doctors and nurses in surgical and medical areas.

The level of disaggregation available from the Financial Templates is relatively low (at least compared to the level of disaggregation of information from other sources, for example HWIP (see below). For example, the breakdown by type of staff is limited to 5 categories: medical personnel; nursing personnel; allied health personnel; support personnel; and management/administration personnel.

The definition of costs does not extend to what is usually required for weighting together different types of labour: what is available is salary, rather than total compensation, although salaries may be a reasonable proxy.

The lack of information in the Financial Templates on the number of outsourced FTEs is resolved by assuming that the average cost of and average hours worked by an outsourced FTE is the same as a salaried FTE (total expenditure on outsourced staff is divided by the average cost of an FTE to yield the number of outsourced FTEs).

6.3.5 Existing analyses: Health Workforce Information Programme (HWIP) (used from 2006/07)

The Ministry's main source of information on the number of staff working in New Zealand health care is the Health Workforce Information Programme (HWIP), which is run by DHBNZ. Example reports, along with more detailed information about HWIP, are available in the quarterly *Health Workforce Information* reports (DHBNZ 2008).

The HWIP includes a regular quarterly survey of DHBs, which asks about the staff employed. There are a number of mandatory fields which are listed in table 4. Table 4 also presents those percentages of the mandatory fields which are valid, pre- and post-a data correction phase.

For the productivity measure, the same data elements on staff numbers from HWIP as for the Financial Templates are used. HWIP provides an opportunity to expand coverage, as well as to increase the level of disaggregation (see section 5.3.3 for a discussion of the level of disaggregation in relation to output: this is also apt for inputs).

The collection of two further pieces of information has been under discussion, and data are beginning to be collected. These are the Australian New Zealand Standard Classification of Occupation (ANZSCO) and Workforce Strategy Groups mapping.

Table 4 Mandatory fields in DHBNZ and HWIP staff survey, along with indicators of data validity

Mandatory Fields	Valid Raw Data	Valid Data after correction
Birth Date	96%	96%
Common Chart of Accounts	27%	28%
Employment Start Date	100%	100%
Employment Status	74%	100%
Ethnicity	70%	100%
Facility	80%	80%
Health Service	50%	50%
Iwi Affiliation	43%	100%
Scope Of Practice	51%	51%
Sex Total	76%	100%
Total Contracted Hours	93%	93%
Union Status	76%	79%
Average (over all fields)	70%	82%

Source: Reproduced from Table 1 in *Health Workforce Information* (DHBNZ 2008)

Over recent years, much effort has been put into standardising definitions, for example of the mapping between ANZSCO and the Workforce Strategy Groups, and the definition of what is a full-time equivalent (FTE), the latter being defined as a 40 hour working week, taking into account annual leave, statutory holidays, and time off in lieu.

Together, the mandatory fields along with the occupational information provide a great deal of information that is of use in measuring the quantity of labour in the New Zealand health care industry. In particular, the numbers of staff and hours provide a quantity measure of labour, and ANZSCO as well possibly, as length of service and other variables provide an opportunity to incorporate differences in the quality of labour using a disaggregation approach.

The detailed data dictionary is published on the web, entitled the *Health workforce information programme (HWIP) code set* (DHBNZ 2006).

This information on staff quantity and quality would need to be used alongside appropriate weights, or staff costs, when used as a measure of labour input. It would be useful to compare and reconcile the information from the HWIP source with the Financial Templates that are the source for the staff numbers (see section 6.3.4) used in compiling the Ministry's current productivity measure.

6.3.6 Capital inputs: summary of concepts

Ideally, the best measure of the capital input to production is the flow of capital services that are generated from the capital held. Capital services are not directly observed, but

instead are estimated from a measure of the capital stock – assuming that the flow of capital services is directly proportional to the underlying stock of the capital being considered. This approach typically assumes constant capacity utilisation rates, and in New Zealand the capital stock data are predominantly sourced from the productive capital stock series from the National Accounts, which are derived using a perpetual inventory model (PIM).

The relative weight of capital services is given by the user cost of capital. The user cost of capital can be seen as an imputed rent: it is the rent that the owner of the capital might notionally charge themselves for use of the capital. In some cases, there may be fully functioning capital rental markets, and the imputed rents may be inferred from equivalent actual rents. For many assets, however, there are no fully functioning capital rental markets, and the imputed rent has to be calculated indirectly. The user cost of capital can be seen as being made up of two basic terms: the cost of financing and the change in the value of the capital. The cost of financing is made up of two further parts: an estimate of the interest payment on a loan to purchase the capital and the cost of depreciation. See section 5.4.6 for discussion of the appropriate rate of return to use when undertaking this calculation for the public sector.

The OECD's *Measuring productivity* (OECD 2001) sets out the methodology and concepts. Implementation for market sector industries in New Zealand is set out in *Productivity statistics: sources and methods* (Stats 2009).

The scoping issues discussed in section 5.2 are particularly difficult in respect of measuring capital. This is due to the need in a productivity measure to match the inputs to the output within scope: were the scope of the health care productivity measure to be delineated by whether the government or private individuals are the source of funding, then difficult questions arise about which capital assets should be included as part of government production. While (publicly-owned) DHB provider hospitals would clearly be in scope, what about (private sector) general practices? The solution to this has already been proposed, and is covered by recommendation G13 in section 5.4.3.

6.3.7 Statistics NZ's measured sector capital services

The capital services input index measures the flow of capital services generated by the use of the stock of capital assets for a given March year. No allowance is made for differences (across industry and time) in asset capacity utilisation rates.

As capital service flows cannot be directly measured, industry level flows are modelled, based on the productive capacity of industry capital stock. The industry level flows are aggregated to the measured sector level using industry shares of the measured sector current-price capital income as weights. More specifically, the following steps occur:

- The starting point is the annual constant-price productive capital stock series. An asset's productive capital stock is its gross capital stock adjusted for the decline in its efficiency.
- Measured in constant prices, the productive stock represents standardised efficiency units and can be interpreted as a measure of the potential capital services that the asset can contribute to the production process. The productive capital stock series are built up using a perpetual inventory model (PIM) that generates productive capital stock estimates for 26 asset types by industry, of which only 24 are used in the capital services index.

- The model specifies for each asset type a mean expected useful life, a retirement function based on a distribution about this life and its pattern of (hyperbolic) efficiency decline. These parameters, and gross fixed capital formation in constant prices, are used to estimate an asset type's productive capital stock in volume terms.
- In addition to the PIM-derived fixed asset stocks, the range of capital included in the productivity measures is supplemented by estimates for seven other assets, namely livestock, exotic timber grown for felling, and five different types of land: agricultural and forestry; commercial; industrial; mining; and other non-agricultural land.
- Capital service flows are assumed to be proportional to these productive stock estimates, and are aggregated to the industry level using a Tornqvist index, with weights based on implicit rental prices (or user costs) which are a function of an exogenous real rate of return, depreciation, net taxes on production and asset price changes.

The PIM produces estimates of capital services for the health care industry. The underlying data on capital assets that are fed into the model are collected by Statistics NZ from the Ministry of Health and through the Crown Financial Information System (CFIS). A fine level of detail is collected and used.

6.3.8 Intermediate consumption: summary of concepts

Intermediate consumption, sometimes referred to as consumables, consists of all other items incurring expenditure other than labour and capital. The ideal way to measure the change in intermediate consumption over time is by deflating current price expenditure with suitable price indexes. Generally speaking, the quality of measures of volume change in intermediate consumption improves with the level of disaggregation of the expenditure and price deflator data. See section 5.3.3 for a discussion of the level of disaggregation of output, which is just as relevant for measuring intermediate consumption.

A measure of intermediate consumption is only needed as part of an input measure if a gross output total factor productivity measure is being constructed: it is inappropriate to include intermediate consumption if the output measure is a value added one. However, it is important to note that in calculating value added, intermediate consumption is subtracted from gross output.

6.3.9 Statistics NZ's health care industry intermediate consumption

Statistics NZ compiles information on health care industry intermediate consumption in current prices as part of the New Zealand National Accounts.

The source of information on intermediate consumption in current prices is the expenditure reports that the Ministry sends to Statistics NZ's Government and International Accounts unit, and information available in the Crown Financial Information System (CFIS). These contain a great deal of information on the type of goods or services incurring expenditure.

6.3.10 Ministry of Health information on expenditure

The Ministry collects information on all the (public) expenditure incurred by DHBs on consumables, as well as labour and capital. Part of the rationale for collecting these data

are to provide Statistics NZ with the information that is needed in constructing estimates of health care industry intermediate consumption and the health care industry Producer Price Indices (PPIs). The level of the disaggregation of this information is as provided to Statistics NZ (see section 6.3.9).

6.3.11 DHB accounting systems

DHBs are actively seeking ways to improve their accounting systems. Some have procured off-the-shelf systems which allow the tracking of expenditure and to examine the reasons for changes over time, including the ability to distinguish between price and quantity change. Currently, there is no single nationwide system, with each DHB and the Ministry collecting information on all the (public) expenditure incurred by DHBs on consumables, as well as labour and capital. Part of the rationale for collecting these data are to provide Statistics NZ with the information that is needed in constructing estimates of health care industry intermediate consumption and the health care industry Producer Price Indices (PPIs). The level of the disaggregation of this information is as provided to Statistics NZ (see section 6.3.9).

7 Education

This section discusses the availability of data for measuring change in education output and inputs, along with the issues that these data sources present for those interested in measuring change over time in health care productivity. Separate sub-sections are devoted to early childhood education, schooling, tertiary education, and other education, addressing output quantity, output quality, and output weights for each sub-sector. These are followed by separate sub-sections covering labour inputs, capital inputs, and intermediate consumption. Before launching into these descriptions, here follows a summary of concepts and a description of the existing analyses of education output (along with critiques of their sources and methods).

7.1 The education system in New Zealand

This section describes the education system in New Zealand to help the reader understand the scoping issues and the general context for any ensuing productivity measure. Education in New Zealand ranges from optional early childhood education for children under six, through compulsory schooling for those aged six to sixteen, to post-school vocational training and tertiary education up to the doctoral level. It is delivered by a combination of public and private institutions. Because conceptual issues and data sources are specific to each educational sector, this section separately presents detailed information for each level. See sections 7.2.3 *early childhood education*, 7.2.4 *school*, 7.2.5 *tertiary education*, and 7.2.6 *other education*.

Possibly the single most important question to be answered before work on government productivity could move forward is that of scope. Economic statistics published by Statistics NZ, such as Gross Domestic Product and Productivity, are produced on an industry basis, without regard to the finance of those industries. Educational output estimates consistent with the System of National Accounts are required to expand Statistics NZ's existing suite of industry-based official productivity estimates. Users may also wish to answer questions about productivity with regard to government expenditure on and/or delivery of educational services. The selected scope has implications for data requirements, compilation methods, and coverage. Refer to section 5.2 for discussion of scope as it relates more broadly to government sector productivity measurement.

The distinction between public and private educational institutions is less clear-cut than might be expected at first glance, and must be determined by examining ownership and control² of the provider. Additionally, the Ministry of Education's understanding of the question may differ from that of Statistics NZ. The table below describes the ownership possibilities of each type of educational institution, as recorded by the Ministry of Education.

² Control is defined as 'the ability to determine general corporate policy by appointing appropriate directors, if necessary'. See SNA 1993, paragraph 4.30 for discussion.

Table 5. Ownership of NZ educational institutions

ECE	Community-based ECE services	Owned by an incorporated society Owned by a charitable trust Owned by a statutory trust Owned by a community trust Owned by a government department Owned by a health board Owned by a local authority Owned by a trading enterprise Owned by a public education institution Owned by the crown	
	Private ECE Services	Privately owned by a sole teacher Privately owned by a company Privately owned by a partnership Owned by a private trust Owned by a state owned enterprise	
School ³	State	State: Not Integrated	State: Integrated
	Private	Private: Fully Registered	Provisionally Registered
	Other Vote Education (e.g. special education)		
Tertiary	Public Tertiary Institution Privately owned Established by Act Owned by a trust Owned by an incorporated society Corporate Institutions (including Government agencies)		

Source: MOE

What should be considered government education for the purposes of productivity analysis? An industry-based approach requires assigning a provider to either the government or private sector. This is consistent with the System of National Accounts and the existing Statistics NZ productivity estimates. Potential definitions of the boundary between government and non-government are explained below, with inclusions at each level of education.

Government delivery

- None of the ECE providers are owned and operated by government entities, except incidentally as a service to their staff (eg university crèches)

³ Homeschooling is excluded from this table as it is provided outside of educational institutions.

- Only state schools, including the Correspondence School, are fully owned and operated by the state. (State integrated schools privately own their capital.)
- Public universities⁴, polytechs, and wananga are fully owned and operated by the state
- Specialised public 'other tertiary education providers', such as the School of Dance and Drama, are fully owned and operated by the state. Educational arms of government bodies, such as the Police Academy, are also fully owned and operated by the state.

Government control

This is a difficult consideration to measure precisely. All ECE providers are subject to some amount of government control through the licensing and funding regimes. All schools are subject to some amount of government control through the licensing and funding regimes, and the requirement for compulsory schooling for children aged 6–16 years. All tertiary providers are subject to some amount of government control through the licensing and NZQA registration of qualifications.

Recommendation E1

Consideration must be given to consistently applying definitions of government and private education across all levels. The definition selected should fit the question that government productivity measures are intended to answer.

From a policy perspective, users may be interested in understanding the productivity associated with government financing of educational institutions or services. Government funding ranges from full funding of state schools, to a few hundred dollars per pupil at private schools. A clear threshold would be required in defining a scope based on government funding.

Government funding

- All ECE services described receive funding from the government. The proportion of service covered by the Ministry of Education varies by service type, as shown in table 16.
- State schools are 'fully funded' by the Ministry of Education, although this only makes up an average of 86 percent of their income – the rest is composed of local donations (see table 7). Integrated schools are partially funded by the Ministry (salaries and operation), and private schools receive per-student stipends from the government (see table 8).
- Government funded tertiary education includes all public universities, polytechs, and wananga, as well as the registered private tertiary institutions that receive state funding for particular programmes. They might exclude the unfunded portion of educational services delivered by state tertiary providers.

⁴ all colleges of education have been incorporated into universities

- In addition to the specialised public 'other tertiary education providers' and government tertiary providers, the government funds industry and targeted training programs delivered in both classroom and workplace settings.

Treatment of government funding

If the selected scope is government-funded education, the proportion of productivity allocated to government should be equal to the proportion of expenditure provided by government. Government only provides 82-88% of funds to state and state integrated schools, with the rest being locally raised through donations and fundraising⁵. Care must be taken in treating this as uniformly and transparently as possible, consistent with the scope of the productivity estimates. Refer to section 5.4.3 for more general discussion of this concept.

Table 6. Total Revenue of State and State Integrated Schools by category

State Schools Revenue⁽¹⁾ *By revenue category* 2000–07

Revenue category	Year							
	2000	2001	2002	2003	2004	2005	2006	2007
	\$ (000)							
Government grant	2,585,664	2,640,155	2,755,637	2,934,513	3,118,812	3,297,963	3,463,247	3,582,130
Investment	28,332	32,172	28,617	29,781	33,381	41,451	47,893	54,532
Local fund	307,955	343,571	377,882	411,084	440,724	425,773	435,240	493,662
Other	14,918	18,152	39,264	49,424	41,494	41,905	42,601	22,303
Total	2,936,869	3,034,050	3,201,401	3,424,802	3,634,411	3,807,091	3,988,982	4,152,626
Government percentage %	88.04	87.02	86.08	85.68	85.81	86.63	86.82	86.26

Source: Ministry of Education Financial Information Database for Schools

(1) GST exclusive.

State Integrated Schools Revenue⁽¹⁾ *By revenue category* 2000–2007

Revenue category	Year						
	2000	2001	2002	2003	2004	2005	2006
	\$ (000)						
Government grant	296,758	306,875	322,912	348,740	378,114	410,411	441,012
Investment	2,556	2,692	2,654	2,722	3,048	4,000	4,784
Local fund	42,927	49,544	56,826	66,273	72,397	71,978	73,015
Other	2,877	1,114	3,225	2,742	1,341	856	2,184
Total	345,118	360,225	385,617	420,477	454,899	487,246	520,996
Government percentage %	85.99	85.19	83.74	82.94	83.12	84.23	84.65

Source: Ministry of Education, 2008

(1) GST exclusive.

⁵ Levels of local funding and investment income vary noticeably by decile, with decile 10 schools receiving 119 percent to 147 percent of the total revenue from all sources that is received by decile 1 schools.

A second consideration in the schooling sector for the scope of government-funded education is inclusion of the proportion of private school education that is paid by government, identified in table 8.

Table 7. Operational Funding of Private Schools by category

Category	Year						
	2000	2001	2002	2003	2004	2005	2006
	\$ (000)						
Adjustment	2,110	2,029	1,537	1,295	940	890	-59
Māori language	48	42	48	63	80	79	81
NCEA grant	...	...	...	...	33	39	40
Per pupil funding	36,812	36,890	37,428	36,808	36,007	38,374	36,236
Total	38,969	38,961	39,012	38,166	37,061	39,382	36,298

Source: Ministry of Education Education Management Information System

(1) GST exclusive.

Note: NCEA – National Certificate of Educational Achievement

Symbol: ... not applicable

Recommendation E2

Most education involves a certain degree of co-financing through fees and donations, and for integrated schools through privately owned capital. Care is required to treat this consistently in accordance with the principles laid out in this report.

Public funding can also be specific to the recipient of the educational services. International students are generally not eligible for public funding, even if they attend a public educational institution. Conversely, state educational funding for students with special needs can be used to acquire appropriate special education at a public or private school.

At this stage, the question of which educational activities will be in the scope of potential productivity estimates has yet to be decided. This report attempts to cover the broadest possible needs, with sufficient disaggregation to also answer more specific questions. Selected potential definitions of scope include:

- Publicly funded and delivered educational services (top left of box below)
- Publicly funded educational services, regardless of delivery (first two columns below)
- Publicly delivered educational services, regardless of funding (first row below)
- All educational services divided into publicly and privately funded groups.

Table 8 Funding and delivery matrix of NZ educational system

		Funding		
		Public	Mixed	Private
Delivery	Public	State schools Correspondence School Universities Polytechnics Wananga Government agencies ¹		Fee-paying international students
	Mixed	Special schools	Integrated Schools ²	
	Private		Community-based ECE Private Schools Registered private tertiary Industry training orgs	Private ECE Registered private tertiary

(1) For example, The New Zealand Police Academy and New Zealand Defence College. While these are publically funded and operated, they are not integrated into the mainstream education system.

(2) Integrated schools are listed as mixed because they own and derive services from their own capital.

7.2 Education output

7.2.1 Summary of concepts

As for health care, the basic framework for measuring education output is set out in SNA 1993, which encourages direct measurement of the actual volume amounts of goods and services produced and/or consumed, but acknowledges that the use of deflated expenditure on inputs is an option; that is, the 'output=inputs' method. The other main publications available provide further detail on implementation. (See section 5.1 for detailed discussion.) The conceptually pure measure emerging from this literature, along with real world limitations on achieving it, is summarised in table 5.

Individual educational services, including preparing and delivering lessons, giving and marking examinations, as well as general supervision and counselling, can be characterised as 'teaching services'⁶. The goal of measurement is to accurately capture this output⁷.

Output quantity

Teaching services are provided in groups of varying sizes, which means that an hour of a teacher's time can provide varying amounts of individual educational benefit to students. To satisfy the National Accounts framework, which measures both what is received and what is produced, the *Handbook on price and volume measures in the National*

⁶ Ancillary educational services, including school administration, transportation, and catering, should be deflated or directly estimated in volume separately from core educational services. (OECD 2008, paragraph 2.24).

⁷ It is acknowledged that some subsectors – namely tertiary – have other outputs of equal importance. See section 7.2.6 for discussion of tertiary sector research.

Accounts (Eurostat 2001, paragraph 4.12) states that the appropriate output measure of education is the **sum of the individual educational benefit provided to each pupil**. Hence, the individual educational benefit should be expressed as an hour of teaching received by a student at a particular level and programme type ('pupil-hours'). Pupil-hours or full-time student equivalents (FTSEs) are superior to headcounts, because they capture differing levels of educational intensity in areas where less-than-full time participation is common.

In tertiary education, lessons are both fewer than they are at lower levels and less important relative to student efforts outside of class (ie outside of the National Accounts 'production boundary' of the education provider). Additionally, students proceed through programmes at varying levels of intensity. This makes classroom student-hours a less relevant measure of output. Student numbers or full-time equivalents are often used as a direct volume measure for tertiary education output, but they cannot capture changes in educational quality or intensity. Degree completion is also a problematic measure because of the difficulty with timing production, as well as the comparability of degrees over time.

For that reason, international thinking on the topic is that credit completion, if available, is a better proxy for output at the tertiary level. It more accurately indicates the intensity of the student's attendance, and can be seen as an indirect indication of the quantity of teaching services, if we assume a correlation between student workload and quantity of teaching.

Output quality

In addition to measuring the quantity of educational output, users may be interested in controlling for changes in education over time. This is known as 'quality adjustment'. The main tool for implicitly capturing change in **quality** is differentiating between different **types** of quantity in an output measure: in education, it is necessary to differentiate between different types of schooling (at a minimum between primary, secondary, tertiary, and special). The conceptual criterion is that the categories should be homogenous; however, it is recognised that this may not be practically attainable.

Cautionary note

'Quality' in this context does not necessarily denote that something is better or worse, but that it has different defining characteristics. For example, special education is different from traditional primary schooling, and hence should be treated separately. See section 5.3.1 for more information.

Other techniques for explicitly incorporating quality include: (1) adjusting the **quantity** measures for **quality** change (eg adjusting by mean standardised test scores on the assumption that change in score represents change in the quality of educational output); and (2) defining the **quantity** measure of output in terms of **quality** (eg measuring only courses passed).

There is currently no consensus on how to incorporate into an output **quantity** measure the other aspects of **quality** that are not, or cannot be, picked up by differentiation, for a number of reasons. The main types of **quality** adjustment for education are considered to be:

- exam scores
- school inspection results
- class size⁸ (favoured by Italy)
- attendance rates (currently used in the UK).

Grades, exam scores, credits, and the like, depend greatly on student efforts, and are not indicators of change in educational services as such. However, *if the assumption is made that student effort is in constant proportion to teaching services*, student attainment can be taken as a proxy for the volume of teaching services *of a constant quality*⁹.

Table 9 Aspects of conceptually pure method of measuring changes in education output over time, with limitations

Aspect of conceptually pure method	Limitations
A. Education output should be defined from the perspective of the consumer: a unit of output covers a course of education at a given level, regardless of the intensity with which a student progresses through it or whether it is delivered by a public or private provider.	A.1 Typically, countries' education information systems are uneven in their depth of information. While an ideal measure would feature student numbers attainment-adjusted to represent educational output of a constant quality for each level ¹⁰ , most areas will only have data sufficient for pupil-hours or full-time student equivalents (FSTE) without regard for the success of education delivered. Some sectors will only be able to consistently provide student numbers.
	A.2 Even where information systems provide such depth of information, there are significant conceptual issues that need to be addressed for defining the unit of output for parts of the education system. While it is relatively simple to define the output of a mainstream primary school, this is not the case for all types of education; for example, what is a course of education in a special school where each student has different needs and abilities; what is the output of tertiary sector research?

⁸ International opinion on the relationship between class size and educational outcomes is mixed. See Blatchford (2009) for a summary of the class size debate. It is important enough to merit inclusion as a quality-adjustment option in the forthcoming OECD handbook on measuring education output, but has fallen out of favour as a determining factor in NZ education policy as a result research showing that effective teaching, regardless of class size, has a more powerful impact. See, for example, Hattie (2005).

⁹ Constant quality of teaching must be specified in this assumption. Research suggests that quality of teaching matters a great deal, potentially doubling a child's learning in a year. But as with the extra effort put in by more engaged students, teaching quality is only observable in a limited sense.

¹⁰ This would be an 'A method' in the schema proposed by Eurostat (2001), as discussed in section 5.4.1.

	<p>A.3 This concept cuts across the usual National Accounts methods, which distinguishes between the value-added provided by different parts of the economy. In the case of education, a child accumulates educational benefit as they move through private sector early childhood education providers to public sector primary and secondary education providers – unpicking the relative contributions of each of these providers (their individual value-added) is a difficult task.</p>
<p>B. Any measure should be as comprehensive as possible, covering all of the different types of education provided by the different parts of the system.</p>	<p>B.1 Many countries have good information on primary and secondary education, but relatively less information on early childhood, special, and tertiary education that is easily accessible.</p>
<p>C. The relative importance of different types of education should be given by the marginal valuation.</p>	<p>C.1 There is little conceptual basis for judging relative importance in the absence of a competitive market that allows for clearing or marginal prices:</p> <ul style="list-style-type: none"> (i) average costs provide information from the producer perspective and are generally easily available (hence, this is what is recommended in the literature). (ii) revealed preference studies could provide information from the consumer perspective.
<p>D. Change in education output can occur because of either a change in the number of students and/or a change in the quality of education. Some of the quality change can be picked up by differentiating between different types of education. Other types of quality can be picked up by examining the contribution of education to outcome.</p>	<p>D.1 Differentiation will not pick up quality change within levels/types of education.</p> <p>D.2 Quality is multi-dimensional, and the choice of which dimension or dimensions are relevant depends on the type of education. For example, for alternative education units, the main dimension of quality may be improved attendance and engagement with education, whereas for mainstream secondary schools the attainment of higher qualifications may be more relevant.</p> <p>D.3 There is no agreed method for combining two or more quality dimensions for treatments where this is appropriate: how relatively important is exam scores against, say, class size?</p> <p>D.4 Distinguishing the role played by an education system from other factors affecting education outcomes (engaged parents, increased student effort, etc) is difficult and needs further work.</p>

7.2.2 Existing Analyses

This section explains in detail Statistics NZ's current measure of educational output in the National Accounts. This is compiled so that the National Accounts can comprehensively cover the total economy. However, Statistics NZ does not publish a separate education output index.

Classification and Population

Table 10 below describes the scope of Statistics NZ's education output measure in the National Accounts in terms of various classifications, and the concordance between them. The following classifications are shown: Australia New Zealand Working Industry (ANZWI), Australia New Zealand Standard Industrial Classification 1996 (ANZSIC96), Australia New Zealand Standard Industrial Classification 2006 (ANZSIC06), and National Accounts Working Industry 2006. The working industry classifications are used within Statistics NZ for low-level calculations, but are not published.

Table 10 Scope of National Accounts Education Industry by Classification

ANZWI	ANZSIC96	Description	ANZSIC06	NAWIO6
N011	8410	Pre-school education	8010	PP111
N012	8421 primary 8424 special 8432 combined	Primary Education and Special Schools	8021 primary 8024 special 8023 combined	PP112
N013	8422	Secondary Education	8022 secondary	
N014	8431 universities 8432 polytechnics	Post-School Education	8102 universities 8101 polytechnics	PP113
N015	8440	Other Education	8211 sports & rec instruction 8212 arts education 8219 other education, nec 8220 ed support services	PP114

In addition to industry classification, each kind of activity unit (KAU) is assigned an institutional sector and market/non-market status. The private market group is relatively small and includes: English language providers, driving schools, corporate trainers, some tertiary providers. The private non-market part includes: private schools and other non-profit type providers.

Value added for public education is calculated at the 4-digit working industry level for Public Early Childhood education (N011), Public Primary and Special Education (N012), Public Secondary education (N013), Public Post-school Education (N014), and Public Other education (N015).

Private sector education value added is derived for the total industry group. Private market (1M) ECE, primary, secondary education providers, as well as all (market and non-market) private tertiary education providers are grouped together with other (non-tertiary) education providers as 'N01M'. Private non-market ECE and school education providers are grouped together with other (ie non-tertiary) private education providers as 'N01N'.

Table 11 Current National Accounts treatment of public and private education

ANZWI	Public (2N)	Private non-market (1N)	Private market (1M)
N011	the 33 kindergarten associations considered (by GIA) to be Government entities	Non-profit ECE (352 units)	All other ECE? (240 units)
N012	State and integrated primary, combined primary/secondary and special schools (2,146 units)	Private primary schools, combined primary/secondary and educational trusts (30 units)	17 units
N013	State and integrated secondary schools (315 units)	Private secondary schools and educational trusts (23 units)	5 units
N014	8 universities 3 wananga 20 polytechs	None	Private training establishments (98 units)
N015	NZ Drama School and NZ School of Dance (23 units)	Private tertiary institutions, ITOs and educational trusts (185 units)	English language providers driving schools corporate trainers etc (1,083 units)

Detailed information by series

New Zealand National Accounts for education are produced on the following basis

	Current price series	Chain-volume series
Annual	<ul style="list-style-type: none"> • Production • Expenditure 	<ul style="list-style-type: none"> • Production • Expenditure
Quarterly	<ul style="list-style-type: none"> • Expenditure 	<ul style="list-style-type: none"> • Production • Expenditure

Production (Gross output less intermediate consumption)

Constant price quarterly value added is calculated at the 4-digit working industry level for public education and the total private market education sector (all levels aggregated to N01M) using the interpolation of annual values without quarterly indicators. The estimated value added for series are chained to derive the quarterly total (private and public) education value added. Because educational services are delivered in annual units, quarterly changes in output or value added are estimated annually and allocated across the four quarters.

Constant price annual value added for education is extrapolated with a volume index based on student enrolments in private and public schools provided by the Ministry of Education.

Current price value added is available at the 4-digit working industry level for public education and private education. The data for public education comes via the Crown Financial Information System (CFIS), annual reports or directly from education providers. The private data comes from the *Annual Enterprise Survey* (AES).

The roll numbers used to represent educational output are as follows:

- **ECE:** Total number of enrolments in licensed kindergarten services from the Annual Early Childhood Education Child and Staff return, which represents an enrolment snapshot. These data are available back to 1990.
- **School:** Total number of enrolments by school type (primary and secondary), including international fee-paying students. These data are available back to 1991.
- **Tertiary:** Total Domestic FTSE for universities, polytechs, and teachers colleges (wanangas are excluded), with no separation by level or subject of study. This is available back to 2000 in its current form, and to 1994 by public/private.

Expenditure (private fce + government fce + inventory change +GFKF)

Current price private final consumption expenditure (annual & quarterly) on education is measured using market output for the education industry accounts for government education, and market and non-market sales for private education. The **constant price private final consumption expenditure (annual & quarterly)** series is deflated using the tuition and examinations sub-index of the CPI, which covers school tuition, university tuition, and a small weighting of 'special interest courses' including piano lessons. In both cases, the quarterly series is interpolated.

Current price government final consumption expenditure (annual) on education is estimated as the sum of costs less sales from Ministry of Education financial data and annual reports. Quarterly current prices (excluding sales) use funding payments made to schools and tertiary institutes as an indicator.

For the purposes of **Constant price government final consumption expenditure**

- current price intermediate consumption (annual and quarterly) is deflated using the education sub-index of the PPI
- current price annual sales are deflated using the education sub-index of the PPI and interpolated quarterly
- current price compensation of employees is extrapolated by the output volume indicator (ie roll numbers) for annuals, and an employment indicator for quarterlies. Both indicators are sourced from Ministry of Education data.

Changes in inventory are sourced annually from the Ministry of Education. The book values are reflatd using the education sub-index of the PPI for the current price series, and expressed in base-year average prices for the constant-price series.

Gross fixed capital formation is calculated from Ministry of Education financial data and annual reports, deflated for constant price series using the educational buildings sub-index of the CGPI. AES data are used for private units on an annual benchmark, or balanced year basis. These private data are used to attribute an appropriate proportion of the non-residential building total from the *Quarterly Building Activity Survey* (QBAS).

Treatment of fees and funding

School fees are treated:

- as donations or transfers when paid by domestic students for government owned primary and secondary schools, and *are not* included in gross output for the education industry.
- as sales when paid by foreign students, and therefore *are* included in gross output.

Government funding:

- to state educational providers is treated as a current transfer.
- to private non-market educational providers (1N) is also treated as a current transfer.
- to private market education (1M) industries is considered social assistance benefits in kind (SABIK) and is treated as income (ie GOVTFUND variable is added to the OTHINC variable and so to gross output).

Suggested Improvements

Eurostat (2001) recommends an output indicator approach, where the indicators satisfy the following criteria:

- covers all services provided;
- weighted by the cost of each type of output in the base year;
- as detailed as possible; and
- quality adjusted.

There is room for improvement in the Statistics NZ output measure of education on each of these metrics, in light of the data sources detailed in this report. Specific recommendations will be made in the sections devoted to various levels of education.

International consensus holds that the ideal output measure for ECE is number of actual pupil-hours. The current output measure used by National Accounts falls short of this in two regards: breadth of coverage and use of headcounts rather than FTSEs. ECE data from the Ministry of Education is available from 1990. Starting in 1996, full-time student equivalents are available for a full range of provider type.

The internationally recommended optimal output measure for each level of schooling is number of pupils, attainment adjusted. Potential sources of attainment adjustment include: standardised test scores, proportion of students leaving school with a qualification, and proportion of students leaving school with a qualification of a certain standard (eg university entrance). Barring that, the recommended proxy is number of pupil-hours or full-time student equivalents. This measure may be further adjusted for attendance, if desired, as it is in the UK. These data are available from the Ministry of Education from 2000.

For reasons discussed in section 7.2, the internationally recommended output measure for tertiary education is number of completed credits by level (1–3, 4–7 non-degree, bachelor and postgraduate), separated into subject area where possible. Barring that, the recommended proxy is full-time student equivalents by level (1–3, 4–7 non-degree, bachelor and postgraduate), separated into subject area where possible. These data are available from the Ministry of Education from 2000.

Recommendation E3

Statistics NZ's volume measures for education should be aligned as closely as is practicable with recommendations representing international best practice.

How does New Zealand's education measure compare?

How far have countries progressed in moving away from the 'output = inputs' method? The following table summarises the findings of a 2006 OECD and Eurostat survey on compilation methods of National Accounts estimates of output for health and education services. For more detail see section 10.3.

Table 12 Summarised results of 2006 Eurostat and OECD surveys of methods for education services

Quality adjusted quantity measure	Austria, France, Hungary, Italy, Latvia, Lithuania, Malta, Spain, Sweden, UK
Quantity measure only, no quality adjustment	Australia, Belgium, Czech Republic, Finland, Germany, Greece, New Zealand
Output=inputs	Canada, Denmark, Japan, Korea, Luxembourg, Switzerland, US

Source: OECD

7.2.3 Early Childhood Education

This section describes delivery and funding of Early Childhood Education in New Zealand, in order to help the reader understand, for example, the scoping issues as well as the general context for any ensuing productivity measure. Some data are supplied for illustration. For detailed information on the data sources referred to in this section, see chapter 10.

ECE is education and care for infants and young children before they begin school. The International Standard Classification of Education defines pre-primary education as having the following principal characteristics: 'Programmes at level 0, (pre-primary) are defined as the initial stage of organised instruction, and are designed primarily to introduce very young children to a school-type environment; ie to provide a bridge between the home and a school-based atmosphere. Upon completion of these programmes, children continue their education at level 1 (primary education)' [UNESCO 1997, paragraph 37].

The majority of children in early childhood services in New Zealand are under five; however, children may attend early childhood services up to their sixth birthday, when schooling becomes compulsory. As of 1 July 2007, the Government pays for up to 20 hours per week of early childhood education and care through teacher-led services for

three and four year old children. The government has agreed to extend this to include other licensed ECE services (ie Playcentre and Te Kohanga Reo) as of July 2010.

As laid out in section 7.2.1, the ideal output measure for ECE is number of actual pupil-hours. The current output measure used by National Accounts falls short of this in two regards: breadth of coverage and use of headcounts rather than FTSEs.

Currently, government-classified ECE output is limited to a subset of kindergartens, and the public/private distinction is decided on a case-by-case basis. This classification is currently under review, and it may be decided that no ECE providers are classified to the government sector. Non-kindergarten licensed ECE and all license-exempt ECE groups are excluded from the National Accounts output indicator. As of 2008, licensed kindergarten covered 23 percent of enrolments in licensed ECE and 21 percent of total ECE enrolments (ie including license-exempt).

Table 13 Enrolments in licensed and/or chartered early childhood education services by service type as at 1 July (1992 to 2008)

Type of service	Year					
	1992	1993	1994	1995	1996	1997
	Number of students					
Kindergarten	45,603	46,030	46,604	47,208	46,960	46,756
Playcentre	20,601	21,540	19,979	19,108	17,596	17,058
Education and care centre	39,300	45,158	49,687	53,769	57,582	61,597
Te kōhanga reo	12,617	14,514	12,508	14,015	13,279	13,104
Home-based network	3,470	4,907	5,414	6,114	6,558	7,615
Correspondence school	812	783	802	901	993	1,024
Total	122,403	132,932	134,994	141,115	142,968	147,154

Type of service	Year					
	1998	1999	2000	2001	2002	2003
	Number of students					
Kindergarten	46,307	45,993	45,869	45,439	45,169	45,109
Playcentre	16,787	16,261	15,808	14,786	14,879	15,200
Education and care centre	65,205	68,132	71,231	73,192	76,246	78,967
Te kōhanga reo	11,689	11,859	11,138	9,594	10,389	10,319
Home-based network	8,300	8,498	8,937	8,546	8,591	9,587
Correspondence school	1,044	1,097	984	947	913	991
Total	149,332	151,840	153,967	152,504	156,187	160,173

Type of service	Year				
	2004	2005	2006	2007	2008
	Number of students				
Kindergarten	45,287	44,920	44,435	43,695	41,487
Playcentre	15,440	15,059	14,888	14,664	14,929
Education and care centre	81,096	83,889	86,059	91,733	97,756
Te kōhanga reo	10,418	10,070	9,493	9,236	9,165
Home-based network	9,922	9,770	9,802	11,073	13,065
Correspondence school	922	813	577	737	591
Total	163,085	164,521	165,254	171,138	176,993

Source: Ministry of Education Annual ECE summary reports

Symbol: ... not applicable

ECE data from the Ministry of Education are available from 1990. Starting in 1996, full-time student equivalents are available by provider type, as shown in the following tables. These are not currently used by National Accounts.

Table 14 Child FTEs at Licensed Early Childhood Education Services (2001 - 2008)

Type of service	Year							
	2001	2002	2003	2004	2005	2006	2007	2008
	Number of students							
Kindergarten	19,706	20,082	20,323	21,121	21,081	20,811	20,604	20,562
Playcentre	2,794	2,882	2,947	3,031	2,966	2,907	2,815	2,836
Education and care centre	39,710	42,698	44,787	47,556	50,791	53,180	58,244	66,093
Home-based network	5,157	5,147	5,885	6,463	6,596	6,590	7,600	9,113
Total	67,366	70,809	73,942	78,171	81,434	83,487	89,263	98,604

Source: Ministry of Education

(1) At school 30 hours or more per week.

(2) Excludes te kōhanga reo and the Correspondence School.

Adjustment of output quantity to represent actual hours of education received (rather than just enrolled), can be estimated using the one-week snapshots from RS6 1, which record hours enrolled, hours attended, and 'casual' not-enrolled hours.

Recommendation E4

The appropriate output measure of ECE education should be full-time student equivalents, disaggregated by service type. The definition of full-time at the ECE level should be consistent over time and across service types.

Recommendation E5

If quality-inclusive output measure is desired, data are available to compare enrolled ECE hours with actual ECE hours delivered in census weeks.

ECE licensing and regulation

ECE in New Zealand is funded, but not delivered, by the Ministry of Education. ECE services can be community-based or private. A community-based ECE service is an incorporated society, a charitable, statutory, or community trust, or owned by a community organisation (eg a city council, church, or university). Community-based services are prohibited from making financial gains that are distributed to their members. Private ECE services can be owned by a private company, publicly listed company, private trust, partnership, or an individual. Private services are able to make financial gains and distribute these to their members.

Any premises used regularly for the education or care of three or more children under the age of six must be licensed, except where specifically exempted by the Minister of Education. Licensing is regulated by the following pieces of legislation: Education (Early Childhood Services) Regulations 2008 (SR 2008/204); Education (Registration of Early Childhood Services Teachers) Regulations 2004 (SR 2004/236); and Education (Early Childhood Centres) Regulations 1998 (SR 1998/85). These regulations set out minimum requirements for: adult to child ratios, proportion of staff holding an ECE

teaching qualification recognised by the New Zealand Teachers Council, and the curriculum required for licensing.

ECE provision and service types

ECE services can be provided and organised in a range of ways, as described in table 15.

Table 15 ECE service types

Licensed ECE Services	Teacher-led ECE Services	Kindergarten Education and Care Services Correspondence School ECE Services Homebased Childcare Casual Childcare
	Parent/whānau led ECE Services	Playcentre Te Kōhanga Reo
Licence-Exempt ECE Groups		Playgroup Nga Puna Kohungahunga Pacific Island Early Childhood Groups Playcentre (Licence-Exempt) Te Kōhanga Reo (Licence-Exempt)

Source: MOE

Teacher-Led ECE Services are required to have a person responsible (or home-based care coordinator) who is a registered ECE qualified teacher, and they must meet the teacher registration targets for registered teacher staff. For funding purposes, teacher-led services include: Kindergartens, Education and Care Services, and Homebased Care Services.

- **Kindergartens** are a teacher-led early childhood service represented by the New Zealand Kindergartens Inc. (NZKI) or the New Zealand Federation of Free Kindergartens, that provides sessional programmes for mainly three and four year old children. These have been treated as government entities in the National Accounts, but the classification is currently under review.
- **Education and Care Services** provide sessional, all-day, or flexible-hour, programmes for children from birth to school age. They may be privately owned, community-based, or operated as an adjunct to a business or organisation. Individual Education and Care Services may be known by many names, including crèches, private kindergartens, aoga, punanga reo, and childcare centres. These services are teacher-led and required to meet the teacher registration targets.
- **Home-Based Childcare Services** provide early childhood education to small groups of children in a caregiver, educator's, or child's own home. Home-based care services are grouped together in networks, which are supervised by co-coordinators who are registered teachers.

- **Correspondence School ECE Services** offer distance learning programmes for children aged three to five years who are unable to attend or have limited access to early childhood services because of isolation, illness, a physical disability, or itinerancy. These children can also attend an early childhood service for up to two sessions per week.

Parent/Whānau Led ECE Services do not have to meet teacher registration targets, and have high levels of parent and/or whānau involvement in providing education and care for children. These services include licensed Playcentres and licensed Te Kōhanga Reo. They are not eligible for 20 hour free ECE funding from the Ministry of Education.

- **Playcentres** Early childhood services that belong to an association affiliated with the New Zealand Playcentre Federation Inc. A primary characteristic of playcentres is that families manage and implement the education programme.
- **Te Kōhanga Reo** An early childhood centre administered by the Te Kōhanga Reo National Trust. The programmes in Kōhanga Reo are based on the total immersion of children from birth to school age in Māori language, culture, and values.

Licence-Exempt ECE Groups have been issued an exemption from licensing requirements, in recognition of the fact that more than half of the children attend with a parent. They take the following forms.

- **Playgroups** Community-based groups of parents and pre-school children whose playgroups meet for one to three sessions per week.
- **Ngā Puna Kōhungahunga** Licence-exempt groups in community-based locations that are culturally appropriate for Māori.
- **Pacific Island Early Childhood Groups** Available to pre-school children with the purpose of developing and maintaining Pacific Island languages and cultures. There is a high level of parent participation.

ECE funding history

The history of ECE funding is one of increasing complexity. ECE was funded in some format by the Ministry (then Department of Education) prior to 1990; reliable data are unavailable prior to 1990. The funding structure 1990–2005 consisted of five funding bands based on the provider and age of child: a quality and standard rate for under-two services, a quality and standard rate for over-two services, and a single rate for Kindergartens.

A new funding structure was implemented in 2005 that consisted of 34 funding bands. The rates at each funding band were set on the basis of the associated costs for different types of services, and the percentage of teachers that are qualified/registered. Kindergarten and Education & Care services were aggregated and assigned a funding band based on the proportion of qualified/registered teachers. Homebased, Te Kōhanga Reo, and Playcentres had specific service type rates, and were assigned either a quality or standard rate based on the operation and teachers at the centre. A separate licence-exempt rate existed for licence-exempt services.

With the introduction of the Free ECE policy in July 2007, another 14 rates were added to the funding structure. These rates were intended to cover all costs for the centre, so that parents did not have to pay fees.

Table 16 ECE funding rates effective from 1 July 2009

	Age of child		20 hours ECE ⁽²⁾
	Under 2	2 and over ⁽¹⁾	
\$ / child / hour			
All-day teacher-led centre-based services			
Percentage of registered teachers			
100	12.94	7.79	12.35
80–99	12.16	6.91	11.42
50–79	10.36	5.46	9.83
25–49	8.35	4.35	8.64
0–24	7.14	3.62	7.88
Sessional teacher-led centre-based services			
Percentage of registered teachers			
100	12.09	6.07	7.26
80–99	10.80	4.95	6.30
50–79	9.24	4.12	5.40
25–49	7.53	3.55	4.77
0–24	6.55	3.19	4.41
Home-based education and care services			
Quality rating			
Quality	7.91	4.24	8.83
Standard	6.94	3.75	8.34
Te kōhanga reo			
Quality rating			
Quality	8.40	4.22	7.88
Standard	7.35	3.70	7.42
Playcentre ⁽³⁾			
Quality rating			
Quality	8.40	4.22	
Standard	7.35	3.70	

Source: Ministry of Education

(1) Excluding hours funded under the Government's 20 hours ECE policy.

(2) Hours funded under the Government's 20 hours ECE policy.

(3) Funded from July 2010.

Scope issues in ECE

The boundary between education and care in ECE services is hazy. For this, we look to the International Standard Classification of Education for guidance. The main classification criteria for establishing the boundary between pre-primary education and childcare, or between pre-primary and primary education, according to ISCED are:

- the educational properties of the programme;
- school or centre based;
- the minimum age of the children catered for;
- the upper age limit of the children; and
- the staff qualifications (subsidiary criterion).

For a programme to be considered as pre-primary education, it has to be school-based or centre-based. These terms are used to distinguish activities in settings. Such as, primary school, pre-schools, and kindergartens from services provided in households or family settings.

'Such programmes are designed for children aged at least three years. This age has been chosen since programmes destined for younger children do not normally satisfy the educational criteria in ISCED. The upper age limit depends in each case on the typical age for entry into primary education.' (ISCED, paragraphs 39–41.)

However, it also points out that flexibility is key, and that the guideline of age three does not preclude younger children from participating (paragraph 35) under conditions that meet the educational criteria.

- Services **based on an approved ECE curriculum**. All licensed ECE providers must have a registered curriculum.
- Services **based at an ECE provider centre**. Excludes home-based networks and ECE provision by the Correspondence School.
- **Age** of pupils. Without providing justification, the ISCED definition implies that there is a minimum age required for ECE to be 'education' rather than 'care'. ECE is bounded on the top by the age of entry into primary school (six). To satisfy this, we must select only pupils of ages three to five, which coincides with those chosen by the Ministry of Education for their 20 hours free ECE policy.

The ISCED goes on to say in paragraph 42: 'Where appropriate, the requirement of pedagogical qualifications for the teaching staff can be a good proxy criterion for an educational programme in all those countries, in which such a requirement exists. It serves to distinguish pre-primary education from child-care for which para-medical or no qualifications are required.'

This brings us to the question of teacher qualification, which is represented in the available data in terms of teacher qualification, teacher registration (correlated with qualification but separate), and in the organisation and leadership of the ECE service. Teacher qualifications are used by the Ministry of Education as a proxy for higher quality educational services, for which the government is prepared to pay a premium.¹¹

- Services **provided by qualified teachers**. Select only those services with a minimum proportion of qualified and registered teachers.
- Services **designed and run by qualified teachers**. Select only teacher-led services.

¹¹ This is reflected in the funding of ECE. See table 16.

Finally, one question on which ISCED offers no guidance is that of duration. With the high labour participation rate, many parents of young children in New Zealand require childcare far beyond the 30 hours a week that is considered full-time ECE. Ministry of Education staff acknowledge that multiple enrolments are common and difficult to net out because young children do not have unique identifiers following them through the system the way that secondary students do. It seems unlikely that a child attending ECE 50 hours a week receives twice the educational services of a child attending 25 hours a week.

- **Duration.** Is there a maximum volume of educational service that can be reasonably delivered to a child in a day? Select hours up to that point and declare the remainder 'care'.

Recommendation E6

Stakeholders should be engaged in defining the boundary between education and care in manner consistent with the question these measures are intended to answer.

7.2.4 School

This section describes the delivery and funding of primary and secondary education in New Zealand to help the reader understand, for example, the scoping issues as well as the general context for any ensuing productivity measure. Some data are supplied for illustration. For detailed information on the data sources referred to in this section, see chapter 10.

The recommended output measure for each level of schooling is number of pupils, adjusted for attainment. See section 7.2.1 for discussion of output concepts. Potential sources of attainment adjustment include standardised test scores, proportion of students leaving school with a qualification, and proportion of students leaving school with a qualification of a certain standard (eg university entrance).

Barring that, the recommended proxy is number of pupil-hours or full-time student equivalents. This measure may be further adjusted for attendance to more closely represent the actual education delivered, if desired, as it is in the UK; see section 10.2 for discussion of this option.

Recommendation E7

At a minimum, full-time student equivalents by level should be used to estimate school output quantity.

New Zealand School types

Schooling in New Zealand is compulsory from ages six to 16. It can be delivered by state, integrated, private, and special schools, or outside of a school setting by way of the Correspondence School or homeschooling.

Table 17 School Types with 2007 numbers

Primary: (2,045 schools)	Full Primary School (Year 1–8), 1,126 schools
	Contributing School (Year 1–6), 796 schools
	Intermediate School (Year 7–8), 123 schools
	Kura Kaupapa Māori (Primary), 68 schools
	Kura Teina (Primary) ¹² , 2 schools
Composite: (144 schools)	Composite School (Year 1–15), 139 schools
	Restricted Composite School (Year 7–10) (also known as Middle School), 4 schools
	Kura Kaupapa Māori (Composite)
	Correspondence School, 1 school
	Kura Teina (Composite), 3 schools
Secondary: (334 schools)	Secondary School (Year 7–15), 101 schools
	Secondary School (Year 9–15), 233 schools
	Secondary School (Year 11–15)
Other: (47 schools)	Special School, 47 schools
	Homeschool, 6,473 students

Fully-funded **state schools** are co-educational at the primary level, and offer either single sex or co-educational options at the secondary level. The Ministry owns their capital, and pays their operating expenses and salaries. In 2007, 84.8 percent of students attended state schools.

State integrated schools are those that have previously been private and are now integrated into the state-funded system, as well as a handful of new schools with 'special character' set up in the same model. The Ministry pays their teachers' salaries and operating expenses, but the capital is privately owned and maintained. In 2007, 11.1 percent of students attended state integrated schools.

Private schools are owned by private proprietors, governed by an independent board, and registered with the state as meeting specific standards. They receive some state funding in the form of per-student subsidies, and charge tuition fees. In 2007, 4.0 percent of students attended private schools.

The Correspondence School is a state school providing distance learning for full-time students, students simultaneously enrolled at their local school, adult students over age 19, and those with special education needs unable to attend regular school. The

¹² Kura Teina are included in the Full Primary and Composite totals.

Correspondence School provides early childhood, primary, and secondary education. As of 2007, the Correspondence School had 5,546 students.

Kura Kaupapa Māori are state schools where the principal language of instruction is Te Reo Māori, and which follow the Te Aho Matua teaching and learning philosophy. The first Kura Kaupapa Māori opened in 1985. Kura Kaupapa Māori can be either primary or composite schools. **Kura Teina** are applicant schools accepted into the preparation and assessment process for establishment as a Kura Kaupapa Māori. As of 2007, there were 68 Kura Kaupapa Māori and 5 Kura Teina in New Zealand, serving 6,272 students.

Special schools provide specialist education or support for students with specific physical, behaviour, sensory, or intellectual support needs. There are 47 special schools and 8 residential special schools in New Zealand, serving 2,799 students. In addition to operating special schools, Vote Education funding is also made available for special needs students wherever their education is delivered, publicly or privately; this can pay directly for special education, or it may pay for services to support their education, such as speech therapy.

Exceptional cases

In addition to the various school types, there are delivery formats or student types that are sufficiently different from the categories above that they merit separate treatment.

International fee-paying students are international students studying at a secondary or tertiary level who meet the full tuition costs on their own or from funds provided to them by sponsors other than the New Zealand Ministry of Foreign Affairs and Trade. New Zealand Agency for International Development funded students are on scholarship from the New Zealand Agency for International Development (prior to 2004, this was known as a MFAT scholarship). They are reported separately from foreign-fee paying students. At July 2007, there were 10,204 foreign fee-paying students, comprised of 2,873 in Years 1–8, and 7,331 in Years 9–15. Foreign fee-paying students comprise 1.3 percent of the New Zealand school population.

Recommendation E8

A decision is required to include or exclude international students in accordance with the question these measures are intended to answer. International students must be treated consistently on both the inputs and output side, and should be treated consistently at the school and tertiary level.

Adult students over age 19 represented 4,671 students in 2007. Most of these students are either special needs students or refugees.

Homeschooling is a generic term for children schooled at home during the compulsory schooling ages (6 to 16). To homeschool a child, the parents/caregivers must satisfy the Ministry that the child will be taught at least as regularly and as well as they would have been in a registered school. If satisfied, the Ministry issues an exemption certificate and the student is deemed to be 'homeschooled'. The parents/caregivers do not have to teach the child, they can arrange for someone else to teach the child or may purchase a programme from someone else. Homeschooling parents/caregivers are given an annual grant from the Ministry to help with the cost of learning materials or programme purchase. In 2007, there were 6,473 children being homeschooled in New Zealand, or less than 1 percent of the school population.

Separate **alternative education programmes** have been formally available since 2000 for students aged 13 – 16 who have become alienated from the education system and are either unwilling to attend a regular school, or schools are unwilling to enrol them, in a mainstream setting. In 2007, 1,318 students were enrolled in alternative education programmes.

Teen parent units provide educational programmes for teenagers who are pregnant or who have prime responsibility for their children's care; and who have enrolled within the age range to receive free education (ie up to age 19 years). These units are attached to a host secondary school.

Recommendation E9

Alternative education programmes and teen parent units represent a sufficiently different service from mainstream secondary education that they merit separate treatment. This requires identifying them in the data on the inputs and output side so that they can be included or excluded as required by scope.

School Qualifications

New Zealand has offered a number of school qualifications. The paragraphs below describe the system as it existed prior to the introduction of the National Certificate of Educational Achievement (NCEA) in 2002.

School Certificate was usually taken in year 11 (Form 5) of school, but many secondary students at other levels also entered. School Certificate was awarded in single subjects. Most students took five or six subjects, or combined one or two School Certificate subjects with other courses offered by their school. Many School Certificate subjects were a mix of internal and external assessment.

Sixth Form Certificate was generally taken by students in year 12 (Form 6) of school. Most students took five or six subjects. Many studied Sixth Form Certificate subjects along with School Certificate or University Bursaries subjects. Sixth Form Certificate required at least four hours of supervised study per week in each subject. Students had to meet reasonable assignment and attendance requirements. Sixth Form Certificates were internally assessed by schools. Grades on a scale of 1 to 9 were awarded in individual subjects, with a grade 1 representing the highest achievement and grade 9 the lowest achievement.

Higher School Certificate was a course completion award, granted to candidates who completed five years of New Zealand secondary level education beginning at Year 9, and who are deemed by their school to have satisfactorily completed a year 13, 60 percent of which is at a level of study beyond year 12. Its principal purpose was to certify the satisfactory completion of five years' secondary schooling and, as a consequence, that the holder had a basic preparedness, including English language and study skills, for tertiary study. Students had to study at least three subjects in advance of Sixth Form Certificate. In addition to the University Bursaries subjects, NZQA approved 17 Higher School Certificate subjects. There were no external examinations, no grades or marks, and Higher School Certificate was not awarded in individual subjects. Higher School Certificate was part of the university entrance requirement.

Students generally entered **University Entrance, Bursaries, and Scholarships** (commonly known as Bursaries) at the end of year 13 (Form 7). As the full title indicates, the qualification served many purposes: candidates could qualify for entrance

to university, gain monetary awards (bursaries), and be awarded scholarship grades for very high achievement. Results were used by employers and by tertiary education providers for deciding entrance and selection for tertiary courses. Students could take up to six subjects. In many subjects, there was a combination of internal assessment from the work completed during the year, and the national examination. Between 1986 and 1992 inclusive, the University Entrance qualification was awarded to candidates who scored grades D or higher in at least four Bursaries subjects. From and including 1993, the University Entrance qualification has been awarded to candidates who: either scored grades C or better in at least three Bursaries subjects and were awarded Higher School Certificate, or gained an A or a B Bursary.

The **National Certificate of Educational Achievement (NCEA)** was phased in from 2002 as New Zealand's national qualifications for senior secondary students. NCEA level 1 replaced School Certificate in 2002, NCEA level 2 was introduced in 2003, and NCEA level 3 and New Zealand Scholarship replaced University Entrance, Bursaries, and Scholarships in 2004. Schools offered Sixth Form Certificate (Transitional) instead of NCEA in 2003 and 2004.

NCEA qualifications are gained by building up credits awarded for each standard achieved. Standards are organised into 'levels' of increasing difficulty. Some are assessed internally, by teachers, and some externally in end-of-year exams. Most schools organise the assessment of their programmes and courses in groups of standards. There are two types of standards – 'unit standards' and 'achievement standards'. Achievement standards are 'not achieved' (fail), 'achieved', 'achieved with merit', or 'achieved with excellence'. Unit standards are either 'achieved' (pass) or 'not achieved' (fail).

The standards assessed in schools are usually at levels 1, 2, and 3. Most students will start at level 1 in year 11, though students often study at a mix of levels depending on their ability in particular subject areas. Schools prepare a programme and use a mix of standards to assess students as they progress. Not all students will be assessed against the same standards.

Each standard achieved is worth a certain number of credits. Credits count towards NCEA, and may also contribute towards other national certificates, such as the National Certificate in Mathematics.

Credits can be used for more than one qualification. NCEA level 1 is 80 credits achieved from level 1 or higher, and must include eight from numeracy standards and eight from literacy standards. NCEA level 2 requires a minimum of 60 credits at level 2 or above and 20 credits at any other level, with no specific literacy or numeracy requirements. NCEA level 3 requires 80 credits, of which 60 must be at level 3 or above, and 20 at level 2 or above.

School scope questions

Once the various exceptional cases above are treated, the primary scope question is around the outside boundary of school education. Potential scope-defining characteristics emerging from the available data include:

- Services **based on an approved curriculum**. This should include homeschooling and school-to-work initiatives known as the Gateway programme.

- Services **based at a school**. Excludes homeschooling and the Gateway programme.
- **Age** of pupils. Schooling is compulsory to age 16 years, but students range into adulthood.

Recommendation E10

A decision is required on how to treat the Correspondence School. It should be applied consistently on both the inputs and output side so that it can be included or excluded as required by scope.

Another scope issue is the internal division between primary and secondary school. The International Standard Classification of Education defines primary education as having the following principal characteristics: 'Programmes at level 1 are normally designed on a unit or project basis to give students a sound basic education in reading, writing, and mathematics, along with an elementary understanding of other subjects, such as history, geography, natural science, social science, art, and music' (ISCED, paragraph 45).

ISCED cites as key criteria for primary school 'the beginning of systematic studies characteristic of primary education, eg reading, writing, and mathematics', with secondary consideration given to 'entry into the nationally designated primary institutions or programmes; and the start of compulsory education where it exists' (paragraph 48). Included in this category are programmes suitable for children with special needs, and 'literacy programmes within or outside the school system which are similar in content to programmes in primary education for those considered too old to enter elementary schools are also included at this level because they require no previous formal education' (ISCED, paragraph 51).

Barring other information, ISCED indicates that the first six years of compulsory education should be considered primary. By comparison, secondary education programmes '...are usually on a more subject-oriented pattern using more specialized teachers and more often several teachers conducting classes in their field of specialization. The full implementation of basic skills occurs at this level. The end of this level often coincides with the end of compulsory education where it exists' (ISCED, paragraph 52).

The key criteria defining secondary school is that there are more qualified teachers conducting classes in their field of specialisation. ISCED also puts some bounds around age and achievement, expecting the equivalent of six years of education prior to secondary, and ending with the end of compulsory education.

7.2.5 Tertiary education

This section describes the delivery and funding of tertiary education in New Zealand to help the reader understand, for example, the scoping issues as well as the general context for any ensuing productivity measure. For detailed information on the data sources referred to in this section, see chapter 10.

Tertiary education in New Zealand straddles three different ISCED levels, which are defined in terms of their complexity and purpose.

ISCED level 4 – post-secondary non-tertiary: These programmes are often not significantly more advanced than programmes at ISCED 3 (secondary), but they serve to broaden the knowledge of participants who have already completed a programme at

ISCED level 3. Education beyond school level leading to an award not equivalent to a diploma is ISCED level 4. This level can be subdivided into programs that prepare for ISCED level 5, and those that prepare for direct entry into the labour market. It is important to note that for internationally comparative purposes this is considered post-secondary, rather than tertiary.

ISCED level 5 – first stage of tertiary education (not leading directly to an advanced research qualification): This level consists of tertiary programmes having an educational content more advanced than those offered at ISCED levels 3 and 4. Entry to these programmes normally requires the successful completion of ISCED level 3 or a similar qualification at level 4. These have a minimum cumulative theoretical duration (at tertiary) of three years' full-time equivalent, although typically they are of four or more years. They typically require that the faculty have advanced research credentials, and they may involve completion of a research project or thesis. Programmes can be divided into those that are theoretically based/research preparatory/giving access to professions with high skills requirements programmes on the one hand, and practical/technical/occupationally specific programmes on the other hand. This level includes diplomas, degrees, and postgraduate programmes.

ISCED level 6 – second stage of tertiary education (leading to an advanced research qualification): This level is reserved for tertiary programmes which lead to the award of an advanced research qualification. The programmes are therefore devoted to advanced study and original research, and are not based on course-work only. Only doctoral degrees are ISCED level 6.

The New Zealand Qualifications Authority (NZQA) national qualifications framework has 10 levels, depending on the complexity of the learning. NQF Levels 1–3 are of approximately the same standard as senior secondary education and basic trades training, or ISCED level 4. Levels 4–6 approximate to advanced trades, technical, and business qualifications, also ISCED level 4. Levels 7 and above approximate to advanced qualifications of graduate and postgraduate standard. Level 7 (Bachelors degree or equivalent), level 8 (honours and postgraduate certificates or diplomas), and level 9 (Masters degree) are equivalent to ISCED level 5. Level 10 doctorates equate to ISCED level 6.

For reasons laid out in section 7.2.1, the recommended output measure for tertiary education is number of completed credits by level (1–3, 4–7 non-degree, bachelor and postgraduate), separated into subject area where possible. Barring that, the recommended proxy is full-time student equivalents by level (1–3, 4–7 non-degree, bachelor and postgraduate), separated into subject area where possible to reflect the different associated costs for various course types.

Recommendation E11

The most desirable output measure available for New Zealand's tertiary education is credits completed broken down by: subsector (university, polytechnic, etc), qualification level, domestic/international, broad field of study, and public/private.

Tertiary providers

The tertiary education sector in New Zealand – as defined by the Ministry of Education – includes all post-compulsory educational organisations that provide formal programmes of study. These can be divided into public tertiary education institutions (TEIs),

government training establishments (GTEs), other tertiary education providers (OTEPs), and private tertiary education (PTE) providers. For Statistics NZ, non-TEI providers are considered 'other education', which is covered in section 7.7 of this report.

Public TEIs include universities, colleges of education, polytechnics, or wananga, as defined by the Education Act 1989. New Zealand's eight universities are primarily concerned with advanced learning and knowledge, research, and teaching to a postgraduate level. Additionally, universities are charged by statute (Education Act 1989, section 162) with being 'repositories of knowledge' and serving as 'critic and conscience of society'. Institutes of Technology and Polytechnics (normally known as polytechs) are characterised by a wide diversity of vocational and professional programmes. The three Wananga provide programmes with an emphasis on the application of knowledge regarding ahuatanga Māori (Māori tradition) according to tikanga Māori (Māori custom).

Colleges of education mainly provide specialist teacher education training, along with other non-teaching courses; such as, business, performing arts, sport coaching and science, as well as professional development for teachers. All of these institutions in New Zealand have now amalgamated with universities (see table below).

College of Education	Amalgamated with
Auckland College of Education	University of Auckland (2004)
Hamilton College of Education	University of Waikato (1992)
Palmerston North College of Education	Massey University (1996)
Wellington College of Education	Victoria University (2005)
Christchurch College of Education	University of Canterbury (2007)
Dunedin College of Education	University of Otago (2007)

Recommendation E12

Universities, polytechs and wananga provide distinct and separable educational services and should be treated as such. Care should be taken with the treatment of Auckland University of Technology, which moved from the polytech category to the university category.

Tertiary funding

The government provides funding for New Zealand students to undertake formal learning with a combination of student loans, student allowances, and tuition subsidies paid to tertiary education organisations. In the recent past, the largest share of this funding has been delivered through student component funding that is allocated on a per student basis, with differential rates set by subject area. In most cases, the student is also charged an enrolment fee. A question that flows naturally out of the funding model is how to handle direct student support when calculating tertiary education. A substitution between student support and university support is not a reduction of inputs from a whole-of-government perspective, but is from the perspective of an individual institution. Particular care must be taken to ensure that the education inputs are defined

in a manner consistent with the overall question that productivity estimates are intended to answer.

Recommendation E13

The funding of tertiary education is complex and involves a large amount of co-financing across government and across the public/private split. Care should be taken to define the scope in a manner consistent with the question these measures are intended to answer, and to treat it consistently in both inputs and output.

Table 18 Government Operating Expenditure on Tertiary Education 2001-2008

	Financial year						
	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/8
Administration of tertiary education							
Ministry of Education ⁽¹⁾	11,911	13,336	10,943	12,547	15,595	8,350	6,385
New Zealand Qualifications Authority ⁽²⁾	2,857	2,155	4,803	11,289	11,182	12,048	16,574
Tertiary Education Commission / Skill New Zealand ⁽³⁾	19,886	27,357	43,100	41,995	47,913	53,672	63,308
Ministry of Social Development ⁽⁴⁾	30,743	30,115	30,837	35,164	37,566	38,062	37,908
Inland Revenue ⁽⁵⁾	8,600	8,900	9,200	9,600	18,300	22,700	26,400
Careers ⁽⁶⁾	7,140	7,972	8,779	10,426	11,353	15,216	16,793
Total	81,137	89,835	107,663	121,021	141,909	150,048	167,368
Tertiary tuition/capability/research							
Tuition subsidies & capability ⁽⁷⁾	1,364,634	1,558,814	1,698,730	1,656,482	1,703,559	1,712,528	1,863,418
Performance-based Research Fund ⁽⁸⁾	8,092	27,828	76,932	167,328	220,231
Centres of Research Excellence	1,223	14,433	19,660	21,059	21,316	21,411	23,206
Building research capability in the social sciences	...	...	...	...	1,333	1,333	1,333
Total	1,365,857	1,573,247	1,726,482	1,705,369	1,803,140	1,902,600	2,108,187
Other tertiary training							
Industry training	69,402	79,297	87,434	99,256	118,314	141,018	153,108
Modem apprenticeships	7,573	15,971	20,138	23,921	29,283	33,482	41,144
Training opportunities	84,333	80,542	86,344	81,605	79,820	83,101	85,516
Youth training	58,730	70,832	60,498	57,217	55,334	56,875	55,595
Skill enhancement	8,234	6,814	7,292	6,155	4,893	3,979	4,084
Gateway	1,599	2,484	4,528	6,302	8,510	10,549	13,022
Ngā Kaiarataki Pathfinders	...	...	373	707	816	592	985
English for Migrants	2,746	5,523	6,289	6,213	4,756	3,675	2,524
NZTE enterprise training	7,755	9,039	9,413	10,003	9,912	10,072	10,080
Community education ⁽⁹⁾	16,764	17,109	17,303	16,332	30,805	41,272	40,310
Total	257,135	287,611	299,611	307,711	342,443	384,615	406,367
Research contracts to tertiary orgs							
Foundation for Research & Technology	32,000	39,111	45,333	54,222	60,444	66,294	70,737
Health Research Council	32,415	31,705	34,744	39,361	48,268	57,252	58,881
Marsden Fund	20,546	20,667	23,766	26,600	27,706	27,497	27,858
Total	84,961	91,483	103,844	120,183	136,418	151,042	157,475
Student support							
Student allowance	400,620	387,366	380,056	359,176	354,132	382,324	385,724
Training incentive allowance	35,582	36,757	41,503	36,153	32,191	28,675	27,231
Unemployment benefit – training	36,011	34,200	36,900	37,500	46,257	59,116	65,841
Tertiary scholarship ⁽¹⁰⁾	18,795	23,461	23,885	31,606	47,402	55,168	64,086
Total	491,008	481,784	482,344	464,435	479,982	525,283	542,882
Student loan							
Write-off / write-down / impairment	273,100	291,000	319,500	435,400	341,200	638,600	256,100
One-off initial fair value write-down ⁽¹¹⁾	1,414,700	...	...
Total	273,100	291,000	319,500	435,400	1,755,900	638,600	256,100
Total operating expenditure	2,760,677	2,970,391	3,019,910	3,251,890	4,759,986	3,958,976	3,705,652

Source: Ministry of Education

- (1) Includes Administration of Resourcing, Provision of Information and Strategic Leadership of the Tertiary Education System. Because of changes to output classes, a discontinuity in the data exists between 2005/6 and later years. Any comparisons over this period should be treated with caution.
- (2) Includes Stewardship of the New Zealand Qualifications System, which will include expenditure for non-tertiary education qualifications.
- (3) Includes Provision of Information, Management of Grants and Contracts, Strategic Coherence Across the Tertiary Sector and Minimise the Duration of Unemployment.
- (4) Includes Services to Students and Student Job Search.
- (5) The cost of administering student loans.
- (6) Includes Provision of Information, Kiwi Careers and Building Better Trade Training Decisions.
- (7) Includes expenditure on the Student Achievement Component, provider capability funding (such as Growth Pilots) and the Tertiary Education Organisation Component (TEOC) excluding the TEOC PBRF component.
- (8) Includes payments made via TEOC - PBRF.
- (9) Includes other expenditure such as settlement of the wānanga capital establishment claim, funding for the University of Auckland Starpath project, and expenditure for Whare wānanga development.
- (10) Community education funding previously allocated through tuition subsidies was transferred to this output class from 2005/06.
- (11) Includes expenditure via TeachNZ scholarships, NCEA and scholarship awards, Enterprise scholarships, Merit scholarships, Step-up scholarships, Trainee Medical Intern Grant, Top achiever doctoral scholarships and Māori and Pasific Island scholarships and bursaries.
- (12) A one-off fair value write down of the student loan scheme associated with a change in accounting standards.

Symbol: ... not applicable

The Tertiary Education Strategy 2007-12 accompanied substantial changes to the way tertiary education was managed, to the systems for the steering and funding of tertiary education and to the approach to quality assurance and monitoring. The new arrangements took effect from 1 January 2008. The system reforms have split the funding of tertiary education, so that 70 percent of funding supports the costs of teaching and learning, and 30 percent supports tertiary education organisations to ensure that they have the capability needed to focus on their core role and distinctive contribution.

From 2008, the student component has been replaced by a new investment system – under which the Tertiary Education Commission (TEC) will make three-year funding decisions based on the quality and relevance of the provision offered. Some funding – a new student achievement component – continues to be delivered on a per student basis, with some being allocated to tertiary education organisations to fund developments in their capability – the tertiary education organisation component.¹³

While the student achievement component and the tertiary education organisation component are the largest funds administered by the TEC, training programmes for some formal students are managed by the TEC through other funds, such as Youth Training, which are targeted to particular types of students.

Tertiary research funding

The main funding of research activities was historically delivered as part of the student component funding for degree and postgraduate enrolments, supplemented with 'research top ups'. This system was phased out from 2004–2006 and replaced with the Performance-Based Research Fund (PBRF). Under the PBRF, providers are allocated funding on the basis of their research performance, using a set of performance indicators complemented by peer assessment of the quality of their research.

¹³ While this is accurate as of the time of writing, education funding and policy is in flux and may be restructured.

The introduction of the PBRF system has shaped the distribution of research activity between tertiary subsectors. A 2008 study of the effects¹⁴ reported the following key findings:

- The principal effect of the PBRF has been to shift research funding to the universities from institutes of technology/polytechnics.
- Between the universities, the effects of the PBRF are more complicated. Discounting for the effects of subject-based weightings, there are five universities whose research quality allocations are clustered in a similar range on a full-time equivalent staff basis. The other two dimensions of the PBRF – research degree completions and external research income – produce greater variations of performance, and are therefore more important drivers of funding shifts.
- The PBRF subject weightings tend to shift funding towards those universities with substantial research activities in the sciences and the applied sciences – more sharply than the old research top-ups system. In large part, this is a consequence of the fact that in some universities these fields are the focus of considerable research activity, but may not attract large numbers of enrolments. Conversely, some lower-funded fields that draw significant enrolments may have lower research performance.

¹⁴ http://www.educationcounts.govt.nz/publications/tertiary_education/18792

Table 19 Funding for research through research top-ups and PBRF by sub-sector 2000-2007 (\$million)

Subsector	Year					
	2001	2002	2003	2004		
	Top-ups	Top-ups	Top-ups	Top-ups	PBRF	Total
	\$(million)					
University ⁽²⁾	98.27	101.34	110.42	107.49	16.32	123.81
Institute of technology or polytechnic	4.71	5.10	5.99	6.56	0.19	6.74
Wānanga	0.38	0.47	0.52	0.60	0.01	0.61
Private training establishment	0.44	0.48	0.51	0.61	0.02	0.63
Total	103.79	107.39	117.43	115.26	16.54	131.79

Subsector	Year					
	2005			2006		
	Top-ups	PBRF	Total	Top-ups	PBRF	Total
	\$(million)					
University ⁽²⁾	99.66	39.19	138.84	72.61	120.28	192.89
Institute of technology or polytechnic	5.91	0.44	6.35	4.08	1.39	5.48
Wānanga	0.61	0.03	0.64	0.51	0.09	0.60
Private training establishment	0.52	0.05	0.57	0.81	0.16	0.97
Total	106.70	39.71	146.41	78.02	121.92	199.94

Subsector	Year
	2007
	PBRF
	\$(million)
University ⁽²⁾	201.11
Institute of technology or polytechnic	4.47
Wānanga	0.35
Private training establishment	0.39
Total	206.31

(1) GST exclusive.

(2) College of education data is combined with university data.

Note: PBRF – Performance-based Research Fund**Source:** MoE

In addition to funding scholars and institutions individually, the government supports seven inter-institutional research networks (CoREs) focused on areas of established research excellence of importance to New Zealand:

- Growth and Development – Auckland
- Maori Development and Advancement – Auckland
- Molecular Bio-discovery – Auckland
- Molecular Ecology and Evolution – Massey
- Food and Biological – Massey

- Advanced Materials and Nanotechnology – Victoria
- Bio-Protection – Lincoln

Over and above these sources of research funding, tertiary education organisations are expected to raise additional research revenue through the contestable science funds supported by the government through Vote Research, Science and Technology. Tertiary education organisations also bid for contracts to provide research for firms and other organisations.

Table 20 Total research income by income type in the universities 2002-2006

Income type	Year			
	2003	2004	2005	2006
\$(million)				
Research top-up	110	107	100	73
PBRF	...	16	39	120
CoREs	19	20	21	21
Other research contract ⁽²⁾	203	236	261	280
Other	2	3	4	3
Total	335	383	425	497
As a percentage of all university income %	16.17	16.96	17.30	20.09

Source: Tertiary Education Commission, Ministry of Education

(1) Colleges of education data is combined with university data.

(2) PBRF external research income is used as the measure of contract income.

Symbol: ... not applicable

Note: PBRF – Performance-Based Research Fund CoREs – Centres of Research Excellence

Source: Tertiary Education Commission and Ministry of Education

Tertiary student support

Prior to 1992, the government's financial support for tertiary study had traditionally been in the form of tuition subsidies, paid directly to tertiary education providers, and 'grants-in-aid' which were paid directly to students and were principally intended to subsidise living costs. Tertiary assistance grants were also available to help with living costs. In 1980, in response to the increasing numbers of older students wanting to study full-time, hardship grants were introduced.

In 1989, taxable student allowances were introduced. In 1992, the government introduced the Student Loan Scheme. This provided students with the opportunity to borrow for tuition fees, course costs, and living expenses. In 2000, the government altered the Student Loan Scheme so that students were not charged interest while studying. In 2006, student loans were made interest free for borrowers who are resident in New Zealand.

Table 21 Government financial support for tertiary study 1997/98–2007/08

Fiscal year	Student allowances	Tuition subsidies	Student loans	Total	Total as a % of Gross Domestic Product
	\$ (millions)				Percent
1997/98	344	1,052	652	2048	2.1
1998/99	378	1,114	618	2110	2.1
1999/2000	375	1,084	702	2161	2.0
2000/01	391	1,210	867	2468	2.2
2001/02	401	1,381	935	2717	2.2
2002/03	387	1,576	952	2915	2.3
2003/04	380	1,724	997	3101	2.2
2004/05	359	1,701	969	3029	2.0
2005/06	354	1,811	1,046	3211	2.1
2006/07	382	1,921	1,176	3479	2.1
2007/08	385	2,185	1,201	3771	2.1

Source: MOE

Tertiary student Fees

Between 1992 and 2000, there was an unregulated fee environment. This coincided with a period when the government was reducing the amount of funding per student to increase the share of their education costs paid by students. This resulted in significant increases in fees during this time.

The government introduced the fee stabilisation policy in 2001 to address the significant increases in domestic tuition fees that had occurred since 1992 in the unregulated fee environment; the government offered TEOs an increase in tuition subsidy rates in 2001 in return for freezing their domestic tuition fees at 2000 levels. The government repeated the process in 2002 and 2003 with further increases in tuition subsidy rates in return for domestic fees remaining frozen at 2000 levels.

The Fee and Course Costs Maxima (FCCM) policy was introduced in 2004. Under this policy, the government publishes a maximum fee level for each category of course, with high-cost courses having higher maxima than low-cost courses. Undergraduate fees are limited by FCCM and can only increase by 5 percent each year towards the maxima, via the Annual Fee Movement Limit (AFML). At the postgraduate level, fees can increase by a maximum of \$500 per year on an EFTS basis, via the Postgraduate Fee Increase Limit (PFIL).

While most students in formal tertiary education are New Zealanders, international students also make up a significant number of formal students. International students are usually required to pay the full costs of their tuition. Australian citizens, students on approved exchange schemes between NZ and foreign providers, and international doctoral students are treated as domestic students and pay domestic fees.

Tertiary scope questions

The primary scope concerns in the tertiary sector are: (1) distinguishing between educational services and other services (eg research) provided by the tertiary sector; and (2) the boundary between tertiary and other education.

Tertiary research output

Research is recognised as an important output of universities, but there is no international consensus at this time on a research output measure. Quantifying and quality-adjusting research output is known to be a difficult matter that raises some of the general problems associated with the measurement of R&D activities; such as, whether unsuccessful research constitutes output. Given the need to capitalise research and development within the National Accounts under the System of National Accounts 2008, it may be prudent to wait for further guidance from and decisions by the community of National Accountants.

Recommendation E14

Research is recognised as an important output of universities with an income stream that is increasingly separate and identifiable. However, identifying research funding in a longer time series may be impossible at this time. Stakeholders should be engaged in discussion about whether to explicitly include or exclude research within the productivity estimates.

Research output was quantified inconsistently across institutions prior to the introduction of the PBRF in 2004. Additionally, funding was used for research without being specifically allotted to it. Under the PBRF, research funding is delineated and research output is quality assessed (rather than quantified). This seems a solid measure going forward, but would not provide the time-series we are looking for at this time.

Because universities have different ways of counting research output, care should be taken when comparing research output per FTE academic staff.

Table 22 University reported research output per full-time equivalent (FTE) academic staff member 2002-2007

University	2002	2003	2004	2005	2006	2007
Auckland University of Technology	1.3	1.4	1.3	1.7	1.8	1.9
University of Otago	2.1	2.1	2.6	3.4	3.8	3.9
Victoria University of Wellington	2.2	2.2	2.6	2.6	3.0	2.7

Note: Some universities do not report research output counts in their annual reports (Auckland, Massey) while others do not report on a comparable basis over time (Lincoln, Waikato).

The research output totals include college of education totals.

Source: MOE, from annual reports of the universities and colleges of education

Analysts at the Ministry of Education's Tertiary Sector Performance Analysis and Reporting (TSPAR) unit believe that the most reliable approach to measuring research output prior to the PBRF is the share of publications and citations indexed within aggregated bibliometric indexes of research. This method is strongly biased toward the

sciences and is fraught with compositional change issues that would be very challenging to net out. The Ministry of Research, Science, and Technology (MoRST) holds the unit record data, which is prohibitively priced. TSPAR analysts would be eager to share the data should Statistics NZ wish to buy this data annually.

Table 23 Share of world indexed publications and citations by New Zealand TEIs

	Five-year period				
	1993–2003	2000–04	2001–05	2002–06	2003–07
	%				
Publication	0.41	0.41	0.42	0.43	0.44
Citation	0.35	0.35	0.35	0.38	0.40

Source: Thomson Reuters

Another possible measure is external research income. This provides a reasonable proxy for the commercial value of research, but is distorting when used as an approximation of social value. A selection of available data illustrating each of these options is presented in the three tables below.

Table 24 Ratio of citations per research paper by New Zealand TEIs to citations per research paper worldwide

PBRF subject panel	2003–07	
	New Zealand	Worldwide
	Ratio ⁽²⁾	
Biological sciences	0.68	0.82
Community education ⁽³⁾	0.75	0.98
Health	1.11	1.13
Humanities & law	0.60	0.80
Maths & inform sciences and technology	1.00	1.03
Medicine & public health	1.03	1.08
Physical sciences	1.07	0.98
Social sciences	1.03	0.84
All	0.85	0.92

Source: Thomson Reuters

(1) Only citations related to the papers published in the five-year periods are included in this measure.

(2) A value greater than 1 indicates the academic impact was higher than the world average.

(3) Community education funding previously allocated through tuition subsidies was transferred to this output class from 2005/06.

Table 25 University research contract income per academic FTE 2002-2006

University	2002	2003	2004	2005	2006
	\$				
Auckland University of Technology	1,487	2,295	3,180	5,057	7,348
Lincoln University	38,006	59,175	78,785	75,368	73,835
Massey University	20,710	24,361	25,706	28,998	31,334
University of Auckland	37,050	44,892	52,312	53,773	58,210
University of Canterbury	17,883	19,115	14,150	20,765	25,141
University of Otago	49,386	46,726	53,471	60,631	59,772
University of Waikato	14,492	16,681	19,091	22,117	23,513
Victoria University of Wellington	15,165	13,200	16,956	19,519	24,826
All universities	25,762	28,477	31,965	35,329	38,353

Note: Colleges of education data are combined with the universities. The PBRF external research income is used as the measure of contract income.

Source: Annual reports of the universities and the Tertiary Education Commission

Recommendation E15

Research is acknowledged as an important output of universities that involves extensive co-funding and co-production. Given the lack consistent data and the uncertainty of research's treatment in the National Accounts, it would be difficult to create a robust measure for it at this time. A decision will be required to either include or exclude identifiable research on both the inputs and output side.

7.2.6 Other education

This section describes delivery and funding of other education in New Zealand to help the reader understand, for example, the scoping issues as well as the general context for any ensuing productivity measure. For detailed information on the data sources referred to in this section, see chapter 10.

Other education is the residual category for educational and training services that fall outside of the ECE, school, and provider-based tertiary categories. This ANZSIC 1996 classification (N8440) includes art, dance, drama, music, and other performance schools; skills development such as driving, English language, and elocution; and the administration (as opposed to delivery) of educational programmes, eg Industry Training Organizations. Under ANZSIC 06, 'Other education' will be further divided to separate out arts education (eg the national Dance and Drama schools) and 'Educational Support Services' defined as those 'engaged in providing non-instructional services that support educational processes or systems'. Tertiary and other education are currently combined in the Ministry of Education data, and will need to be separated for mapping to ANZSIC.

Other education is considered informal and is therefore not covered by the ISCED classification.

While there is no specific output measure recommendation for other education, the internationally recommended output measure for tertiary education is number of completed credits by level (1–3, 4–7 non-degree), separated into subject area where possible. Barring that, the recommended proxy is full-time student equivalents by level (1–3, 4–7 non-degree), separated into subject area where possible.

Other education providers

Other education providers include: government training establishments (GTEs), other tertiary education providers (OTEPs), and private tertiary education (PTE) providers.

GTEs are state-owned organisations other than educational institutions that provide education, training, or assessment services (eg Navy, Department of Conservation); this is a term used mainly by NZQA when registering and accrediting training sections of government organisations.

OTEPs are organisations not elsewhere classified that deliver programmes of tertiary education or in support of tertiary education of some national significance. The New Zealand Schools of Dance and Drama are examples. While it is important to note these in an exhaustive list, these categories are not numerically significant.

PTEs are private institutions registered with the New Zealand Qualifications Authority and other tertiary education providers (OTEP) in receipt of grant funding from the Tertiary Education Commission. Some offer training for specific employers on a full cost-recovery basis. Others are funded by the government for the delivery of targeted training programmes and some have arrangements with Industry Training Organisations (ITOs) to deliver programmes funded through the Industry Training Fund. PTEs may also receive tuition subsidies through the student achievement component, while some receive no Crown funding at all. Many of those that receive no funding are English language schools that cater to full-fee-paying international students. Registered PTEs must meet the financial, educational, and management quality requirements set by the NZQA, and funded PTEs have also to meet the financial and management requirements set by the TEC.

Other education funding

Other education is often publicly funded, to some extent, but privately delivered, as with industry training¹⁵. Government funding is administered through the Tertiary Education Commission. The Ministry of Education only has reliable data for those education providers it funds in some way. Additional sources of information would be required to produce productivity estimates for other education.

¹⁵ Some polytechnics deliver the off-job component of industry training.

Table 26 Government and Industry Expenditure on Other Tertiary Education

Government Expenditure⁽¹⁾ on Other Tertiary Education
Financial years 2001–09

	Financial year							
	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
	\$							
Industry training	69,402	79,297	87,434	99,256	118,314	141,018	153,108	164,710
Modern apprenticeship	7,573	15,971	20,138	23,921	29,283	33,482	41,144	41,508
Training opportunity	84,333	80,542	86,344	81,605	79,820	83,101	85,516	82,186
Youth training	58,730	70,832	60,498	57,217	55,334	56,875	55,595	64,225
Skill enhancement	8,234	6,814	7,292	6,155	4,893	3,979	4,084	3,554
Gateway	1,599	2,484	4,528	6,302	8,510	10,549	13,022	16,583
Ngā Kaiarataki Pathfinders	...	...	373	707	816	592	985	1,185
English for migrants	2,746	5,523	6,289	6,213	4,756	3,675	2,524	1,390
NZTE enterprise training	7,755	9,039	9,413	10,003	9,912	10,072	10,080	8,518
Community education ⁽²⁾	16,764	17,109	17,303	16,332	30,805	41,272	40,310	72,774
Total	257,135	287,611	299,611	307,711	342,443	384,615	406,367	456,634

Source: Ministry of Education, Tertiary Education Commission, Inland Revenue, Ministry of Social Development, Ministry of Research, Science and Technology, Health Research Council, Royal Society and New Zealand Trade and Enterprise

(1) GST exclusive.

(2) Funding previously allocated through tuition subsidies was transferred to this output class from 2005/06.

Symbol: ... not applicable

Industry and Government Contributions⁽¹⁾ to Industry Training
1996–2008

	Year						
	1996	1997	1998	1999	2000	2001	2002
	\$(million)						
Government allocation	...	61.7	67.8	63.1	65.9	71.1	90.6
Industry cash contribution ⁽²⁾	14.7	19.6	24.7	26.9	27.9	30.2	38.1

	Year					
	2003	2004	2005	2006	2007	2008
	\$(million)					
Government allocation	97.5	124.8	136.7	166.8	190.6	198.099
Industry cash contribution ⁽²⁾	41.2	46.4	55.3	61.1	66.3	70.6

Source: Ministry of Education

(1) GST inclusive.

(2) Reported cash contribution by industry understates its actual cash contribution.

Symbol: ... not applicable

Recommendation E16

Consideration must be given to consistently applying definitions of government and private education across all levels. The definition selected should fit the question that government productivity measures are intended to answer. There is the strong possibility that no 'other education' providers should be legitimately included in the government sector.

Other education scope questions

Other education can be provided by government training establishments (eg NZ Police Academy), public 'other' tertiary providers (eg the national dance and drama academy), and private tertiary providers.

There are two major categories that straddle the boundaries of education that will need careful consideration: non-provider-based education and non-formal education. In both of these cases, the treatment needs to be consistent on both the inputs and output side.

Non-provider based education

Industry training is designed and delivered in conjunction with industry, and counts toward recognised qualifications. The training is administered and supported through the 37 industry training organizations, which have been established by particular industries. In the industry training system, all trainees enter into a training agreement with their employers. Most of the training takes place on the job and progress is assessed by registered assessors. **Industry training organisations (ITOs)** facilitate individual training arrangements, purchase off-job training from tertiary education providers, and then tailor these arrangements to the needs of learners and employers.

Within industry training, there is a modern apprenticeship scheme that is an employment-based education initiative aimed at encouraging participation in industry training by young people aged 16–21 years. The initiative combines the mentoring aspect of the apprenticeship tradition with formal industry training that leads to recognised qualifications at levels 3–4. The programme is administered by TEC, which contracts the services of Modern Apprenticeships coordinators.

There are a series of targeted non-tertiary training programmes for skill development within New Zealand administered by TEC (formerly by Skill NZ); Programmes include Skill Enhancement, Training Opportunities, and Youth Training.

Skill Enhancement is a vocational training programme for young Maori and Pacific peoples, with a wide range of pathways that lead to qualifications at level 3 and above. This programme was disestablished in the 2009 budget.

Training Opportunities is a labour market programme for people aged 18 years and over who are considered disadvantaged in terms of employment and educational achievement. These programmes provide foundation and vocational skills training at levels 1–3.

Youth Training is for youth up to the age of 18 years who have left school with no or very low-level qualifications. These programmes provide foundation and vocational skills training at levels 1–3.

Gateway is available to state and integrated secondary schools, and supports senior secondary students (Year 11 to Year 13) undertaking structured workplace

learning across a range of industries and businesses around New Zealand, while continuing to study at school.

Workplace Literacy funding is available for literacy, language, and numeracy training, and integrated with vocational/workplace training to help workers meet their employment and training needs.

Non-formal education

Education that does not contribute to a recognised qualification is considered non-formal. Adult and community education (ACE) can be provider-based through community education providers, tertiary education institutions, schools, and others. It can also be non-provider based, offered through community organisations and adult literacy programmes.

ACE is supported by and delivered through a range of community organisations. Funding for ACE is also available to schools and tertiary education institutions. Analysts at the Ministry of Education do not recommend using data for ACE delivered outside of TELs, as it is not considered robust.

Recommendation E17

The most desirable output measure for industry and targeted training is credits completed by level.

Recommendation E18

On the basis of its small size and poor data availability, it is recommended that Adult and Community education be excluded from productivity estimates for the present.

7.3 Education inputs

This section focuses on the data requirements and availability of appropriate data for measuring inputs to education, as the concepts and methods are rather less contentious than is the case for output.

7.3.1 Labour inputs

Labour input should ideally be actual hours worked broken down by staff type. In most labour measures used by Statistics NZ, hours paid is used as a proxy for hours worked for reasons of data availability. Measured sector productivity estimates use a labour volume series that combines various Statistics NZ labour data sources into a coherent volume measure of labour services by industry. See section 6.3.2 for a detailed discussion about the compilation of these data.

Within the education-specific data, teaching staff is generally recorded separately from other labour, and is privileged in analytical reporting. While teaching is the primary category of labour in education, substitutions are possible between different forms of labour (eg teachers doing administrative work), and between labour and intermediate consumption or capital (eg using computers and broadband to facilitate distance learning rather than adding teachers). For this reason, it is important to capture all categories of labour.

ECE labour inputs

The Ministry of Education collects ECE labour information in the Annual Return of Children and Staff, described in the output data availability section later in this report.

The Ministry publishes a time series of ECE full-time teacher equivalents (FTEs) by provider type. These data are available from 2005, and shown for demonstration purposes in table 27¹⁶. Although not published, the Ministry also collects the component information required to calculate three different categories of non-teaching staff FTEs: senior management staff, support staff, and specialists (eg psychologists, physiotherapists). See section 9.1.1 for further discussion of this collection.

Table 27 Usual teaching staff (FTE*) in licensed ECE services by type of service

Type of service	Year		
	2005	2007	2008
	Number of FTEs		
Casual education & care	98	100	81
Kindergarten	1,672	1,671	1,860
Education & care centre	10,327	11,704	13,205
Home-based network	293	288	348
The Correspondence School	29	18	18
Total	12,419	13,781	15,511

Source: Ministry of Education

(1) Full-time teacher equivalents calculated using total hours/25.

Excludes specialist teaching staff and paid support staff.

Cautionary Note

Some forms of ECE, including Playcentres and Te Kohanga reo, incorporate unpaid labour by design. This can impact labour productivity, and should be treated transparently in engagement with stakeholders.

Should further information differentiating labour quality be desired, qualification of teaching staff¹⁷ can be used (available from 2001). Qualification levels of ECE teachers have been rising over time. In general, kindergartens, home-based networks, and the Correspondence School have much higher levels of qualification, as shown in the annual snapshot table below.

¹⁶ One full-time teacher equivalent is defined as a teacher employed for a full working week. This may be varied, for example, by two teachers sharing a full-time teaching equivalent. FTEs are calculated by adding together total part-time hours worked, dividing by 25, and rounding to two decimal places.

¹⁷ Educational research indicates that teacher qualification is strongly correlated with improved educational outcomes, where 'years of experience' is not. See Cameron, M. and Baker, R. (2004), and discussion in section 7.3.1.

Table 28 Teaching staff (headcount) at teacher-led ECE services by service type and qualified status as at 1 July 2008

Service Type	Qualified Staff	Not Qualified Staff	Qualified percentage
Kindergarten	1,943	59	97.1
Casual-education and care	72	35	67.3
Education and care	7,905	6,460	55.0
Homebased network	367	2	99.5
Correspondence School	18	-	100.0
TOTAL	10,305	6,556	61.1

Source: MOE

School labour inputs

At the present time, teacher salaries in state and state integrated schools are legally required to be paid directly by the Ministry of Education on the basis of payscales set in collective contracts (ie no performance-based pay). This pay can be topped up with 'allowances' of a specified amount for additional duties, as well as retention bonuses for hard-to-staff schools. Principals have a separate contractual payscale that operates in a similar fashion. All payroll transactional data for teachers, principals, and a substantial proportion (~90 percent) of support staff at state and state integrated schools since 1999, is captured in the Teacher's Payroll Data Warehouse. To date, no reliable way of distinguishing hours paid from actual hours worked has been identified.

Table 29 Full-Time Teacher Equivalents at State and State Integrated Schools by school type

School type	Year							
	2001	2002	2003	2004	2005	2006	2007	2008
Number of FTTEs								
Primary & intermediate	23,365	23,364	23,617	23,583	23,357	23,738	23,891	24,124
Composite	1,485	1,572	1,691	1,795	2,008	2,042	2,062	2,103
Correspondence	318	290	290	285	244	210	205	211
Secondary	15,378	15,597	16,485	17,281	18,044	18,471	18,679	18,785
Special	745	764	799	835	909	931	974	973
Total	41,292	41,586	42,882	43,778	44,562	45,393	45,811	46,196

Source: Ministry of Education

(1) Full-time teacher equivalents calculated using total hours/25. Excludes specialist teaching staff and paid support staff

Private schools provide teacher counts on the June roll returns, but the information is much less detailed; the best existing labour data for teachers and other employees of private schools is likely to be from the LEED database.

Also included in the Teacher's Payroll Data Warehouse is data from the Teacher Census. The Teacher Census is a survey of teachers working in state and state integrated schools carried out by the Ministry of Education every three years. Teacher Census data

collections have taken place in 1998, 2001, and 2004. Ethnicity and date of birth information collected by the census is used to validate details held on the payroll. Aggregate Teacher Census information is analysed by the Ministry of Education, and results are published and made available to teachers, schools, and teacher organisations.

Treatment of teacher training and development

Further information about changes in labour input quality over time is available in the existing data on teacher qualification and/or experience. Teacher qualifications show an important but complex relationship to student outcomes. The international evidence shows that non-qualified adults working as teachers or teacher aides do not generally have a positive impact on student outcomes, and in some cases have negative impacts. Conversely, highly qualified teachers can have very marked impacts on the outcomes for diverse students, particularly younger students. Students learn more from teachers with high academic skills than teachers with weak academic skills. The evidence is stronger when higher order student outcomes, such as critical thinking and sustained thoughtfulness, are included in outcome measures.

For this reason, the Ministry of Education already publishes several indicators related to teacher qualification from the teacher census data.

In addition to initial teacher training, labour quality is affected by ongoing professional development. The Ministry of Education runs a variety of targeted professional development programmes for that aim to improve student outcomes by improving teaching. While these programmes do not alter the labour input quality of individual teachers in a transparent way like an additional qualification, expenditure on these programmes flows through into the labour income shares used to weight labour and capital when calculating productivity.

The **Literacy Professional Development Project (LPDP)** began in March 2004. The LPDP has a focus on improving teacher content knowledge in literacy, pedagogy, and practice, and building effective professional learning communities. The project provides schools with an evidence-based professional development programme that aims to improve student learning and achievement in literacy. A total of 288 schools (3,288 teachers) have participated in the project to date. Schools work within the project for two years.

An independent evaluation of LPDP was commissioned and undertaken by the New Zealand Council for Educational Research (NZCER) in collaboration with the University of Canterbury. The final evaluation report was received by the Ministry in August 2007. Overall, the evaluation found that the gains in reading and writing achievement by students from schools in the LPDP were greater than those that could be expected without the intervention.

The underlying philosophy behind the Ministry of Education's **Numeracy Development Projects (NDP)** is that teachers are key figures in changing the way in which mathematics is taught and learned in schools. Their subject matter and pedagogical knowledge are critical factors in the teaching of mathematics for understanding. The effective teacher of mathematics has a thorough and deep understanding of the subject matter to be taught, how students are likely to learn it, and the difficulties and misunderstandings they are likely to encounter. The focus of the NDP is to improve

student performance in mathematics through improving the professional capability of teachers.

Tertiary labour inputs

The recommended labour input measure for tertiary education is hours worked by employee type. Unlike school teachers, tertiary workers are not paid directly by the Ministry, so there is no equivalent of the Teachers Payroll Data Warehouse. Detailed academic staffing data collections at the Ministry of Education go back to 1997, and are considered of good quality from 2000. Research staff at the Ministry have backdated them to 1994 for universities and polytechnics, and 1995 for wananga. While there exists gross personnel expenditure of good quality from 1998 for public TEIs, there is not the equivalent data for PTEs or industry training.

Table 30 Academic staff FTEs employed in public providers by sub-sector

Subsector	Year						
	2001	2002	2003	2004	2005	2006	2007
	Number ⁽¹⁾						
University ⁽²⁾	6,609	6,940	7,182	7,558	7,776	7,659	7,758
Institute of technology & polytechnic	4,182	4,266	4,461	4,424	4,434	4,367	4,331
College of education ⁽³⁾	793	792	777	494	344	301	...
Wānanga	255	586	797	897	844	673	669
Total	11,839	12,584	13,217	13,373	13,398	13,000	12,758

Source: Annual reports of tertiary education institutions

(1) Data relates to staff employees during the week 29 July to 4 August.

(2) Auckland College of Education staff are treated as university staff in 2004.

(3) From 1 January 2007 the last remaining colleges of education merged with their local universities.

Symbol: ... not applicable

Table 31 Non-academic staff FTEs employed in public providers by sub-sector

Subsector	Year						
	2001	2002	2003	2004	2005	2006	2007
	Number ⁽¹⁾						
University ⁽²⁾	8,283	8,898	9,346	10,048	10,294	10,243	10,687
Institute of technology & polytechnic	3,159	3,306	3,664	3,899	3,889	3,851	3,837
College of education ⁽³⁾	822	883	894	504	375	297	...
Wānanga	380	680	923	1,062	939	779	761
Total	12,644	13,768	14,827	15,513	15,497	15,170	15,284

Source: Annual reports of tertiary education institutions

(1) Data relates to staff employees during the week 29 July to 4 August.

(2) Auckland College of Education staff are treated as university staff in 2004

(3) From 1 January 2007 the last remaining colleges of education merged with their local universities.

For further information on changes in labour quality over time, the staffing data includes the required information for differentiating labour input quality by academic rank starting from 1994/5, with an incomplete collection of salary scales to provide cost weights. A certain amount of interpolation would be required.

Private TEI staff data are provided to Ministry of Education. The non-academic staff data in private and public educational institutions are considered weaker than the academic equivalent. The best existing labour data for teachers and other employees of private schools are likely to be from the LEED database.

Treatment of labour devoted to tertiary sector research

Research is an important output of the tertiary sector, as discussed in section 7.3.5. While there is no direct measure of hours devoted to research or service, the notional expected labour allotment for academic staff at a university is 40 percent teaching, 40 percent research, and 20 percent service. A certain proportion of academic appointments are identifiable as research-only.

Funding designated for research is an identifiable stream from 2000 onward, representing 15 percent to 20 percent of university revenue, but Ministry and university staff acknowledge that the boundary between research and other academic work is far from crisp; research has also been funded out of the general funding.

Recommendation E19

Labour devoted to tertiary research should be estimated and treated in a manner consistent with the treatment of research output.

Other education labour inputs

Other education is the least well-documented subsector of education. There are aggregate figures for how much programs cost and how many students go through them, but not how the money is spent in the production of those educational services, which are neither owned by nor paid directly by the Ministry of Education. Current information suggests that the best information available may already be held within Statistics NZ, feeding into the National Accounts and LEED. This can provide labour, capital, and intermediate consumption data on a case-by-case basis for the few public educational institutes not included in other categories (eg the national dance and drama school).

Outside of these few public educational institutes, other education is both co-financed and co-produced. The Industry Training, Modern Apprenticeships, and Gateway programmes are workplace-based, with labour and capital that would be very challenging to identify. The Industry Training Organizations (ITOs) that administer these educational programmes vary in size across industries, and over time, in a way that suggests that they are not a reliable proxy for inputs to education.

Targeted training, including the Skill Enhancement, Training Opportunities, and Youth Training programmes, are largely delivered by tertiary providers using labour and capital that will be accounted for in the tertiary sector inputs and the funding streams earmarked for those programmes.

7.3.2 Capital inputs

This section focuses on the data requirements and availability of appropriate data for measuring capital inputs to education, as the concepts and methods are rather less

contentious than is the case for output. It also highlights some scope questions that specifically manifest in use of capital.

Capital inputs to production are not the capital itself, but the flow of services from capital, which are not directly observable. These services are approximated by assuming that service flows are in proportion to the productive capital stock (stock of capital assets after each vintage has been converted into 'efficiency-standardised' units representing the amount of use remaining in them). The capital services used in the National Accounts is calculated for all industries within a perpetual inventory model (PIM). This calculates consumption of fixed capital for each of 26 assets by industry and year. See section 6.3.7 for a detailed discussion of the compilation of these data.

ECE capital inputs

All ECE capital is privately held. This sector is covered by the *Annual Enterprise Survey*, so Statistics NZ coverage of ECE capital is equivalent to that of other industries.

School capital inputs

The Ministry of Education stores schools' financial accounts in the Financial Information Database for Schools (FIDS). The financial data are first categorised by the school and then aggregated by the Ministry for national trends. What falls in the category of revenue or expense is subject to interpretation at each school. Detailed data on intermediate consumption and capital formation in state and state integrated schools are already supplied by the Ministry of Education to Statistics NZ for the purposes of government accounts. The government accounts data are slightly more disaggregated and already aligned with the categories required by the National Accounts, but should not be treated as a separate data source, as it is also sourced from FIDS.

Capital input should ideally be disaggregated by type, as well as the characteristics, of the receiving school, which are available in the FIDS data. The Ministry publishes a variety of financial series for schools, broken down by school type and authority (ie state, state integrated, or private). Published expense categories include administration, depreciation, learning resources, local funds expenditure, property, and other expenses. Operational funding categories include base funding, careers, heat/light/water, isolation, maintenance, Maori language, NCEA, other, per pupil funding, relieving, Secondary Tertiary Alignment Resources, special education grants, Targeted Funding for Educational Achievement, and vandalism. Custom aggregations can be made available by agreement between Statistics NZ and the custodians of the FIDS database at the Ministry of Education.

Treatment of capital in state integrated schools

An unusual feature of state integrated schools introduces an additional level of complexity for compiling accurate estimates of productivity. Capital services in state integrated schools are consumed in the public sector, but generated by capital held in the private sector (eg by the church or educational trust). Care will have to be taken to fully account for relevant capital, which will be reported in industry QA (Personal and other services) with churches¹⁸ rather than industry NA (Education). If the capital is rented by the church to the school at market prices, the flow of services will be represented in intermediate consumption and no adjustments are required. If the

¹⁸ It is possible in the case of large churches, that real estate is held by a separate reporting unit classified to LC property services.

property is provided for use at less than market prices, the productive capital stock (PKS) used for education services, along with the associated consumption of fixed capital and value added, should be identified. Where capital used for the school and that used for other purposes are intermingled, it may be possible to use depreciation estimates from the Ministry of Education to proxy how much is used for educational services.

From there: (1) appropriate rent can be imputed in NA, or (2) adjustment can be made to move the PKS, associated consumption of fixed capital, and value added from QA to NA, as demonstrated in table 32.

Table 32 Treatment of state integrated school capital

	Without adjustment		After adjustment	
	NA Education (integrated only)	QA Community Services	NA Education (integrated only)	QA Community Services
Gross Output (IC+COE+CFK)	<i>140</i>	<i>340</i>	<i>240</i>	<i>240</i>
Intermediate consumption	40	40	40	40
Cost of Employment	100	100	100	100
Consumption of Fixed Capital (school)	0	100	100	0
Consumption of Fixed Capital (other)	0	100	0	100
Value added (GO-IC)	<i>100</i>	<i>300</i>	<i>200</i>	<i>200</i>
Productive Capital Stock	0	500	250	250
Productivity Numerator	<i>100</i>	<i>300</i>	<i>200</i>	<i>200</i>
Productivity Denominator	<i>140</i>	<i>340</i>	<i>240</i>	<i>240</i>
Total Factor Productivity	<i>0.714</i>	<i>0.882</i>	<i>0.833</i>	<i>0.833</i>

Note: Derived figures are in italics.

These manual adjustments are labour intensive, prone to error, and introduce deviation from the published National Accounts. If the capital is added to industry NA without removing it from QA, non-market estimates would be correct, but **the suite of**

productivity estimates as a whole will be incorrect because of the overstatement of QA.

Alternatively, it may be acceptable to state that capital inputs will be underestimated at the 357 state integrated schools serving approximately 11 percent of students, and provide range estimates of the potential error introduced by this choice. This will affect the income shares and therefore input levels, but will impact percentage change minimally if the proportion of the students at state integrated schools remains consistent.

Tertiary capital inputs

The recommended capital input measure for tertiary education is capital disaggregated by type. For the tertiary sector, existing expenditure data from the Statistics NZ government accounts seems to represent the best available data source.

7.3.3 Intermediate consumption

This section briefly covers the data requirements and availability of appropriate data for measuring intermediate consumption in education. Intermediate consumption goods can be measured explicitly as an input, or implicitly by using value-added as the output measure. Value added is defined as gross output less intermediate consumption. Detailed intermediate consumption by industry is periodically benchmarked by Statistics NZ (most recently in 1997 and 2008); in the intervening years, the breakdown of intermediate consumption expenditure into various inputs is approximated in an economy-wide supply/use balancing process. The 2009 commodity data collection for education covered private education only, but the intermediate consumption patterns for ECE, schooling, and other education are expected to be similar. Private tertiary education is substantively different from that offered at public institutions, and should not be used as a proxy if direct measures exist.

ECE intermediate consumption

The Ministry of Education has put a great deal of work into identifying the costs associated with government-funded ECE as part of the 20 Hours Free ECE programme¹⁹. This is likely to be the best model for identifying the inputs associated with the government-funded portion of ECE.

Table 33 Average cost per enrolled hour by ECE service type

Average Cost	Over-two	Under-two
Education & Care	6.09	12.85
Kindergarten	5.50	N/A
Home-based	5.40	10.80
Playcentre	3.85	7.71
Te Kōhanga Reo	5.66	11.32

Source: MOE

¹⁹ More information on this process is available at <http://www.educationcounts.govt.nz/publications/ece/8019>

The Ministry of Education developed funding rates for 20 Hours ECE by calculating the:

1. average cost per hour of ECE: using the total costs of provision from the 2006 Operating Cost Survey for each type of early childhood education service (Sessional Education and Care, All Day Education and Care, Home Based, and Te Kōhanga Reo), and dividing costs by the number of hours of early childhood education provided.
2. average government funding subsidies: using the subsidy rates paid in 2005/06 (the period that most services' Operating Cost Survey related to).
3. average amounts of cross-subsidisation or cost-smoothing: using information on fees and subsidy rates for different age groups and periods of attendance in early childhood education, this estimates how services currently use fees and subsidies to offset their costs; in particular, the estimated additional contribution being made by the first 20 hours per week for three and four year-olds. This amount was then added to the average cost per hour in step 1.
4. costs not met by government funding: adding the results of steps 1 (average cost) and 3 (cross-subsidisation), then subtracting step 2 (funding subsidies), calculated the amount needed in 2005/06 to provide 20 Hours ECE.
5. cost increases since 2005/06: an inflation increase to the results of step 4 (costs not met by government funding).
6. total 20 Hours ECE funding rates: by adding the results of steps 4 and 5 to early childhood education funding subsidy rates (from 1 July 2007).

School intermediate consumption

Intermediate consumption data are sourced from the FIDS database discussed in section 7.3.2.

Tertiary intermediate consumption

For the tertiary sector, existing expenditure data from the Statistics NZ government accounts seems to represent the best available data source.

8 Data availability: health care

8.1 Health care: output quantity

This section sets out the data sources that exist for health care services and accompanying analyses in New Zealand, and discusses the pros and cons of each of the sources from the perspective of output measurement.

A great deal of information is collected every day on the health care services provided in New Zealand, whether in primary or secondary care. Much of this information covers the whole of the national territory and is made available centrally. These sources are known collectively as the 'National Collections' and are:

- **General Medical Subsidy Collection (GMS)**
- Health workforce information
- Hepatitis B Screening programme (Hep B)
- **Laboratory Claims Collection (Labs)**
- Maternity and Newborn Collection (MNIS)
- Medical Warnings System (MWS)
- Mental Health Information Collection (MHDW)
- **Mental Health Information National Collection (MHINC)**
- Mortality Collection
- National Booking Reporting System (NBRS)
- National Booking Reporting System Data Warehouse (NBRS DW)
- National Health Index (NHI)
- National Immunisation Collection (NIR)
- **National Minimum Dataset (Hospital Events) (NMDS)**
- **National Non-admitted Patient Collection (NNPAC)**
- New Zealand Cancer Registry (NZCR)
- **Pharmaceutical Collection (Pharms)**
- **Primary Health Organisation Enrolment Collection (PHO)**

Appendix 3 repeats this list, providing brief descriptions for all in the interests of comprehensiveness. These National Collections have not been designed for measuring productivity, but nevertheless many of them include relevant information. Those collections that are listed above in **bold** are those which offer useful information for productivity measurement, and these are the sources that are described more fully below.

The Mortality Collection and the National Health Index are sources that would prove useful if quality adjustment (based on changes in mortality rates) and a health care pathway approach (using the NHI to link records) were to be worked on.

Other information is collected outside of the framework of the National Collections. These are covered in section 7.1.9.

A word of caution is needed on the occasional duplication of an activity in two or more of these distinct national collections. The reasons for the duplication in separate databases is due to the particular use of each database. For example, hospital discharges associated with newborns and maternity services appear in both NMDS (in order to record all hospital activity) and the Maternity Newborn Collection (MNIS) (in

order to be comprehensive about newborn information). The appearance of the National Health Index (NHI, this is an identifier unique to any individual) on the separate records, along with event date, is the key to avoid double-counting.

There are also analyses of these raw data which are used, or could be used, in monitoring output, inputs, or productivity.

8.1.1 National Minimum DataSet (NMDS)

Overview

The NMDS is a national collection of public and private hospital discharge information, including clinical information, for inpatients and day patients (day care). Data have been submitted electronically by public hospitals since 1993 and for publicly funded events in private hospitals since 1997. Extracts available to MoH include calculated variables, such as cost weight and DRG. Customised data analysis, summarising and reporting can be requested from the Ministry of Health's Information Directorate, and analytical event files are regularly downloaded including those used to calculate the inpatient output component of the Ministry's productivity metric.

Coverage

NMDS captures data on all patients discharged from day patient and inpatient care in publicly funded hospitals and publicly funded patients in private hospitals throughout New Zealand. It does not cover privately funded activity in private hospitals.

An entry in NMDS corresponds with a single discharge. Re-admissions, transfers (to another hospital) etc can be identified through the use of the National Health Index (NHI) which is coded to all records. A set of assumption-based rules may be required to 'link' separate discharges into a single treatment. For example, a time limit may be needed to distinguish between (i) re-admission for the same bout of illness and (ii) repeat occurrence of the same health problem (after complete recovery of the initial bout).

Timing (frequency, time reference, length of time series)

NMDS is a continuous 100 per cent survey of all inpatient and day patient discharges.

MoH holds NMDS datasets that include casemix weights (from the WIES system) for 6-monthly periods, either January to June or July to December.

Data on discharges from public hospitals as far back as 1988 are stored in the NMDS, although it is noted that there have been 'many changes over the years', including addition and deletion of variables as well as in scope/coverage. Data on publicly funded discharges from private hospitals has been collected since 1997.

Use in a measure of productivity

This source provides information on the number of inpatient and day patient activities in public and private hospitals, by type of activity (for example by ICD and DRG) along with information on estimated cost, according to the WIES costing system. For this reason, the NMDS has been, and continues to be, the main data source for existing productivity estimates published by the Ministry of Health. See section 4.3.1 for further information on the Ministry of Health's productivity estimates.

Account needs to be taken of a number of factors which will affect whether, and how, each record is processed from the perspective of use in an output metric. The key consideration will be how the record corresponds to a unit of output:

'1 record = 1 unit of output': in many cases, the record will describe a single activity which constitutes the whole course of treatment within the hospital environment for a patient with a particular diagnosis. In such cases, the record may correctly be considered a unit of output in its own right.

'Concatenation of records': the availability of the NHI on all records means that multiple activities for the same diagnosis can (should) be linked together, allowing a health care pathway type approach to be compiled. Clearly, one record in such cases does not correspond with one unit of output, but the single unit of output will be made up of a number of separate records.

'Exclusion of records': some records may not correspond to 'output' at all and should not be included in a measure of output. Examples of this may be cancelled appointments or patients who die whilst admitted. Care needs to be taken in determining whether there is indeed 'output' generated in such cases, as in some cases the risk of death is high and the hospital is trying its best to prolong life under difficult circumstances; this type of output might be likened to the services of a barrister when the defendant is found guilty.

Known issues

None.

Key variables

The following variables (in bold), along with short descriptions, are those which should be considered useful when analysing information in the NDMS for measuring change in output.

Admission source code This variable helps identify activities along the health care pathway (it identifies transfers from other hospitals).

Age at admission and **age at discharge** and **CCL (complication/co-morbidity class level)** These may be of use if it is considered desirable to distinguish between patient of different types (for example, older patients tend to require more resources than younger patients through earlier admission etc).

Costweight This is the relative price (see section 7.3.1 for a discussion of use of this in measures of output change).

Diagnosis and **clinical code** (in terms of the International Classification of Disease ICD) These variables identify the primary and other diagnoses for the admitted patient.

DRG code current This is the key for identifying multiple activities within a single patient's health care pathway.

Encrypted NHI number This is the key for identifying multiple activities within a single patient's health care pathway.

Event end date and **Event start date** These variables help to identify the sequence of activities whining a health care pathway

Event end type code and **death flag** This variable helps to identify activities which should be linked as part of the health care pathway. It would identify activities resulting in death, if it is considered that such activities should not form part of 'output'.

Health specialty code This variable may form part of the disaggregation classification and help to distinguish between different types of health activity.

Length of stay This may help in quantifying output, for types of care for which the unit of output is considered to be 'a week's worth of care received'. It may also be of use in distinguishing between different types of care (if 'long' lengths of stay are considered to constitute a different type of output from 'short' lengths of stay).

NZ resident status This variable helps to identify activities that are within scope (for example in order to exclude treatment for non-residents I required).

Principal health service purchaser This helps identify the scope of the output measure, by distinguishing between, for example, ACC funding, private funding etc.

Private flag This variable will help identify activities which are within scope (for example indentifying patients paying privately).

Level of disaggregation

NMDS includes a number of variables which capture information on the characteristics which might be considered to be important to the consumer. These include:

Age at admission, age at discharge, CCL (complication/co-morbidity class level), DRG code current, event end type code, health specialty code, and length of stay.

The disease classification at its lowest level is too fine, with over 10,000 categories, which would lead to some cells having zero activity recorded for some years. A problem with some of the other classifications, such as DRG, might be associated with the extent to which homogenous activities are spread across different DRG categories, whereas the ideal situation would involve grouping such activities. For example, the treatment of mental health issues may take the form of counselling or prescription of pharmaceuticals, or a combination of both. See section 3.1.3 'Level of disaggregation for the measure of output' for a discussion of the level of disaggregation.

Overlaps / duplication with other sources

For some kinds of discharge, the record of the discharge will, or may, appear in other databases. The appearance of the NHI on the separate records is the key to avoid double-counting. The reasons for the duplication in separate databases is due to the particular use to which each database is put. For example, hospital discharges associated with newborns and maternity services appear in both NMDS (in order to record all hospital activity) and the Maternity Newborn Collection (MNIS) (in order to be comprehensive about newborn information).

Access to dataset

The MoH's 6-monthly datasets are held as SAS files, and are relatively large: each file is some 5 MB on average. Processing and analysis within MoH is carried out within the SAS environment (currently SAS 9.1).

The patient identifier, the NHI, is encrypted.

Corresponding weights

Estimated costs are calculated by the WIES (Weighted Inlier Equivalent Separations) system. The methodology and data sources are complicated and complex and accordingly are covered separately in section 7.3.1.

8.1.2 National Non admitted Patient Collection (NNPAC)*Overview*

NNPAC stores data about non admitted face-to-face secondary care events, such as outpatient and emergency department visits. The database records both first and follow-up appointments. The main purposes are to monitor non-admitted patient events, to analyse inter-district flows and to monitor the impact of policy. Unlike NMDS, NNPAC does not include information on associated costs, nor on diagnoses or procedures which could be used for disaggregation.

Coverage

NNPAC is designed to be a comprehensive store of all non-admitted events in public hospitals. It also includes information on non-attendances (where the appointment was not cancelled but the patient either never arrived or left before seeing the doctor).

Timing (frequency, time reference, length of time series)

NNPAC is only a recently established database, being established in 2006 and contains data from July 2005. It is a continuous 100 per cent survey.

Use in a measure of productivity

NNPAC provides information which covers other secondary care activity beyond what is already recorded in NMDS, although care needs to be taken as there are records which of the same activity appearing in both NMDS and NNPAC. The NHI is the key to dealing with this double counting.

Known issues

MoH reports that there are some issues about comprehensiveness, due to a fair degree of non-compliance. This could be a significant problem, as it makes measuring volume change over time rather more difficult. For example, if there was a 10 per cent increase in the number of appointments from one year to the next, how much of this would be due to general practitioners seeing more patients and how much would be due to general practitioners recording more of the patients that they see?

It would be fairly easy to deal with the activity of general practitioners who have not recorded appointments before and start all of a sudden: these would be ignored for the first year, and introduced into the calculations as of the second year in order to create a matched pairs comparison. Care would need to be taken with ongoing improvement or deterioration in recording, whereby it may be difficult to distinguish between increasing (decreasing) quality of reporting and increasing (decreasing) activity.

The information held by NNPAC on renal dialysis services is thought to be problematic, with a single unit of measurement not consistently used (one 'unit' may refer to a single treatment, or it may be to a set of treatments).

For renal dialysis and oncology services, there is occasional duplication of records between NNPAC and NMDS, which can on the whole be identified using the NHI.

Key variables

The following variables (in bold), along with short descriptions, are those which should be considered useful when analysing information in NNPAAC for measuring change in output.

Age at time of visit separating activity according to age (or at least bands of age such as 'young', 'adult', 'old') may pick up some of the characteristics of patients when they present (older patients typically require more health care resources for the same diagnosis).

Attendance code This variable identify whether a patient attended or not, and therefore helps identify whether the record constitutes a unit of output or not.

Encrypted NCU id (NHI) This is the key for identifying multiple activities within a single patient's health care pathway.

Equivalent purchase unit This variable identifies which type of contract the event is funded under, and helps associate a price to the event.

Event type This variable may be of use in distinguishing between different types of activity.

Health provider type This variable distinguishes between the type of staff providing service: doctor, nurse or other, and may be of use in distinguishing between different types of activity.

Health specialty code This variable may form part of the disaggregation classification and help to distinguish between different types of health activity.

Purchaser code This variable identifies who has paid for the event, and will help to screen out, for example, overseas patients paying privately, if required.

Service type This variable distinguishes between first and follow-up appointments, and may be of use in moving away from an activity-based unit of output to a health care pathway based unit of output. Combining records for first and (multiple) follow-up appointments together into a single unit of output would approximate a health care pathway if the pathway only involved such appointments. This will not be the case if the patient's health care pathway also includes other activities, for example as an inpatient attendee or if the patient sees a general practitioner.

Volume This variable will help to identify the relative weight for an event. In general, the volume is recorded as '1', but may be a fraction in cases where the unit of measurement for the type of activity in NNPAAC is, say, a block contract purchase for a number of separate units of treatment.

NZ resident status This variable helps to identify activities that are within scope.

Private flag This variable will help identify activities which are within scope.

Level of disaggregation

NNPAAC includes a number of variables which capture information on the characteristics which might be considered to be important to the consumer. These include: age at time of visit, attendance code, equivalent purchase unit, event type, health provider type, health specialty code, and service type.

Access to dataset

MoH has access to the dataset for analytical purposes.

Corresponding weights

NNPAC does not include information on relative weights for the events included.

For some types of outpatient and emergency department activity, WIES are available, and may provide sufficient information (see section 7.3.1).

Outpatient and emergency department activity is funded through contracts, called District Annual Plans (DAPs) between DHBs and the Ministry. Each DHB negotiates its own DAP with the Ministry on an annual basis, and the number of each different type of activity, along with the price, is set out in part of the DAP called the Price Volume Schedule (PVS). In general, there is little notion of a nationwide price for activities, as each DHB negotiates individually. As the PVS is part of the DAP, the number of activities and prices are on a planned basis: there is no reporting of the corresponding turnout at a disaggregated level (planned activity / expenditure and actual turnout is reconciled at the level of total expenditure).

The PVS includes a set of 'adjusters' which are designed to modify the turnout prices in the case of less or more activity being carried out.

Further Analysis needed 1

Where both exist, the WIES and the average DAPs / PVS prices for NNPAC activity should be compared with the aim of choosing the most suitable weights for outpatient and emergency department activity.

8.1.3 General Medical Subsidy Collection (GMS)*Overview*

GMS contains information on the fee-for-service payments made to doctors for patient visits that have been processed by the HealthPAC Proclaim system; that is, visits to doctors other than the one with which the patient is enrolled. GMS is used to monitor contracts with providers, support forecasting and setting of annual budgets, and analyse health needs and assess policy effectiveness.

Coverage

GMS includes information on fee-for-service payments to doctors other than the one with which the patient is enrolled. It also includes after-hours visits for both enrolled and non-enrolled patients. Most GP visits for which there are no fee claims are excluded from GMS.

Timing (frequency, time reference, length of time series)

GMS was established in August 2003 and contains data from November 2001.

Use in a measure of productivity

GMS includes information that could be used as a count of the number of publicly-funded (publicly-subsidised) GP appointments.

The inclusion of the NHI (the unique patient identifier in NZ) would allow appointments for the same health care treatment to be aggregated up from single, independent 'activities' to health care pathways. For patients with co-morbidities in particular (but not only), this variable would need to be used in conjunction with other variables, such as

date of event and diagnosis, in order to ensure that the correct set of activities are aggregated in the appropriate health care pathways.

Known issues

The MoH reports that there are some issues about comprehensiveness, due to a fair degree of non-compliance (non-submission of information by what's thought to be 40 percent of Primary Health Care Organisations). This could be a significant problem, as it makes measuring volume change over time rather more difficult. For example, if there was a 10 percent increase in the number of appointments from one year to the next, how much of this would be due to general practitioners seeing more patients, and how much would be due to general practitioners recording more of the patients that they see?

One method of dealing with the activity of general practitioners who have not previously recorded any appointments and then start to record all appointments, would be to ignore activity for the first year, and begin comparison from the second year onwards in order to create a matched pairs comparison (and vice versa). Care would need to be taken with ongoing improvement or deterioration in recording, whereby it may be difficult to distinguish between increasing (decreasing) quality of reporting and increasing (decreasing) activity.

Key variables

The following variables (in bold), along with short descriptions, are those which should be considered useful when analysing information in GMS for measuring change in output.

Age in years Separating activity according to age (or at least to bands of age such as 'young', 'adult', 'old') may pick up some of the characteristics of patients when they present (older patients typically require more health care resources for the same diagnosis).

Amount paid (excluding GST) This variable could be used as part of a set of information used in constructing the relative weight. Information on the patient co-payment (and other contributions to total cost) would also be needed to ensure that the relative weight is correctly specified.

Encrypted NHI number This is the key for identifying multiple activities within a single patient's health care pathway.

Health professional group code This variable distinguishes between the professional accreditation of staff providing service: Medical Council, Nursing Council, and Dental Council, and may be of use in distinguishing between different types of activity.

Level of disaggregation

GMS includes a number of variables which capture information on the characteristics of the service which might be considered to be important to the consumer. These include: age in years and health professional group code.

Access to dataset

The MoH has access to the dataset for analytical purposes.

Corresponding weights

GMS includes information on the payment made to the medical practitioner as part of the fee-for-service. In order to use this information in constructing a relative weight for

these kinds of activity, the total amount of payment needs to be known. This can be compiled using information on the capitation payment in the PHO collection (see section as well as the amount of the patient co-payment).

8.1.4 Primary Health Organisation collection (PHO)

Overview

PHO contains information on patients enrolled with general practitioners, along with information on the capitation payments paid by the Ministry as part of the overall funding system for general practitioners and PHOs. It is used to assist PHOs, DHBs, and the Ministry to report and monitor patient enrolment, to provide PHOs, DHBs, the Ministry, and researchers with population data to assist with population health research, and to assist PHOs to examine and improve the quality of their enrolment information.

Coverage

PHO captures information on all patients who have enrolled with a general practitioner.

Timing (frequency, time reference, length of time series)

PHO was established in 2005 and is updated quarterly.

Use in a measure of productivity

PHO does not contain explicit information on activity, although it does include the date of the last contact with a primary health care doctor in that quarter, which can be used to contribute to a count of contacts in conjunction with other sources (GMS, Labs, and Pharms: see their entries in this section).

PHO also includes information on whether or not enrolled patients are also enrolled as Careplus patients (see Careplus enrolment status variable below for definition), which could be one component used in constructing health care pathways.

A third use in measuring output quantity, is that some of the payment made to PHOs reflects achievement against public health targets: the nature of these targets, along with the potential for compiling indicators of associated output, has yet to be explored. The PHO Performance Management weblink below contains a document explaining the performance indicators and payments available to PHOs.

<http://www.dhbnz.org.nz/Site/SIG/pho/default.aspx>

PHO also contains information on capitation costs, which should be used in constructing the weights for GP activity. Capitation payments are dependent on a number of variables, including age of patient, whether or not certain types of service card (for example, a community service card) are held, deprivation of the area and ethnicity of the patient, as well as whether or not some payment has already been made through the GMS system. These payments should be added to patient and DHB fee-for-service co-payments for GP appointments to arrive at total cost.

Known issues

None.

Key variables

The following variables (in bold), along with short descriptions, are those which should be considered useful when analysing information in PHO for measuring change in output.

Age Separating activity according to age (or at least to bands of age such as 'young', 'adult', 'old') may pick up some of the characteristics of patients when they present (older patients typically require more health care resources for the same diagnosis).

Amount payable, actual ffs deduction amount, and fee amount These variables could be used as part of a set of information used in constructing the relative weight for GP appointments. The actual amount paid from the capitation funding side is the difference between what is due because of the capitation formula for the particular PHO and what has been paid through the GMS system for patients enrolled with that same PHO, but who had an appointment with a doctor other than the one the patient is enrolled with.

CBF NHI number This is the key for identifying multiple activities within a single patient's health care pathway.

Careplus enrolment status This variable identifies whether a patient is a Careplus enrollee or not. Careplus is a funding programme for PHOs designed to provide low cost access for people with high needs in New Zealand. This variable may help distinguish between single activities and health care pathways.

Level of disaggregation for a measure of output quantity change

PHO includes two variables which capture information on the characteristics of the service which might be considered to be important to the consumer. These include: age and Careplus enrolment status.

Access to dataset

The MoH has access to the dataset for analytical purposes.

Corresponding weights

See Amount payable, actual ffs deduction amount, and fee amount in the *Key variables* section above.

8.1.5 Primary Health Organisation high-level volume reporting

Overview

Some PHOs provide the Ministry with a high-level report setting out the volume of primary care contacts each quarter. Data are broken down by age, ethnicity, and deprivation.

Coverage

65 of the 91 PHOs provide this information.

Timing (frequency, time reference, length of time series)

PHOs provide this high-level information once a quarter, with the data relating to total contacts in the quarter.

Use in a measure of productivity

This may be a good source with which to corroborate the estimates of primary care activity compiled through other sources. If deemed sufficiently good, it could even be the preferred source of information on change over time, given the patchy nature of other sources of information.

Known issues

Only a subset of PHOs provide the information, so there may be some selection bias inherent in any estimates of change in activity if, for example, the subset of PHOs are not representative.

Only counts of contacts are available, so there is no possibility of aggregating up to health care pathways, or formulating any kind of unit of output other than activity.

Access to dataset

The MoH has access to the dataset for analytical purposes.

Corresponding weights

Given the lack of disaggregation in the information reported, weights would simply be total GP appointment weights, taken from the same source(s) as for PHO (see section 8.1.4).

8.1.6 Laboratory claims collection (Labs)

Overview

The Labs collection holds information on publicly funded primary care tests. Until 2008, Labs was the payment system for ensuring funds flowed to the correct test provider. This is no longer the case, and Labs is now only a data warehouse without the direct role in payment processing. For tests carried out prior to 2008, Labs contains claim and payment information for primary care test subsidies that have been audited against the HealthPAC Proclaim system (as well as those reported directly by a subset of DHBs). For tests carried out after 2008, Labs continues to be the data warehouse for information on the primary care tests paid for using public funds, although it has been suggested that the data warehouse is no longer comprehensive due to falling data provision rates.

There are known quality issues with the way payments reported prior to 2003 were allocated to individual DHBs, although this should have no impact at the national level.

Labs allows the Ministry of Health and DHBs to monitor primary care test subsidies.

Coverage

Labs includes information on primary care test subsidies reported in HealthPAC and by a subset of DHBs. It is not comprehensive, so changes over time need to be configured carefully to distinguish between changes in coverage and change in volumes of matched pairs.

Timing (frequency, time reference, length of time series)

Labs was established in 2000 and contains data from July 1997.

Use in a measure of productivity

Labs includes information that could be used as a count of the number of publicly-funded (publicly-subsidised) laboratory tests.

The inclusion of the NHI (the unique patient identifier in NZ) would allow lab tests to be aggregated up with other components of a health care pathway. For patients with co-morbidities in particular (but not only), this variable would need to be used in conjunction with other variables, such as date of event and diagnosis, in order to make sure that the correct set of activities are aggregated in the appropriate health care pathways.

Labs also includes the date of referral, which can be used as part of the count of general practice activity – where this date is different from dates already recorded in other sources such as GMS, PHO, and Pharms (see sections 8.1.3, 8.1.4, and 8.1.8).

Known issues

The recent change in the status of Labs, from a key component of the payment system to data warehouse, has meant that there has been a reduction in the comprehensiveness of the recording of tests.

Key variables

The following variables (in bold), along with short descriptions, are those which should be considered useful when analysing information in Labs for measuring change in output.

Age at visit Separating activity according to age (or at least to bands of age such as 'young', 'adult', 'old') may pick up some of the characteristics of patients when they present (older patients typically require more health care resources for the same diagnosis).

Amount paid EXCL (excluding GST) This variable could be used as part of a set of information used in constructing the relative weight. Information on the patient co-payment (and other contributions to total cost) would also be needed to ensure that the relative weight is correctly specified.

Encrypted NHI number This is the key for identifying multiple activities within a single patient's health care pathway.

Laboratory test, test code and laboratory test group These variables may form part of the disaggregation classification and help to distinguish between different types of health activity.

Number of tests This helps to correctly distinguish between price and volume: each time a test is carried out, the reimbursement is paid.

Provider type This variable distinguishes between the professional accreditation of staff providing service: Medical Council, Nursing Council, and Dental Council, and may be of use in distinguishing between different types of activity.

Referral ID and visit date These variables would help in linking the lab test with other components of the health care pathway, and in identifying the total number of GP contacts.

Level of disaggregation

Labs includes a number of variables which capture information on the characteristics of the service which might be considered to be important to the consumer. These include: age in years and health professional group code.

Access to dataset

The MoH has access to the dataset for analytical purposes.

Corresponding weights

Labs includes information on the payment made to the provider.

8.1.7 Mental Health Information National Collection (MHINC)

Note: as of 1 July 2008, this database migrated to PRIMHD.

Overview

MHINC draws together information on the provision of secondary mental health and alcohol and drug services purchased by the government. This includes secondary

inpatient, outpatient, and community care provided by hospitals and non-government organisations (NGOs). MHINC does not include information on the provision of primary care mental health services, for example, by general practitioners.

Coverage

MHINC includes information on secondary inpatient, outpatient, and community care provided by hospitals and non-government organisations, but not primary care mental health services, for example, by general practitioners.

Due to some psychogeriatric services being funded differently than other mental health services, these are not captured in this database. Also, some mental health services that are funded under block or bulk contracts are not captured in MHINC.

Timing (frequency, time reference, length of time series)

MHINC was started in July 2000. Information on services provided by NGOs were not completely recorded in early years, in particular before 2003.

Use in a measure of productivity

MHINC includes some information that is not already covered in either NMDS or NNPAAC, but care needs to be taken as these other databases will record activity where appropriate (for example, if the event is as a result of the patient being admitted, then NMDS will capture this).

Care will need to be taken to ensure that an appropriate unit of output is used. For example, a unit of output defined according to number of visits will be subject to measurement bias if clinical guidance on frequency of visit changes over time. A more appropriate unit of output for mental health may be 'management of patient over a period of time'.

MHINC does not include any information on relative weights for the different events captured.

Known issues

As of 1 July 2008, this database migrated to PRIMHD.

Key variables

The following variables (in bold), along with short descriptions, are those which should be considered useful when analysing information in MHINC for measuring change in output.

Service setting code, service code, admission type code These variables may be of use in distinguishing between different types of activity, and may be of use in screening out activity already captured in NMDS and NNPAAC.

Units of service This variable defines what the unit of measurement in the database is; for example, number of bed days, number of attendances.

Agency code This variable identifies the type of provider of service, for example DHB provider arm or NGO, and may be of use in setting the scope of the output measure.

Date of birth Separating activity according to age (or at least to bands of age such as 'young', 'adult', 'old') may pick up some of the characteristics of patients when they present (older patients typically require more health care resources for the same diagnosis).

Diagnosis (principal and additional), health specialty code, and clinical code (in terms of the International Classification of Disease (ICD)) These variables may form part of the disaggregation classification and help to distinguish between different types of mental health activity.

Discharge type code, referral date, referral type code, event end type code, event end date These variables may be of use in moving away from an activity-based unit of output to a health care pathway based unit of output, as they identify, for example, end of treatment or transfer.

Encrypted NHI number This is the key for identifying multiple activities within a single patient's health care pathway.

NZ resident status This variable helps to identify activities that are within scope.

Principal health service purchaser This variable identifies who has paid for the event, and will help to screen out, for example, overseas patients paying privately.

Level of disaggregation

MHINC includes a number of variables which capture information on the characteristics which might be considered to be important to the consumer. These include: service setting code, service code, admission type code, diagnosis (principal and additional), health specialty code, and clinical code

Overlaps / duplication with other sources

Where appropriate, mental health events are recorded in NMDS and NN PAC, and therefore care will need to be taken to ensure that events are not double counted when drawing together information on events recorded in the three databases.

Access to dataset

Via the MoH.

Corresponding weights

MHINC does not include information on relative weights for the events included. The National Pricing Project (NPP) identifies the costs of these events.

8.1.8 Pharmaceutical Collection (Pharms)

Overview

Pharms is a data warehouse that supports the management of pharmaceutical subsidies. It contains claim and payment information from pharmacists for subsidised dispensing that have been processed by the HealthPAC General Transaction Processing System (GTPS).

Coverage

Pharms contains claim and payment information from pharmacists for subsidised dispensing.

Timing (frequency, time reference, length of time series)

Pharms was started in July 1992, although records prior to 1996 have been archived (they are available on request).

Two major changes have been introduced since 1992:

- Repeat prescriptions were introduced in 1996; and
- The major drug key changed from Medicode to Pharmacode in 1998.

Use in a measure of productivity

Pharms provides information on pharmaceutical products that can either be seen as units of output in their own right, or components of a health care pathway (alongside GP appointments and so on).

Care will need to be taken to ensure that an appropriate unit of output is used. For example, as clinical guidance changes over time, prescribing practice may change such that in one year a 100mg dosage of a given pharmaceutical for a particular patient's condition is prescribed 6 times a year, and the next year a 50mg dosage is prescribed 12 times a year. In both years, the same quantity of pharmaceutical is prescribed. Different definitions of the unit of output will result in different estimates of volume change.

The ability to distinguish repeat prescriptions allows analysis of different units of output. See text against the Repeat sequence number variable in the *key variables* section below.

Pharms also includes the date of dispensing, which can be used as part of the count of general practice activity (where this date is different from dates already recorded in other sources such as GMS, PHO, and Labs).

Known issues

None.

Key variables

Pharms has a vast range of variables, many of which could be useful in productivity analysis. In short, the most important variables are:

Age at dispensing Separating activity according to age (or at least to bands of age such as 'young', 'adult', 'old') may pick up some of the characteristics of patients when they present (older patients typically require more health care resources for the same diagnosis).

Date dispensed This variable would be of use if aggregating the pharmaceutical costs with other costs along the health care pathway, and in identifying total number of GP contacts.

Encrypted NHI number This is the key for identifying multiple activities within a single patient's health care pathway.

Formulation ID This variable identifies the chemical, and is probably the main way to distinguish between different types of pharmaceutical product, if the fact of a prescription is considered to be the unit of output (independent from the rest of the health care pathway). If the unit of output is considered to be the health care pathway, then the exact type of chemical is not needed: all that would be used is the cost of the prescription in order to give the health care pathway the correct (total) costs weight.

Price, adjustment amount, reimbursement cost, national adjustment, patient contribution, dispensing fee value, and subsidy value These variables could be used as part of a set of information used in constructing the relative weight. Information on the patient co-payment (and other contributions to total cost) would also be needed to ensure that the relative weight is correctly specified.

Quantity, quantity units, prescribed quantity, quantity dispensed, quantity prescribed, frequency, dispensing supplied, dose, day's supply, daily dose, and weight These variables identify the quantity of formulation numbers (these are standardised according to chemical entity) and formulation strength, and could be used to ensure that the correct price / volume breakdown is made.

Repeat sequence number This variable identifies the number of repeat prescriptions (number 1 is a prescription given as part of contact with a doctor, 2+ are the repeats). This variable could be used to identify which prescriptions can be aggregated if the unit of output is defined to be the health care pathway. For chronic conditions, where the unit of output may be along the lines of 'a patient with chronic condition X managed over time period Y', this variable would allow aggregation of prescription costs as part of estimating total costs for that particular unit of output.

Level of disaggregation

Pharms includes a number of variables which capture information on the characteristics which might be considered to be important to the consumer. These include: age at dispensing, formulation ID, quantity, quantity units, prescribed quantity, quantity dispensed, quantity prescribed, frequency, dispensing supplied, dose, day's supply, daily dose, and weight.

Overlaps / duplication with other sources

None within the National Collections.

Access to dataset

The MoH has access to the dataset for analytical purposes.

Corresponding weights

Pharms includes complete information for constructing relative weights.

8.1.9 Other sources

Other information is collected outside of the framework of the National Collections. This sub-section describes the most important of these, in terms of comprehensiveness of health system activity.

Maternity services

A bespoke collection for monitoring funding of maternity events, administered by the Sector Accountability and Funding Directorate within the Ministry of Health.

Disability support services

There are two sources of information on funding of disability support services: the Contract Management System (CMS) and the Client Claim Processing System (CCPS), which together form the basis for managing the flow of finances from purchasers (either the Ministry or DHBs) to providers (care homes and so on). Both sources hold information on activity (although at different levels of aggregation, and on financing (prices)).

CMS is complete for the type of services for which it is the system for ensuring flow of finance. It holds information on bulk purchases, and is therefore at an aggregate level (in many cases, for example, the unit of measurement is the 'contract').

CCPS, by contrast, is thought to be incomplete. It holds information at the event level.

Many disability support services are purchased on the basis of inputs, for example bed days, so care needs to be taken when configuring the unit of output in a measure of productivity.

Care needs to be taken with Disability support services, as these are typically a joined-up mix of different services to parts of the population that need health as well as social care. The health and social care boundary is fraught with definitional difficulties, with much effort made internationally by the OECD and others to try to tighten these definitions. Currently, there exists no agreed consensus on where the exact borderline lies, but there is guidance to help, in the OECD's *A system of health accounts* (OECD 2001b), and in the UK and Eurostat's *SHA guidance* (ONS 2005).

Mental health services

DHBs provide the Ministry with information on mental health services that is distinct and independent from the information collected for NMDS and NNPA.

Many mental health services are purchased on the basis of inputs, for example bed days, so care needs to be taken when configuring the unit of output in a measure of productivity.

Public health services purchased from hospitals

The Ministry purchases some public health services directly from hospitals. Activity is not particularly well captured. For example, there is no data warehouse designed for this purpose.

Price Volume Schedules

Price Volume Schedules (PVS) are part of the way in which District Health Boards inform the Ministry of Health about their expenditure and activity plans to meet local demand for services and government priorities for the provision of health care services. The schedules contain information at an aggregated level on the volume of services to be purchased and/or provided by the DHB, and the price of these services. The level of aggregation is fixed, such that all DHBs report at the same level.

The DHBs tend to publish the information in their PVS as part of their Annual Report. See, for example (WCDHB 2009) and (MCDHB 2009).

Care needs to be taken in using the information in the PVS for the purpose of measuring productivity change, as much of the information they contain relates only to planned or forecast activity, rather than actual output (comparison against output is carried out at a much more aggregated level). Also, the unit of measurement is casemix-adjusted. There is no reporting of raw number of procedures, so it is not possible to undo the case-mix adjustment without access to raw data.

8.2 Health care: output quality

The development of system-wide level measures of change in the quality of health care provided in New Zealand at a system-wide level is in its infancy, as is the case for most other countries. That is not to say that there is a dearth of information on the quality of individual services: it is at the level of the entire health system that information is lacking. This can be put down to two main reasons. Firstly, no overarching model exists for aggregating the various indicators of quality. Secondly, there is yet to be discussion and

agreement as to what indicators of quality should be taken into account for a system-wide level measure of health care quality.

Recommendation H10

Given the development infancy of system-level measures of change in the quality of health care provided in New Zealand, and that until there is broad discussion and agreement on how to construct such measures and combine these with the existing quantity measures, care should be taken in presenting such information.

This sub-section describes the main indicators which are already considered useful for understanding how the system-wide level of health care quality may be changing over time in the UK. Guidance on what might be considered useful has been taken from the *Atkinson review*, which has met with considerable support from other countries and from international institutions. However, this report recommends that New Zealand considers for itself how to construct system-wide measures of health care quality change.

Recommendation H11

New Zealand should draw on the guidance already available globally on how to construct system-wide measures of change in the quality of health care provided in New Zealand, when deciding exactly what specification is appropriate for New Zealand.

8.2.1 Health care quality measures in the *Atkinson Review*

The *Atkinson review* describes two dimensions of quality which are important: health care effectiveness and patient experience. As with characteristics for any set of goods and services, the relative importance of these dimensions, and of individual indicators within these dimensions, depends on the individual good or service. For example, the ratio of importance of health care effectiveness (eg survival) to patient experience (eg politeness of health care staff) is probably of the order of 1:0 in the case of patients with acute myocardial infarction (AMI or heart attack). This will not be the case for patients presenting to their local GP with routine influenza symptoms (although clearly in some cases there is a risk of mortality, in which case the ratio should not be 0:1, but may not be too far off).

The model used in the UK combines measures of change in quantity and the various aspects of quality in a fairly simple way: the model is multiplicative and assumes that the relative importance of a 1 percentage point change in all of the indicators are of equal importance. Therefore, a 1 percent increase in the quantity of a particular operation, and a 1 percent increase in the survival rate for that operation, and a 1 percent increase in the effectiveness of that operation, means that total measured output change will be 3.0301 percent ($1.01 * 1.01 * 1.01$).

An improved model would be very data intensive, requiring information on the relative importance of each of the components of total output change, as well as empirical studies about the way in which the components interact with each other. While some work to produce better models has been carried out for individual diseases, there is as yet very little work available at the level of the aggregate health care system.

Health care effectiveness: survival, health care effectiveness, and waiting times

In the UK, a model for inpatient and day care in hospitals has been adopted, which combines the effects of three indicators of quality change: survival, health care

effectiveness (for those that survive), and the health care effects stemming from changes in waiting times (changes in waiting times are considered to have both health care effects as well as patient experience effects: examples of each include the importance of waiting time for life-threatening conditions and the convenience of patients having outpatient appointments at times that suit them rather than the outpatient clinic). The specification of the model is complex and is not reproduced here. The details can be found in York's paper *Developing new approaches to measuring NHS outputs and activity* (York 2005).

The basic specification of the model is that it is multiplicative: relative changes in each of the components are multiplied together on the assumption that each component is equally important. The model is applied at the level of individual DRGs, so in theory it takes into account differential changes in quantity and the different dimensions of quality for different classes of disease (although, in practice, little empirical evidence is available).

The model also takes into account the fact that, for some types of disease, there may be a very low or very high chance of death. In such cases, the model makes no quality adjustment.

The survival indicator takes the form of survival within 30 days of discharge, which requires linkage between health and population, and vital events databases, which are held by different organisations (in both the UK and New Zealand, by the health and statistical authorities respectively).

The waiting times indicator actually measures change in waiting times at the 80th percentile, in order to strip out the effects of erroneous reporting of extremely high waiting times.

There has been discussion in the UK about refining this particular quality measure to cover only those diseases for which hospital admission can make a difference to the health status of the patient; that is, to confine the measure to avoidable or amenable mortality, but this has not yet been enacted, mainly due to difficulties in mapping the DRG and avoidable or amenable mortality classifications.

Information on survival after hospital admission is available in New Zealand: the Ministry regularly updates a linkage between hospital activity data (held in the NMDS) and population and vital events data (held by Statistics NZ). This linkage can be carried out at any level of aggregation, given the detailed information that exists in NMDS and the appearance of the NHI on both the NMDS and in the vital events register.

Avoidable and amenable mortality information is available in New Zealand, through the NZHIS.

Information on the health effects of hospital treatment is not routinely collected in New Zealand, as is the case in the UK and many other countries. There is growing interest in the UK in collecting information on this, not least for understanding health care performance at the system-wide level, but mainly because of the need to understand the efficiency and effectiveness of what hospitals are doing. There is, therefore, similar interest growing in New Zealand. It is worthwhile ensuring that in discussions of data uses, that Statistics NZ formally lodges its interest in such information.

Recommendation H12

Statistics NZ should formally register its interest in information on the effectiveness of hospital treatment, as part of an information suite that could be used in measuring health care output at the national level.

Information similar to waiting times is available, although there are issues with interpretation. The source is the national patient booking system. The information available is not on waiting per se, but on booked appointments. Further work will be needed to understand the nature of information from this system.

Management of chronic conditions in primary care

In the UK, a payment and reward system for General Practitioners exists, entitled the Quality and Outcomes Framework (QoF). A broad range of extra payments is available to incentivise good clinical practice, and in order to ensure appropriate payments are made, a great deal of information is collected. Some of the indicators used in QoF are output-related, such as the extent to which some chronic conditions are effectively managed. Increases in the proportion of patients whose conditions are effectively managed are used as quality adjustments.

Patient satisfaction

In the UK, there are a number of surveys of patients' experience, each of which is specific to the type of health care received; including, for example, hospital inpatient acute care, mental health services, and so on. Not every survey is carried out for every year (indeed some of the surveys are very occasional), and there are changes in the nature of the questions asked between similar surveys over time. Nevertheless, there is a subset of information which can be used to track changes over time in patient experience. Where this is possible, indicators are constructed that identify the percentage increase in satisfaction over time, and are used in the UK health care output model.

The Ministry collects some information on patient experience through patient surveys after receiving health care. These are described in, for example, the New Zealand *Medical journal*. See for example <http://www.nzma.org.nz/journal/122-1300/3738/>.

8.3 Health care: output quantity weights

8.3.1 Weighted Inlier Equivalent Separations (WIES)

The Ministry of Health operates a casemix funding system, at least in part, for funding its hospitals. In simple terms, casemix funding systems require historical information on activity carried out in hospitals and corresponding historical costs, in order to construct reimbursement 'prices' for current (and future) hospital activity.

Although there is much information available on activities carried out in New Zealand hospitals, until recently there has been very little or no actual New Zealand hospital costs collected: 2008/09 will be the first year for which solely New Zealand cost information will be used in the New Zealand casemix funding system. For previous years, the reimbursement prices for hospital activity in New Zealand have been based on Victorian (Australia) hospital costs.

As the Ministry of Health has adopted the overarching structure of the Victorian casemix funding system, it is important to understand the system in Victoria in order to understand the system in New Zealand.

The calculation of WIES was originally, and continues to be, a significant part of the casemix funding system in Victoria, Australia. This casemix funding system was introduced initially by the state of Victoria on 1 July 1993, as part of a fundamental change in the way in which hospital care was funded: prior to this date, hospital treatment was funded on a historical basis and subject to detailed input controls; from this date, the majority of hospital treatment was funded on a casemix basis. The Victorian casemix funding system involves the following steps (source: State Government of Victoria, Australia):

1. diagnoses for each patient are recorded and coded to a DRG
2. each DRG has a particular 'weighting' set around a value of 1. The weighting is derived through annual costing studies that compare the relative resource consumption of each DRG against all others
3. the aggregate number of DRGs in any time period, multiplied by the weighting of each, results in a number called a weighted separation (a separation is a discharged patient event)
4. the system recognises outliers when the length of stay is abnormally long, or abnormally short – according to agreed statistical parameters. Short stay outliers receive a reduced payment and long stay outliers an increased payment. These payments can be converted into the equivalent of DRG weights. This conversion collapses all DRG payments into a single number – the Weighted Inlier Equivalent Separation, or WIES.
5. WIES are then multiplied by the price (set annually for each grouping of similar hospitals) per unit of WIES (the price paid for a notional DRG with a weighting of 1) to determine the funding available within any time period.

The major modification that the Ministry of Health has made to the Victorian system is that where New Zealand actual data are available, these replace the Victorian data (for example, New Zealand actual costs have been collected for use in the 2008/09 year, thus replacing the Victorian weightings calculated in steps 1, and New Zealand specific thresholds have been introduced for identifying outliers in step 4).

The WIES from the New Zealand casemix funding system is calculated as follows:

$$\text{WIES}_{it} = \frac{\sum_j c_{ijt}^* v_{ijt}^*}{\sum_j v_{ijt}^*} \bigg/ \frac{\sum_{ij} c_{ijt}^* v_{ijt}^*}{\sum_{ij} q_{ijt}^*} \quad (v)$$

where j denotes an activity within a DRG, and the asterisk (*) denotes Victorian data.

Currently, the MoH methodology for calculating volume change over time involves comparing the sum of the WIES for each year, as follows:

$$\frac{\sum_i \text{WIES}_{it}}{\sum_i \text{WIES}_{it-1}} = \frac{\sum_i \left[\left(\frac{\sum_j c_{ijt}^* v_{ijt}^*}{\sum_j v_{ijt}^*} \right) \cdot \sum_j v_{ijt} \right]}{\sum_i \left[\left(\frac{\sum_j c_{ijt-1}^* v_{ijt-1}^*}{\sum_j v_{ijt-1}^*} \right) \cdot \sum_j v_{ijt-1} \right]}$$

(vi)

Note: The extra $\sum_j v_{ijt}$ term has been introduced to account for the differing number of activities between DRGs. Rearranging equation (vi) gives:

$$\frac{\sum_j \text{WIES}_{it}}{\sum_j \text{WIES}_{it-1}} = \frac{\sum_j v_{ijt}^*}{\sum_j v_{ijt-1}^*} \cdot \frac{\sum_j c_{ijt-1}^* v_{ijt-1}^*}{\sum_j c_{ijt}^* v_{ijt}^*} \cdot \frac{\sum_i \left[\sum_j c_{ijt}^* v_{ijt}^* \cdot \frac{\sum_j v_{ijt}}{\sum_j v_{ijt}^*} \right]}{\sum_i \left[\sum_j c_{ijt-1}^* v_{ijt-1}^* \cdot \frac{\sum_j v_{ijt-1}}{\sum_j v_{ijt-1}^*} \right]}$$

(vii)

The first term is the change in the raw number of Victorian discharges.

The second term is the inverse of change in total Victorian expenditure.

The third term is change in total Victorian expenditure, the numerator and denominator of which have been modified with the ratio of New Zealand to Victorian number of raw discharges at the level of DRGs.

If the ratio of raw discharges within DRGs remains constant, the third term is simply change in Victorian expenditure, and thus this and the second term cancel, leaving only the first term.

Where only New Zealand data are used in calculation, the second and third term cancel, again leaving only the first term.

This is a simplified model. There are several complications, but these do not perturb the basic finding that the comparison of the sum of the WIES for a pair of years leads to a comparison of the number of raw discharges:

- Costs are also calculated on the basis of outlier / inlier status and LOS. The model would cope with this extra complexity by changing the definition of j , which would denote the combination of DRG, inlier / outlier status, and LOS, thus leading to the calculation of a much larger number of WIES, one for each combination.
- The NZ DG classification is modified from the Victorian one. This would complicate the mathematical presentation immensely, and introduce an extra (set of) term(s) to deal with the differences.
- The coverage of hospital activity in Victoria for calculating the WIES is different from the coverage of hospital activity in NZ to which the WIES are applied. Again, this would complicate the mathematical presentation immensely, and introduce an extra (set of) term(s) to deal with the difference in coverage.

When multiplied by the price in NZ\$ of the average treatment in New Zealand, these weights could be used as the basis for relative weights for the growth rates in hospital inpatient and day care activity. However, there are some issues that need to be explored.

- The weights are designed for the purpose of reimbursing hospitals for Ministry funded activity. The relative costs / prices for activity funded by other sources, including from the Accident Compensation Corporation (ACC) and private sector payments, may not be the same as those implied by the WIES weights, and thus the WIES weights may be a biased measure of the relative importance of the different types of activity. Further study of the relationship between the WIES weights and total hospital costs, including all sources of funding, may confirm or reject the existence of any bias.
- As the historical weights are based on Victorian activity and costs, when applied to New Zealand activity, they do not average to 1. Simple pro-rating will resolve this issue.

Recommendation H13

Statistics NZ and the Ministry of Health should study the relationship between the WIES weights and total hospital costs, including all sources of funding, to confirm whether use of WIES weights, as the measure of relative importance of different types of hospital inpatient and day care activities, introduces any bias.

8.4 Health care: inputs

8.4.1 Household Labour Force Survey

Overview

The Household Labour Force Survey (HLFS) is a major quarterly survey run by Statistics NZ. It collects information on the labour market participation of those living in private households in New Zealand.

Coverage

The sampling frame for the HLFS is the civilian, non-institutionalised, usually-resident New Zealand population aged 15 years and over.

Timing (frequency, time reference, length of time series)

The survey is collected quarterly.

Use in a measure of productivity

The survey collects most of the information that would be needed to construct a measure of labour inputs to production for the health sector, including number of personnel, hours worked, salaries, as well as information that would help distinguish between the different types of labour input; for example, occupation.

The results of the survey may also be useful when combined with information from other sources. For example, if other sources can only furnish information on contracted hours, then the HLFS could provide information on the relationship between contracted and actual hours worked.

Known issues

Sampling error would be a potential issue, especially if a fine level of detail is required; for example, in differentiating between different types of labour. One way around this may be to combine estimates over a number of periods. However, as well as decreasing the confidence intervals for the estimates of interest, this approach would smooth any changes over time, and would therefore be less sensitive to real change.

The information on income is limited to wages and salaries, and self-employment income, and does not collect information on other parts of employment-related compensation (which would primarily be known by the employer rather than employee). Wages and salaries, though, may be a reasonable proxy for total compensation.

The HLFS does not collect any explicit information that would allow a distinction to be made between those working in the public and private sectors.

Key variables

Number of those in employment, number of those in self employment, industry, occupation, actual hours worked, education, participation in formal study.

Level of disaggregation

The source includes a number of variables which capture information on those characteristics of the medical workforce that might be used to differentiate between different kinds of labour input.

Overlaps / duplication with other sources

Much of the information collected in the HLFS on health care labour is available elsewhere.

Access to dataset

Statistics NZ collects and processes the raw data. Subject to confidentiality assurance, data are available.

Corresponding weights

The New Zealand Income Survey collects information on wages and salaries, and self employment income, as a supplement to the HLFS in the June quarter.

8.4.2 Medical Council's Workforce statistics

Overview

The Medical Council of New Zealand collects and publishes information in the *New Zealand Medical Workforce* (MCNZ 2008). The information is collected as part of the annual renewal practicing certificates under the Health Practitioners Competence Assurance Act 2003. Early renewals (and information collections) were carried out under the Medical Practitioners Act 1995.

Coverage

Renewals are annual, and are staggered over the year. Depending on the birth date of the doctor, the renewal dates are November, February, May, or August.

In 2008, the response rate was 87 percent.

Changes in the Council's registration policies has meant that the sampling frame now includes some doctors who previously held temporary registration and would have been excluded. The sampling frame does not include doctors registered for specific short-term purposes.

It is thought that the inclusion of these doctors who previously held temporary registration in the sampling frame has led to a drop in the response rate, due, for example, to the temporarily registered doctors having left New Zealand by the time the survey is posted.

The results of the survey as published present information on active doctors: the definition of 'active' is that the doctor must have worked for four or more hours a week. The definition of Full time equivalent (FTE) is 40 hours per week.

Timing (frequency, time reference, length of time series)

The information is collected annually.

Two major changes have been introduced since 1992:

- Repeat prescriptions were introduced in 1996; and
- The major drug key changed from Medicode to Pharmacode in 1998.

Use in a measure of productivity

This source of information on doctors in New Zealand would potentially be a very powerful booster alongside more general surveys of the workforce, given that the sampling frame covers all doctors in New Zealand, the survey is sent to all doctors, and that the response rate is 87 percent.

Known issues

The changeover in law to the Health Practitioners Competence Assurance Act 2003 from the Medical Practitioners Act 1995 has meant that there are changes to some of the survey elements, including the terminology used.

Key variables

Information collected in the survey is combined with information already held on the Council's databases, to avoid repeatedly asking for the same information; for example, sex, age, registration date, and country of graduation.

Information available from the survey (and associated databases) includes: region; length of service, country of registration; age; sex; work type (eg primary care or house

officer); vocational scope (eg anaesthesia, emergency, or ophthalmology); hours worked; and type of employer.

Level of disaggregation

The source includes a number of variables which capture information on those characteristics of the medical workforce that might be used to differentiate between different kinds of labour input. These include: length of service, work type, vocational scope, and type of employer.

Overlaps / duplication with other sources

Other surveys include information about doctors employed in the health care industry.

Access to dataset

The MoH has access to the dataset for analytical purposes.

Corresponding weights

Other sources include information on compensation of employment; however, they may not match the level of disaggregation offered in this source.

8.4.3 Ministry of Health's National Asset Management Plan

Overview

The Ministry, together with the health care sector, has produced two National Asset Management Plans, the first in 2006 and the latest in 2009 (the latter is still in draft form). The Plan has been designed to help the sector understand what assets it has at its disposal, as well as to help it prioritise asset planning in the future.

Coverage

Information is collected from all DHBs in New Zealand.

Timing (frequency, time reference, length of time series)

There have been two Plans produced, the first in 2006 and the latest in 2006 (still in draft at the time of writing this report).

Use in a measure of productivity

The Plan is based on a great deal of information collected from DHBs on the current status of their asset base, which could be used in conjunction with other available information as the raw data for a health care industry-focused PIM.

Known issues

The information collected relates to assets held by the DHBs, and does not cover assets held by private sector actors. It therefore covers the majority of secondary and tertiary care, but a much smaller proportion of the primary care sector.

Key variables

Type of asset, replacement cost, functionality, condition.

Level of disaggregation

The source includes variables such as type of asset, which would be the main way of disaggregating the information on assets for the PIM.

Overlaps / duplication with other sources

The information collected for the Plan may be from the same original sources as information collected by Statistics NZ. This would need to be looked into.

Access to dataset

The Ministry holds this information. Given its commitment to providing information on capital assets to Statistics NZ for the PIM, there should be no problem gaining access to other such datasets.

Corresponding weights

See above.

8.5 Health care: complementary indicators

This sub-section sets out a number of complimentary indicators that might be useful in helping to interpret health care output, inputs, and productivity indicators, as discussed in section 5.4.3. The indicators presented are those presented in the UK's *Public service productivity: health care articles* (ONS 2008), and are: average length of stay in hospital; elective day case rate; emergency readmission rates; and number of operations cancelled.

8.5.1 Average length of stay in hospital

Reducing the length of stay in hospital has been a major driver of reduced costs and increased productivity in the English NHS: more patients can be treated with the same number of hospital beds and other fixed resources. The NHS Institute for Innovation and Improvement has estimated that £975m (\$2.2bn) could be saved each year by reducing the average length of stay in hospitals to the level of the top 25 percent of hospitals (if all else remains unchanged)

Care needs to be taken in interpreting movements in the average length of stay in hospital alongside productivity performance, as there are other factors beyond productivity change that could explain changes in the average length of stay in hospital, such as a change in casemix. It is possible that additional resources are being used to reduce length of stay – for example, more clinical staff on duty at weekends – outweighing the savings being made.

8.5.2 Elective day case rate

As well as reducing the costs to the health service, increasing the day case rate plays a part in providing timely treatment, in reducing the risk of cross infection, and in reducing the number of procedures cancelled (BMJ 2005). Treatment by day case surgery is also seen to have a positive quality of life effect for the patient. This is because the procedure is likely to have a shorter waiting time; patients can return home the same day, which means an earlier return to normal activities; and patients can potentially receive care that is better suited to their needs. Treating patients as day cases instead of in-patients would be expected to reduce required inputs.

8.5.3 Emergency readmission rates

Emergency readmissions are generally unlikely to be part of the patient's originally planned treatment, and some may be avoidable (NCHOD 2005). Readmission rates are often used as a measure of the quality of care received by patients in health care systems (HSJ 2004).

There are a number of factors that could explain change in the number of emergency readmissions. For example, hospitals could be dealing with more complex cases, some patients may have more severe symptoms, or hospitals could be discharging some

patients too quickly after treatment. But in some cases, readmission may be part of a deliberate plan, agreed between clinicians and patients, to allow patients to return home earlier on the understanding that they will be readmitted immediately if needed.

Care therefore needs to be taken in interpreting changes in emergency admission as a complimentary indicator alongside a measure of productivity change.

8.5.4 Number of operations cancelled

The number of operations cancelled at the last minute for non-clinical reasons can show how efficiently a health system uses resources. From the perspective of a patient, having an operation cancelled at the last minute is far from desirable.

Again, care should be taken when interpreting changes in number of operations cancelled as a complimentary indicator alongside productivity change. Many factors could influence changes in the number of operations cancelled at the last minute, some of which are outside the control of a health system/provider. These include:

- how effectively hospitals manage their resources and appointments
- the commitment of patients in keeping to their appointments
- the need to divert resources to deal with unexpected pressures from emergency admissions.

8.5.5 Amenable mortality

Three types of mortality can be described:

- Amenable mortality – deaths occurring before age 75 from causes that are considered amenable to medical intervention.
- Preventable mortality – deaths occurring before age 75 from causes that are considered to be preventable through a) individual behaviour, and/or b) public health measures limiting individual exposure to harmful substances/conditions.
- Unavoidable mortality – deaths occurring before age 75 from causes that are considered a) not amenable to medical intervention and b) not preventable through changes in individual behaviour/public health measures.

A comparison of the trend in mortality from these three types of cause (repeated in ONS 2008) has shown a considerable decrease in mortality from causes amenable to medical intervention, whereas mortality from causes considered to be unavoidable decreased only modestly. One interpretation of this is that medical interventions have contributed positively to the reduction in avoidable mortality.

However, there are uncertainties about the attribution of the role played by the health service in reducing amenable mortality, with further study of the attribution needed.

9 Data availability: education

This section sets out the data sources that exist on education in New Zealand, and discusses the pros and cons of each of the sources from the perspective of productivity measurement.

9.1 Education: output quantity

As stated previously, the internationally recommended method of measuring output quantity in education is through direct volume measurement. The internationally-recommended output measures for each level of education are summarised in section 7.2.1.

Table 34 Summary of available data sources for education output

Data source	Details	Issues & limitations
ECE time series of interest already published by MOE	Number of Enrolments by Service Type from 1990 Average Weekly Enrolled Hours for Children at Licensed Services from 1996 Children FTEs at Licensed ECE Services from 1996	
ECE RS61	funded and non-funded enrolment headcounts; detailed information about the qualifications of and hours worked by various types of staff; Breakdown by qualification and type of service data from 2001	From 2000
ECE RS7	Daily funded child-hours per service type, with no headcount.	From 2000, funded hours only
ECE RS71	Operational Costs and Fees at teacher-led Centre-based ECE services; breakdown into teacher salaries, mixed duty staff salaries, admin staff salaries, staff overheads, professional development, admin resources, educational resources, Professional services, Utilities, Other operating costs, Rent for leased property, Property rates, Depreciation, Repairs and maintenance, Interest paid, Other; Costs per hour for individual child by age, broken down into fees outside of 20 Hours free ECE, optional charges, and parent donations;	Intermittent from 2005; teacher-led only

	Total hours of enrolment	
Schools March school roll return	Enrolled headcounts by year of schooling, type of school, type of student and nature of attendance (full-time and part-time); private school teaching staff (FTTEs, or Full time equivalents)	Data available from 2000, with uniform reporting rules introduced in 2005. March counts are higher than July for secondary schools because of attrition
Schools July school roll return	Number by age, year of schooling, type of school, type of student, and nature of attendance (full-time and part-time); Subjects taken by secondary students by learning zone	Data available from 2000, with uniform reporting rules introduced in 2005. July counts are higher than March for primary schools because of additional enrolment
Tertiary Single Data Return	Enrolments, FTSEs and completions	Covers all tertiary providers that receive government subsidy, including many private providers, from 1994.
Tertiary Student Enrolments and Completions (TSEC)	Annual data on enrolments and completions in qualifications derived from SDR; tracks individuals using National student number from 2003.	Available from 1994
Other Ed Performance Management System (PMS)	Industry training completion by programme, certificates, and credits	covers all formally-assessed courses of more than a week's equivalent full-time duration, except those in private training establishments that receive no funding assistance from government. From 2001
Other Ed 'Basil'	Targeted training programmes formerly administered by Skill NZ, and now by TEC, completion data with credits and 2-month outcomes	From 2001

9.1.1 ECE output quantity data sources

The following published ECE time-series of interest are available from the Ministry of Education:

- Number of Early Childhood Enrolments by Type of Service, 1990-2008
- Enrolments by Age at 1 July (not broken down by service type), 1990-2008
- Average Weekly Enrolled Hours for Children at Licensed Services (excluding the Correspondence School), 1996-2008
- Full-time equivalent children at Licensed ECE Services (excluding Correspondence School), 1996-2008 [calculated by multiplying the number of students by enrolled hours during the census week, assuming FT= 30 hours/week]
- Full-time Teacher Equivalent [calculated using total hours/25] by provider type
- Number of usual teaching staff in licensed early childhood education services by highest qualification and type of service.

The return of statistics is a statutory requirement of all early childhood services under Section 144A of the Education Act 1989. The Ministry of Education currently has three data collections for ECE. The collection instruments are available online at: http://www.educationcounts.govt.nz/technical_info/collection_forms. Guidelines for completing the forms, tailored for each type of responding service, are available to assist in interpreting data.

Collection RS61 (Annual return of children and staff)

Overview

This one-week snapshot taken every June, includes an enrolment headcount, and both funded and non-funded hours (under 2, 20 hours free ECE for 3–4 year olds, free subsidy for extra 10 hours, and residual non-free hours), as well as detailed information about the qualifications of and hours worked by various types of staff. It is not used for funding purposes and seems to have no in-built motivation for 'gaming' that might bias the responses.

Coverage

All licensed ECE providers.

Timing (frequency, time reference, length of time series)

Annual data are available from 1997, but are not considered reliable by Ministry staff prior to 2000.

Use in a measure of productivity

This is the primary data source for ECE in New Zealand. It supplies student headcounts, FTSEs, and staff FTEs by type.

Known issues

Breakdown by qualification and type of service data was only collected from 2001, so prior years would have to be interpolated. This collection has a 100 percent response rate for most years, and 99.8 percent (unweighted) in 2007 and 2008.

Key variables

The following variables (in bold), along with short descriptions, are those which should be considered useful when analysing ECE information for measuring change in output.

Type of service This is required to differentiate the five types of licensed ECE provider, which provide substantively different services.

Number of children on the regular roll for each day of snapshot week, number of regular roll attending, and number of casual students The snapshot provides an annual point-in-time estimate of student enrolments and actual educational services delivered, which can be rated up to approximate annual educational output. These are headcounts only and do not provide FTSEs.

Number of children by age and Free ECE participation by age The costs and services associated with providing education to different age groups are such that differentiating into under-2, 2, and 3–5 year old children may be desired. Number of children covers the industry scope, whereas Free ECE hours covers the government-funded scope.

Number of children receiving 20 hours free ECE, by duration of weekly enrolment and age (3-5) These student numbers by age can be used to satisfy the 'government-funded' definition of scope and give a rough approximation of FTSEs. Weekly hours of enrolment are provided in narrow ranges rather than continuous values (eg 'more than 6 and up to 9'), so some assumptions would be required for estimating FTSEs.

Number by age and weekly hours enrolled. These student numbers by age and hours enrolled give a rough approximation of FTSEs (including 20 hours free ECE). Weekly hours of enrolment are provided in narrow ranges rather than continuous values (eg 'more than 6 and up to 9'), so some assumptions would be required for estimating FTSEs. Netting out the 20 hours free ECE would yield approximate FTSEs not funded by government.

Count of paid support staff, with normal hours worked for PT (<25) These data can be used to calculate support staff labour input in the form of FTEs.

Count of specialist staff (eg psychologist), with normal hours worked for PT (<25) These data can be used to calculate specialist staff labour input in the form of FTEs.

Count of teaching staff by highest ECE qualification held, with normal hours worked for PT (<25) These data can be used to calculate teaching staff labour input in the form of FTEs.

Level of Disaggregation for a measure of output quantity change

Variables which capture information on the characteristics of service that might be considered quality-defining: service type, age, and 20 Hours free ECE.

Access to dataset

The MOE holds this dataset.

Corresponding weights

Costs by age and ECE service type are reported in Collection RS71 (see ECE input data availability).

Collection RS7

Overview

RS7 collects daily funded child hours (FCHs) per ECE service type, for funding purposes. These data are collected for internal use and are not published.

Coverage

All ECE services receiving government funding.

Timing (frequency, time reference, length of time series)

Collected every four months. Annual data are available from 1997, but are not considered reliable by Ministry staff prior to 2000.

Use in a measure of productivity

Funded child hours provide the actual hours of educational service delivered (as opposed to enrolled), by age and service type. This is useful for satisfying the 'government-funded' definition of scope or for an attendance-adjusted definition of output.

Known issues

Includes only hours, not headcount.

Key variables

ECE service type This is required to differentiate the five types of licensed ECE provider, which provide substantively different services.

Daily funded child hours (FCHs) Actual hours of government-funded educational service delivered (as opposed to enrolled).

Level of disaggregation for a measure of output quantity change

Variables which capture information on the characteristics of service that might be considered quality-defining: service type, age.

Access to dataset

The MOE holds this dataset.

Corresponding weights

Costs by age and ECE service type are reported in Collection RS71 (see ECE input data availability).

9.1.2 School output quantity data sources

The Ministry of Education carries out statistical collections (roll returns) from all schools in New Zealand at 1 March and 1 July each year, in line with the statutory requirements as detailed in the Education Act 1989.

The Ministry uses the data provided through these collection exercises in a number of ways: to fund and staff schools; to support policy analysis, development and decision making; to monitor the outcomes of the New Zealand education system; and for national and international reporting purposes. The March data are mainly used for schools' resourcing purposes, while the July data are used more for trend analysis as detailed information on age and ethnicity are collected at this time.

March roll return

Overview

The March school roll return data are mainly used for schools' resourcing purposes. However, school leaver attainment data, which is used in a number of analytical

publications, are collected as part of the March return. It includes information on the number of schools, school rolls, numbers of foreign fee-paying students, and numbers of students involved in Māori medium education. The March roll return primarily collects information on full-time student equivalents (FTSE), including regular and foreign fee-paying students, and those in alternative education. These data are aggregated and published on the Ministry of Education website.

Coverage

All schools in New Zealand.

Timing (frequency, time reference, length of time series)

Collected annually at 1 March, available from 2000.

Use in a measure of productivity

The roll returns provide student volumes broken down by school authority and type, making up the best available direct volume measure of educational services.

Known issues

Discussions with the Ministry of Education reveal that, as a rule, March counts are higher than July for secondary schools because of attrition, and that July is higher for primary schools. Data are reliable from about 2000, but each school reported slightly differently until the problem was addressed by new reporting rules in 2005 to make them more uniform.

Key variables

Authority State, state integrated, private.

School type Full primary (year 1–8), Contributing School (Year 1–6), Intermediate School (Year 7–8), Kura Kaupapa Māori (Primary), Kura Teina (Primary), Composite School (Year 1–15), Restricted Composite School (Year 7–10) (also known as Middle School), Kura Kaupapa Māori (Composite), Kura Teina (Composite), Correspondence School, Secondary School (Year 7–15), Secondary School (Year 9–15), Secondary School (Year 11–15), Special School.

Enrolment total student count

School leavers Count and highest attainment level.

Māori medium education (bilingual or immersion) or teach Te Reo or Taha Māori, by Māori and total, by level and number of hours 25>20>12.5>7.5>3.

Private schools teacher FTEs Reported as count of full-time and part-time teaching staff, with snapshot of hours worked by part-time.

Special School FTSE By year 1–15, by type: regular and adult, alternative education, NZAID-funded, and international fee-paying students.

Non-NQF qualifications (eg Cambridge, international baccalaureate), with case-by-case follow-up on leavers.

Alternative education FTSE By student type (regular, adult, and returning).

Foreign fee-paying and exchange students count

Level of Disaggregation for a measure of output quantity change

Variables which capture information on the characteristics of service that might be considered quality-defining: authority, school type, teen parent unit, foreign fee-paying student.

Access to dataset

The MOE holds this dataset.

Corresponding weights

Costs by school type.

July Roll Return

Overview

The July school roll return data are mainly used for trend analysis. It includes information on the school rolls by headcount, numbers of foreign fee-paying students, secondary school subject enrolment, and prior ECE experience of students. These data are aggregated and published on the Ministry of Education website.

Coverage

All schools in New Zealand.

Timing (frequency, time reference, length of time series)

Collected annually at 1 July, available from 2000.

Use in a measure of productivity

The roll returns provide student volumes broken down by school authority and type, making up the best available direct volume measure of educational services. The March roll return is FTSE-based and therefore preferable to the July return for calculating volumes.

Known issues

Discussions with the Ministry of Education reveal that, as a rule, March counts are higher than July for secondary schools because of attrition, and July is higher for primary schools. Data are reliable from about 2000, but each school reported slightly differently until the problem was addressed by new reporting rules in 2005 to make them more uniform. July roll return is headcounts rather than FTSE.

Key variables

Authority

School type

International students International Exchange (EX), NZAID-funded (FE), and International Fee-paying students (FF), with FTE, tuition weeks and tuition paid.

Counts of domestic students are available by primary/secondary or by age within the spreadsheet for excluding non-domestic students. The collection on International Students shows counts by school types from 2004, on a 5-yearly basis from 1976, and more on aggregated data annually from 1991.

Level of Disaggregation for a measure of output quantity change

Variables which capture information on the characteristics of service that might be considered quality-defining: authority, school type, teen parent unit, foreign fee-paying student.

Access to dataset

The MOE holds this dataset.

Corresponding weights

Costs by school type.

9.1.3 Tertiary output quantity data sources

Overview

The **Single Data Return (SDR)** is a data collection used for the purposes of funding students at tertiary education providers, and for statistical reporting requirements under Sections 159 AE and ZK of the Education Act (1989). Information is collected about student characteristics, course enrolment details, course and qualification completions, course details, and student numbers (FTSE).

Coverage

The SDR is required to be completed by all providers that receive the FTSE-based tuition subsidy or have students with Student Loans or Allowances. This means that it does not include all PTEs, but does include those who receive government funding from 2000 forward.

Timing (frequency, time reference, length of time series)

Data are supplied by tertiary education providers three times a year (at 30 April, 31 August, and 31 December).

Use in a measure of productivity

The single data return provides student volumes broken down by provider and type, making up the best available direct volume measure of educational services.

Known issues

None.

Key variables

Subsector

Level of study

FTSE

Level of disaggregation for a measure of output quantity change

Variables which capture information on the characteristics of service that might be considered quality-defining: subsector, level of study, student type (domestic/international), broad field of study.

Access to dataset

The MOE holds this dataset. A 105-page manual is available to assist in interpreting the data. The SDR, along with payments data, is collated into pre-aggregated data cubes that can be queried and viewed using a web browser.

Corresponding weights

Costs by subsector or by subsector, level and field of study where available.

Tertiary Student Enrolment and Completions (TSEC)

Overview

An annual series of data sets on tertiary education enrolments and completions in qualifications, held at an individual student level. The series is available back to 1994 and is used to produce the majority of tertiary education statistics on participation and completion published on Education Counts. This data set is maintained by the Tertiary Sector Performance Analysis and Reporting section, in the Ministry of Education.

The data sets are derived from SDR collections of tertiary enrolments and completions. The TSEC data extends the SDR data sets by including a derived unique student number. This student number is derived through a complex series of algorithms that match qualification enrolments and completion across providers and across time. This identifier provides a link from pre-2003 data to the national student number (NSN) introduced in 2003. Together, these can be used to create an extended longitudinal data series for generating, for example, rates of qualification retention, completion, and progression.

Coverage

Completion data are collected for all formally-assessed courses of more than a week's equivalent full-time duration, except those relating to training opportunities, youth training, skill enhancement, industry training, and students in formal qualifications in private training establishments that receive no funding assistance from government. This covers about 80 percent of all course enrolments.

Industry training completion is available by programme, certificates, and credits. Targeted training data has credits and 2-month outcomes.

Timing (frequency, time reference, length of time series)

Qualification enrolments and completion data are available back to 1994; individual course/paper completion with associated credit weight and pass rating is available from 2001. EFTS and course enrolments and completions are available by provider and area of study from 2000.

Use in a measure of productivity

Credit weighted course completion most closely fits the recommended output quantity measure for tertiary education services.

Known issues

Degree completion as an output quantity measure has a number of difficulties, including timing the production of educational services, and dealing with double diplomas from a single curriculum. Course completion sidesteps these issues.

Key variables

Subsector

Level of study

Course completion

Course credit weight

Broad field of study

Student type (international or domestic)*Level of disaggregation for a measure of output quantity change*

Variables which capture information on the characteristics of service that might be considered quality-defining: subsector, level of study, student type (domestic/international), broad field of study.

Access to dataset

The MOE holds this dataset.

Corresponding weights

Cost per credit by subsector, level, and broad field of study.

9.1.4 Other education output quantity data sources

Because of its nature as a residual category, other education is the sub-sector with the weakest data. The exception to this seems to be industry training, which is heavily monitored.

The Single Data Return and Tertiary Enrolments and Completions series are considered the primary sources of other education delivered at tertiary institutions. It is supplemented by two others that cover non-provider-based education. Industry training information is sourced from the Performance Management System (PMS), available from 2001 or 2002. Targeted training programmes formerly administered by Skill NZ, and now by TEC are reported in 'Basil'.

Industry training completion is available by programme, certificates, and credits. Targeted training completion data has credits and 2-month outcomes.

Table 35 EFTS in STAR courses by sub-sector 2003-2007

Sub-sectors	2003	2004	2005	2006	2007
Universities	129	85	63	100	118
Institutes of technology and polytechnics	886	1,029	1,152	1,320	1,297
Other tertiary education providers	29	62	44	38	45
Private training establishments	162	176	199	265	341
Total	1,206	1,352	1,459	1,725	1,801

Notes: Data relates to students enrolled at any time during the year with a tertiary education provider. EFTS counts the amount of study undertaken in terms of an equivalent full-time student. Totals also include those students with unknown values.

Source: MOE

Table 36 Trainees in industry training (1995 to 2007)

Year	Trainees at 31 December (prior to 2000 figures at 30 June)	Total trainees during year	Modern Apprenticeship trainees at 31 December
1995	18,344	...	...
1996	23,957	...	...
1997	31,652	...	...
1998	45,392	...	...
1999	49,577	...	...
2000	62,857	81,343	800
2001	66,222	95,283	2,049
2002	83,456	106,997	4,344
2003	89,969	126,870	6,259
2004	102,232	139,596	7,269
2005	118,357	162,938	8,390
2006	123,673	176,064	9,466
2007	130,163	185,676	10,850

Notes: Because of changes to reporting systems figures prior to 2000 may not be exactly comparable with later years. Trainee totals also include Modern Apprenticeship numbers.

Symbol: ... not applicable

Source: TEC

9.2 Education: output quality

This section sets out the data sources that exist on education and accompanying analyses in New Zealand, and discusses the pros and cons of each of the sources from the perspective of output quality measurement. As discussed in section 7.2.1, most quality adjustment in education is made implicitly through disaggregation, so that like is compared with like across time and space. This can be supplemented with explicit quality adjustment using completions, exam scores, and attendance rates. Alternatively, indirect outcomes such as financial returns to tertiary education can be used to estimate quality change.

Cautionary note

Grades, exam scores, credits, and other indicators of student performance can be used to proxy change in the quality of education output, only *if the assumption is made that student effort is in constant proportion to teaching services of a constant quality.*

Table 37 Summary of available data sources for education quality

Data source	Details	Issues and limitations
ECE RS61	Detailed information about the qualifications of and hours worked by various types of staff; breakdown by	From 2000

	qualification and type of service data from 2001	
Schools Attendance and Absence surveys	Overall absences and truancy, broken down year level, school type, and other variables for state and integrated schools	Biannual from 1998, except 2000. Covers only state and integrated schools
Schools Achievement Test scores	PISA	3-yearly from 2000 covering sample of 15 year olds
Schools Achievement Test scores	PIRLS	5-yearly from 2001 covering sample of year 5 students
Schools Achievement Test scores	TIMMS	4-yearly from 1994 at years 5 and 9
Schools NCEA qualifications	Highest qualification achieved by school leavers	Phased in from 2002, inconsistent with previous qualifications.
Schools NEMP quality assessments	Annual surveys of the achievement of years 4 and 8	Highly qualitative, not consistent over time
Schools ERO Assessments	Evaluates all schools approximately every 3 years	Highly qualitative, not consistent over time

9.2.1 Attendance and absence surveys

The UK has defined their measure of school output in terms of attendance, as they believe this is a better measure of pupils who are actually being taught in schools. Reliable attendance figures by level are required to pursue this method.

Attendance and absence surveys were carried out in 1996, 1998, 2002, 2004, 2006, and 2009, in which state and state integrated schools were asked to record absences for a selected week. These were classified as justified, unjustified, and intermittent unjustified absences (ie skipping classes). These are presented in terms of overall absences and truancy, broken down by year level, school type, and other variables.

Table 38 Comparison of absence and truancy rates for 1998, 2002, 2004 and 2006

	Absence rate	Absence rate	Absence rate	Absence rate	Truancy rate	Truancy rate	Truancy rate	Truancy rate
School type	Percent							
	1998	2002	2004	2006	1998	2002	2004	2006
Primary	6.9	7.2	8.9	8.9	1.4	1.4	1.8	1.9
Intermediate	6.3	7.2	8.9	8.4	1.4	1.8	2	2.2
Composite	9	8.8	11.6	12.7	2.5	2.4	3.3	3.5
Secondary	11.6	11.9	15.2	16.3	5.6	6	6.9	8.3

Source: Lisa Ng, Research Division, *Attendance, absence and truancy in New Zealand Schools in 2006*, Ministry of Education (June 2007)

While this is not a guaranteed data source, there is no plan to discontinue it, as the data from it is used to inform the Student Engagement Initiative (SEI). Response rates are over 80 percent. There was a change in survey methodology in 2002. Prior to 2002, surveys gathered school level summary data and took an arithmetic mean, whereby each school's rates were calculated, and then the overall mean was calculated. From 2002, surveys used the number of students on the roll and the individual student's participation in the survey as a denominator, providing a more accurate representation of student absence.

The SEI is intended to reduce stand-downs, suspensions, exclusions, and expulsions. Stand-downs are the formal removal of a student from school for a specified period – no more than five school days in a term or 10 school days in a year. Suspension is the formal removal of a student from school until the board of trustees decides the outcome at a suspension meeting. Exclusion and expulsion are the formal removal of a student from the school (the terms distinguish under and over age 16).

In 2006, the Ministry introduced ENROL. It is a web based central electronic student enrolment register for all school students, which is updated by schools when students enrol, change schools, or leave the school system. It also includes fees paid by international students. The collection of this enrolment information is authorised by section 77A of the Education Act 1989. This will be a useful ongoing information source, but is not useful for past data.

Unlike ENROL, which identifies which school a student 'belongs to', schools also record daily school attendance. The Attendance Regulations (1951) require schools to maintain attendance records, and the Education Act (1989) requires schools to ensure the attendance of the students on their rolls. Schools are progressively moving from paper-based to electronic attendance registers. This may be a useful ongoing information source; for instance, it is being used as part of the Ministry's *National Attendance Survey*.

Other possible sources of attendance information include District Truancy Services (DTS) and Non-enrolment Truancy Service (NETS), but these services respond to information gathered by schools, rather than having an independent collection. Information from schools is preferable.

9.2.2 International student achievement tests

There are several international student achievement tests that are used for cross-national comparisons of education. The advantage of international tests is that they are internationally benchmarked and quality-tested, leading to reduced chances of drift over time. The disadvantage is that they are only offered to a sample of students every few years.

There are several possible ways to look at results from these tests:

Mean and distribution of student performance: That is, the average score, as well as the range of lowest and highest scores achieved by students.

Proficiency levels: Some tests have established a range of levels associated with the scores which explain what a student can typically be expected to achieve at each level.

Range of rank: Countries are ranked (within a range) according to the level of student performance. Movement in this range represents an improvement in New Zealand student performance relative to other countries. The Ministry of Education uses PISA results as a source of information to measure progress towards the government education sector's goals of building an education system that equips all New Zealanders with twenty-first century skills.

Variation in student performance: It is possible to look at how student performance varies within a school and between schools. This is expressed as a percentage of the average variance of student performance in OECD countries, eg the OECD average of total variance in student performance of the PISA 2006 science scale is 8,971. If the variation in performance for a given country is stated as 90 percent, this means it is 90 percent of 8,971.

The **Programme for International Student Assessment (PISA)** is a three-yearly survey of 15-year-olds in over 40 countries, assessing three key areas of knowledge and skills: reading literacy, mathematical literacy, and scientific literacy.

PISA assesses how well students approaching the end of their compulsory education are prepared for life beyond the classroom, by focusing on the application of knowledge and skills to problems with a real-life context. The aim of PISA is to provide information on the following questions:

- How well are young adults prepared to meet the challenges of the future?
- Are they able to analyse, reason, and communicate their ideas effectively?
- Do they have the capacity to continue learning throughout life?
- Are some kinds of teaching and school organisation more effective than others?

PISA is an international collaboration that provides information for policymakers and researchers throughout the world.

Although each area of knowledge and skill is assessed on each occasion, the focus of the study changes. In 2000, the focus was on reading literacy, in 2003 it was on mathematical literacy, in 2006 it was on scientific literacy, and in 2009 the focus returned to reading literacy.

Achievement scales with an OECD mean score of 500 and standard deviation of 100 were established for reading literacy in PISA 2000, mathematical literacy in PISA 2003, and scientific literacy in PISA 2006 as the benchmark against which performance has since been measured²⁰. PISA defines proficiency levels anchored at certain score points on the achievement scales to describe types of tasks that students at a certain level would typically be able to perform. Means and distributions of the scores are also reported.

Table 39 New Zealand PISA participation

Year	Students	Schools
2000	3,667	153
2003	4,500	173
2006	5,000	170
2009	4,600 ²¹	~ 175

Progress in International Reading Literacy Study (PIRLS) is a five-yearly comparative study of reading achievement, and is part of a regular cycle of international student assessments co-ordinated by the International Association for the Evaluation of Educational Achievement (IEA). The first survey was carried out in countries including New Zealand in 2001, and the second in 2005. The average reading literacy score for New Zealand in statistical terms did not change from 2001 to 2005. The third cycle of PIRLS is scheduled to be administered in New Zealand and other Southern Hemisphere countries in late-2010, and in Northern Hemisphere countries in early 2011. Although the international data will not be available until the end of 2012, some preliminary (national) data will become available during the first half of 2012.

PIRLS aims to provide teachers, principals, policymakers, and the public with information about the reading literacy skills and abilities of middle primary school students. PIRLS studies two main reasons why students read: reading for literacy experience, and reading to acquire and use information. PIRLS is designed to be able to discriminate between those students who demonstrate very well developed comprehension skills for their age and those who have weak comprehension skills. The skills and strategies are tested through texts and stories, which may or may not be familiar in style, format, and length; PIRLS is not a test of reading per se.

PIRLS scores are reported with mean and 5th, 25th, 75th, and 95th percentiles. They are also reported broken down by the reading type (informative or literary) or process (retrieval and straightforward inferencing versus interpreting, integrating, and evaluating). As with the PISA exam, four points on the reading achievement scale were identified for use as international benchmarks. Approximately one-quarter of New Zealand Year-5 students (24 percent) fell into the lower-achieving category in 2005. These students did

²⁰ Interim measures for mathematical literacy (PISA 2000) and scientific literacy (PISA 2000 and PISA 2003) were available.

²¹ Preliminary figures.

not reach the PIRLS Intermediate International Benchmark (ie scored below 475). Some of this group also did not reach the Low International Benchmark; 8 percent of Year-5 students scored below 400 overall; while 16 percent scored at least 400 but less than 475.

Trends in International Mathematics and Science Study (TIMSS) is an educational research project on student achievement in mathematics and science around the world. It is designed to measure and interpret differences in national educational systems, in order to help improve the teaching and learning of mathematics and science worldwide. In 1994, TIMSS began the first study in a regular cycle of studies at four-year intervals. TIMSS assesses achievement in mathematics and science at middle primary (Year 5) and lower secondary (Year 9) levels, and collects background information on student, classroom, and school contexts through questionnaires.

As well as providing countries with a snapshot of achievement at each cycle, participation at four-yearly intervals has allowed countries, including New Zealand, to measure trends in achievement by comparing performance across the cycles. New Zealand is currently analysing and publishing information from the fourth cycle of TIMSS, and beginning work for participation in TIMSS 2010/11. Approximately 60 countries around the world participated in TIMSS 2006/07.

Like PIRLS, TIMSS is conducted under the auspices of the International Association for the Evaluation of Educational Achievement (IEA) and implemented in New Zealand by the Ministry of Education's Comparative Education Research Unit. The TIMSS assessments are organised around two dimensions: a content dimension specifying the domains or subject matter to be assessed within mathematics and science; and a cognitive dimension specifying the domains or thinking processes to be assessed. The content dimensions for mathematics are: number; geometric shapes and measures; and data display. The content dimensions for science are: life science; physical science; and earth science. For both subjects, the cognitive domains are: knowing, applying, and reasoning.

9.2.3 Attainment of School Qualification

The success of an education system is manifested in, among other things, the success of individuals in finding sustainable employment. A formal school qualification is a measure of the extent to which young adults have completed a basic prerequisite for higher education and training, or many entry-level jobs.

The Ministry of Education already calculates a number of 'indicators' related to the qualification of school leavers that may be appropriate for use in estimates of productivity.

Indicator: Percentage of school leavers with little formal attainment

Numerator: (Data source: Ministry of Education, March School Roll Returns)

- Prior to 2001: the number of students who leave school without any credits towards a qualification in the National Qualifications Framework, plus the number of students that leave school with between 1–11 credits in a National Certificate.

- 2002-2004: the number of students who leave school without any credits towards a qualification in the National Qualifications Framework, plus the number of students who leave school with between 1–13 credits at NCEA Level 1 and other NQF qualifications.
- 2005-2007: the number of students who leave school without any credits towards a qualification in the National Qualifications Framework, plus the number of students who leave school with between 1–13 credits at any NCEA Level and other NQF qualifications.

Denominator: (Data source: Ministry of Education: March School Roll Returns)

The total number of school leavers in a given school year.

Indicator: Percentage of school leavers with NCEA Level 1 or above

Numerator: (Data source: Ministry of Education: March School Roll Returns)

The total number of school leavers who attained one of the following as at the time they left school in a given school year:

- NCEA Level 1 or other Level 1 NQF qualification or School Certificate; or
- 30–59 credits at Level 2 or above for NCEA or other National Certificate at Level 2 or Sixth Form Certificate; or
- Cambridge International Exams, International Baccalaureate, Accelerated Christian Education, or other Overseas Awards at Year 12; or
- NCEA Level 2 or other Level 2 NQF qualification; or
- 30–59 credits at Level 3 or above for NCEA or other National Certificate at Level 3, without University Entrance requirements; or
- 42–59 credits level 3 or above for NCEA or other National Certificate at Level 3, with University Entrance requirements; or
- Cambridge International Exams, International Baccalaureate, Accelerated Christian Education, or other Overseas Awards at Year 13; or
- University Entrance; or
- NCEA Level 3 or other Level 3 NQF Qualification; or
- University Bursary (A or B); or
- NZ Scholarship or National Certificate Level 4,

Denominator: (Data source: Ministry of Education: March School Roll Returns)

The total number of school leavers in a given school year.

Indicator: Percentage of school leavers with NCEA Level 2 or above

Numerator: (Data source: Ministry of Education: March School Roll Returns)

The total number of school leavers who attained:

- NCEA Level 2 or other Level 2 NQF qualification; or

- 30–59 credits at Level 3 or above for NCEA or other National Certificate at Level 3, without University Entrance requirements; or
- 42–59 credits level 3 or above for NCEA or other National Certificate at Level 3, with University Entrance requirements; or
- Accelerated Christian Education (ACE) or overseas award (including International Baccalaureate) at Year 13; or
- University Entrance; or
- National Certificate Level 3; or
- University Bursary (A or B); or
- NZ Scholarship or National Certificate Level 4,

as at the time they left school in a given school year.

Denominator: (Data source: Ministry of Education: March School Roll Returns)

The total number of school leavers in a given school year.

Indicator: School leavers with a university entrance standard

Numerator: (Data Source: Ministry of Education: March Roll Returns)

The total number of school leavers who attained:

- 42–59 credits level 3 or above for NCEA or other National Certificate at Level 3 with University Entrance requirements; or
- Accelerated Christian Education (ACE) or overseas award (including International Baccalaureate) at Year 13; or
- University Entrance; or
- National Certificate Level 3; or
- University Bursary (A or B); or
- NZ Scholarship or National Certificate Level 4,

as at the time they left school in a given school year.

Denominator: (Data Source: Ministry of Education: March Roll Returns)

The total number of school leavers in a given school year.

Known interpretation issues with the NCEA qualification indicators

NCEA is part of the National Qualifications Framework and has replaced School Certificate, Sixth Form Certificate, and University Entrance/University Bursary qualifications. In 2002, all schools implemented NCEA Level 1, replacing School Certificate. In 2003, NCEA Level 2 was rolled-out; however, schools were still able to offer a transitional Sixth Form Certificate Programme. From 2004, Level 3 NCEA replaced Higher School Certificate and University Entrance/University Bursaries. In 2004, a new Level 4 qualification, New Zealand Scholarship was also offered. See section 7.2.4 for a more complete discussion of various school qualifications used.

Due to methodological changes in the allocation of attainment levels in 2003 and 2004, for leavers achieving a qualification between little or no formal attainment and UE

standard, the percentages of leavers with at least NCEA Level 1 in both 2003 and 2004 are not comparable with other years, and have been omitted.

Data are available to recalculate the rates separately for public, private, and integrated schools.

The Ministry also offers highest attainment by school leavers in a more continuous form, with half-steps between NCEA levels. Whatever approach is taken, there will be a break in the series with the introduction of NCEA.

Table 40 Highest Attainment of School Leavers 2002 to 2004

Level Of Attainment	University Bursary ⁽¹⁾		Entrance Qualification ⁽²⁾		Higher School Certificate ⁽³⁾		NCEA Level 2 / 6th Form Cert. ⁽⁴⁾⁽⁵⁾	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
2002	10,018	19.1	4,144	7.9	6,147	11.7	12,941	24.8
2003	10,523	19.7	4,845	9.1	7,292	13.6	13,235	24.8

Level Of Attainment	NCEA Level 1 ⁽⁶⁾		14+ credits at NCEA Level 1 ⁽⁴⁾⁽⁷⁾		No Qualifications ⁽⁸⁾		Total
	Number	Percent	Number	Percent	Number	Percent	Number
2002	1,964	3.7	7,747	14.7	9,585	18.2	52,546
2003	4,398	8.2	4,983	9.3	8,195	15.3	53,471

Level Of Attainment	NCEA Level 3 or higher ⁽⁹⁾		30+ Credits at NCEA Level 3		NCEA Level 2 ⁽¹⁰⁾		30+ Credits at NCEA Level 2 ⁽¹¹⁾	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
2004	17,850	32.1	4,523	8.1	11,566	20.8	4,357	7.8

Level Of Attainment	NCEA Level 1 ⁽¹²⁾		14+ credits at NCEA Level 1 ⁽⁴⁾⁽⁷⁾		No Qualifications ⁽⁸⁾		Total
	Number	Percent	Number	Percent	Number	Percent	Number
2004	5,799	10.4	4,445	8.0	7,094	12.8	55,634

Source: MOE

(1) Includes Scholarship, A or B Bursary, NQF Level 3, and NQF Level 4.

(2) Includes at least 42 credits at NQF Level 3, Accelerated Christian Education Certificate (ACE), and overseas awards at Year 13 level.

(3) Includes 14 to 41 credits at NQF Level 3 or above.

(4) Figures include students gaining one or more subjects in School Certificate or Sixth Form Certificate, irrespective of the grade awarded.

(5) Includes Sixth Form Certificate, at least 14 credits at NQF Level 2, NQF Level 2, ACE or overseas awards at Year 12 level, and 1–13 credits at Level 3 or above.

(6) Includes other NQF at Level 1, and 1 to 13 credits at Level 2 or above.

(7) Includes School Certificate in one or more subjects, and ACE or overseas awards at Year 11 level.

(8) Includes fewer than 14 credits at Level 1.

(9) Includes NZ scholarship, NQF at Level 4, University Bursary, NQF Level 3, NCEA Level 3, University Entrance, International Baccalaureate Diploma, Accelerated Christian Education Certificate Year 13 and other overseas awards at year 13 level.

(10) Includes NCEA Level 2 and Other NQF Level 2 Qualifications.

(11) Includes 30+ credits at Level 2 or above, Accelerated Christian Education Certificate Year 12 and other overseas awards at Year Level 12.

(12) Includes NCEA Level 1 and Other Level 1 NQF Qualification.

Recommendation E20

Student attainment data are available for estimating output quality, but poses challenges in continuity (qualifications) and periodicity (achievement tests). Stakeholder engagement is recommended for any decisions on the suitability of adjusting for attainment, and the correct distribution of point-in-time achievement over a pupil's schooling career.

Recommendation E21

If used, qualification achievements must not be treated as a continuous measure in which each level of attainment has equal value that can be summed together. Care must also be taken around the discontinuity in the qualifications series, marked by the introduction of NCEA in 2002.

9.2.4 Student and school quality assessments

National working parties or committees of enquiry between 1962 and 1990 highlighted a need for dependable and consistent information about the educational achievements, attitudes, and motivation of New Zealand students. To this end, national monitoring began in general education settings in 1995, and in Māori -medium settings in 1999. Other countries have used national monitoring for up to 30 years.

Since 1995, the **National Education Monitoring Project (NEMP)** has been conducting annual surveys of the achievement of Year-4 and Year-8 students in the New Zealand education system. A light sampling approach is used, involving about three percent of the students (1,440 students) at each year level. Tasks are administered using a variety of approaches, such as one-to-one interviews with a teacher (videotaped), team activities involving four students (videotaped), activities arranged in a series of stations, and 'tests' undertaken in parallel by four students. Video clips are used as resources for many of the tasks, and extensive use is made of other visual or audio material, equipment, and supplies. Some tasks are presented and responded to on laptop computers. Over a four-year cycle, very broad coverage of the school curriculum is achieved, with 15 different learning areas covered during the cycle. The assessments are administered by about 100 experienced teachers, seconded from their schools for this purpose for six weeks (which includes a week of special training). All marking is done after task administration is completed, and each year involves about 6,000 hours work by senior university teacher education students and 3,500 hours work by experienced teachers.

Table 41 NEMP Forums by year of assessment

2007 2003 1999 1995	Science Art Graphs, tables, and maps
2008 2004 2000 1996	Music Aspects of technology Reading and speaking
2009 2005 2001 1997	Information skills Social studies Mathematics
2010 2006 2002 1998	Listening and viewing Health and Physical education. Writing

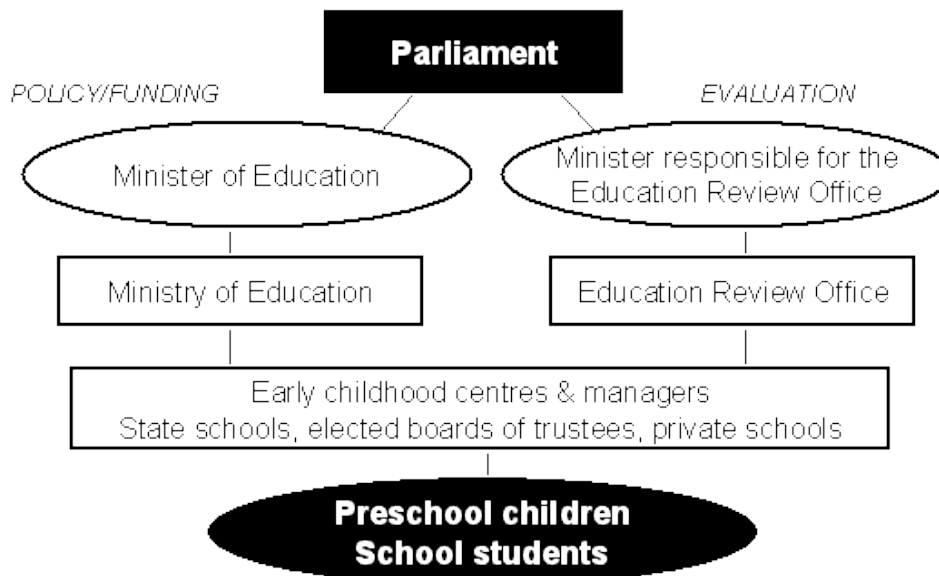
Source: National Education Monitoring Project

Each report involves a great deal of comparison by gender, socio-economic status, and ethnicity, as well as some comparison between Year-4 and Year-8. Although NEMP assessments are comparable over time through the use of link times, there are substantial changes between years.

While these monitoring reports are highly detailed and comprehensive, they are unlikely to assist in constructing productivity estimates because of their qualitative nature. We may be able use them as sources of triangulation data.

The **Education Review Office (ERO)** is a government department whose purpose is to evaluate and report publicly on the education and care of students in schools and early childhood services. ERO's findings inform decisions and choices made by parents, teachers, managers, trustees, and others, at the individual school and early childhood level, and at the national level by government policymakers.

Figure 3 The New Zealand early childhood and school education system



Source: Education Review Office

In an Education Review, ERO investigates and reports to boards of trustees, managers of early childhood education services, and the Government on the quality of education provided for children and students at individual centres and schools.

Schools and early childhood services are reviewed, on average, once every three years. Reviews are undertaken more frequently where the performance of a school or centre is poor and there are risks to the education and safety of the students. ERO's reports on individual schools and early childhood services are freely available to the public.

Because the law requires that students educated at home be taught as regularly and well as in a registered school, ERO also reports to the Secretary for Education on the education of homeschooled students.

As with the reports of the National Education Monitoring Project, ERO reports are quite comprehensive but don't lend themselves to quantitative comparison.

Recommendation E22

The available quality assessments by the National Education Monitoring Project and the Educational Review Office are not sufficiently quantitative or longitudinally consistent to be used in indexes of quality change for adjustment of educational output quantity.

9.2.5 Employment Outcomes of Tertiary Education (EOTE)

Statistics NZ has undertaken a feasibility study exploring integrating data on tertiary enrolments and completions, and industry training student records with the Linked Employer-Employee Data (LEED), for the purposes of studying the employment outcomes of tertiary education.

The high match rate (89.5 percent) and relatively low false positive rate (1.4 percent) indicate that it is feasible to create an integrated dataset for all students with a national student number. Because the National Student Index is maintained, there is a guarantee

that the quality of the linking should not decrease over time. If an integrated dataset is created, it may be useful as a source of quality data.

9.3 Education: output quantity weights

9.3.1 Concept

In the absence of market prices, the best estimation of the relative value of different educational services is the sum of costs from all public and private sources.

9.3.2 Data sources

Table 42 Summary of available data sources for education output quantity weights

Data source	Details	Issues & limitations
ECE RS71	Contains total cost per child-hour of ECE, broken down by age	From 2000. Covers only teacher-led, centre-based ECE
Schools Financial information database for schools (FIDS)	Stores schools' financial accounts, with detailed info on income and expenditure. Broken down by school type and authority	Includes private schools
Tertiary Financial Performance of Public TEIs	Financial performance information published annually by MOE	From 2000. Covers only public institutions
Single Data Return	Tertiary Staffing and PBRF Staffing collections	Available from 1994, includes PTEs who receive government funding from 2000 forward
Statistics NZ internal sources	Aggregate income, expenditure and capital formation data	Covers public and private

9.4 Education: inputs

Table 43 Summary of available data sources for education inputs

Data source	Details	Issues & limitations
ECE time series of interest already published by MOE	Teacher FTEs by provider type Number of usual teaching staff in licensed ECE services by highest qualification and type of service	
ECE RS71	detailed information about the hours worked by various types of staff, Breakdown by qualification and type of	From 2000

	service data from 2001	
Schools Teacher Payroll Data Warehouse	Comprehensive database of payroll transactional data for teachers, principles, and portion of support staff	State and state integrated schools only. From 1999
Schools Teacher Census	3-yearly census captures years of experience, qualification, registration, and professional development	State and state integrated schools only. From 1999
Schools Financial information database for schools (FIDS)	Stores schools' financial accounts, with detailed info on intermediate consumption and capital formation. Broken down by school type and authority	Includes private schools
Tertiary Staffing data collections	Academic FTEs by appointment type, rank and sub-sector; non-academic FTEs by subsector	Academic backdated to 1994/5. Non-academic from 2000

9.4.1 Collection RS71 (Survey of Operational Costs and Fees to teacher-led Centre-based ECE services)

Overview

This survey collects information on the costs of providing ECE services. Information from the survey is used to update ECE funding rates, including rates for free ECE.

Coverage

All teacher-led, centre-based ECE services.

Timing (frequency, time reference, length of time series)

Was collected in 2005, 2006, and 2008 (not yet available). As such, it is not useful as a time series but only as benchmarks.

Use in a measure of productivity

Source of ECE data by service type for: cost per child by age, capital input in current dollars; relative weights of capital, labour, and intermediate consumption; and labour input quantity (FTEs) by type.

Known issues

Interpolation required for non-survey years.

Key variables

The following variables (in bold), along with short descriptions, are those which should be considered useful when analysing ECE information for measuring change in output.

Teacher salaries, including gross salaries and wages for all staff primarily engaged in the education and care of children. Includes trained, untrained, in-training, permanent and relieving teachers, and teachers employed through an agency. Includes payments for leave and long service leave, and vehicle costs if they are part of a salary package.

Mixed duty staff salaries, includes gross salaries and wages for staff members who spend part of their time teaching and part of their time in administrative duties.

Admin staff salaries, includes gross salaries and wages for all non-teaching administrative staff employed, such as management staff, support staff, cook, cleaner, and office staff.

Staff overheads, includes costs such as ACC levies, allowances, superannuation and Kiwisaver employer contributions, staff travel, subscriptions, teacher registration contribution, recruitment, and payroll services.

Professional development, includes the costs of any course fees, transport, accommodation, or other expenses incurred as part of a staff member taking part in professional development.

Admin resources, includes stationery supplies, computer/fax/photocopier consumables (eg ink cartridges), and postage.

Educational resources, includes books, puzzles, games, art and craft supplies, and play equipment.

Professional services, includes accounting, auditing, legal, human resources, and administration services provided on contract by a professional service provider.

Utilities, includes electricity, gas, water, and phone/fax/internet charges.

Other operating costs, includes all other costs incurred in the day-to-day running of the ECE service that are not covered in any of the preceding categories (eg insurance, advertising, food, bank fees, cleaning, medical supplies, special events – such as parties and excursions, vehicle costs, and gardening costs).

Property and equipment costs, includes land, buildings, playground equipment, furniture, fittings and fixtures, office equipment (eg computer, photocopier) and whiteware.

Gross Fixed Capital formation

Total hours of enrolment

Costs per hour for individual child by age, broken down into fees outside of 20 Hours free ECE, optional charges, and parent donations.

Level of disaggregation for a measure of output quantity change

Service type, labour type (teaching, mixed, admin, support)

Access to dataset

The MOE holds this dataset.

Corresponding weights

FTEs by labour type, cost per child by age (output cost weights).

9.4.2 Teacher Census

The Teacher Census is a survey of teachers working in state and state integrated schools carried out by the Ministry of Education every three years. Teacher Census data collections have taken place in 1998, 2001, and 2004. Ethnicity and date of birth information collected by the Census is used to validate details held on the payroll. Aggregate Teacher Census information is analysed by the Ministry of Education, and results are published and made available to teachers, schools, and teacher organisations.

Whilst Teacher Census questions vary for each census, they essentially cover a range of areas including date of birth, gender, ethnicity, iwi (first collected 2004), teacher

registration status, qualifications, years of teaching service in New Zealand and overseas, current designation, professional development, labour market interest, proficiency to teach the curriculum in a language other than English, delivering the curriculum in Māori or a Pasifika language (first collected 2004), secondary teacher teaching subjects, and year of schooling level of students taught.

In total, 43,759 teachers took part in the 2004 Teacher Census, a response rate of 91 percent of teachers who were teaching in the week of the Census. The teacher response rate was very high across all school types.

9.4.3 Teacher qualifications

Teacher qualifications: primary and intermediate schools

Numerator: (Data Source: Ministry of Education: Teacher Census)

Highest teaching qualification held by all primary and intermediate school teachers who completed the 2004 Teacher Census of teachers in State and State Integrated schools, who started their teaching in New Zealand, by number of years in the teaching workforce.

Denominator: (Data Source: Ministry of Education: Teacher Census)

Total number of primary and intermediate school teachers who completed the 2001 Teacher Census of teachers in State and State Integrated schools, who started their teaching in New Zealand, by number of years in the teaching workforce.

Teacher qualifications: secondary schools

Numerator: (Data Source: Ministry of Education: Teacher Census)

Total number of secondary school teachers who completed the 2001 Teacher Census of teachers in State and State Integrated schools, who started their teaching in New Zealand, by number of years in the teaching workforce.

Denominator: (Data Source: Ministry of Education: Teacher Census)

Total number of secondary school teachers who completed the 2001 Teacher Census of teachers in State and State Integrated schools, who started their teaching in New Zealand, by number of years in the teaching workforce.

Interpretation issues with teacher qualifications measures

Comparing the qualification profiles of first year teachers who entered the service at different points in time gives an indication of how the qualifications of new teachers have changed over the last 30 years. It may not be a completely accurate reflection of the trend because some teachers will since have left the service and be excluded from the survey.

Different aspects of teacher qualifications (eg higher academic qualifications, pedagogical knowledge, access to teaching experience as an integrated part of initial teacher education) show different relationships to student outcomes depending on the curriculum area; the age of the student taught; the specific links between subject-specific knowledge in training and the curriculum areas taught; and the nature and quality of

initial teacher education experience. Length of initial teacher education has been found to be related to effectiveness, particularly with diverse students, but length is also related to quality. This indicator is under development, as a best evidence synthesis commissioned to support the indicator development is in progress. This indicator provides an overview of teacher qualifications for 40 years, but is under construction because further work would need to be carried out to distinguish between the length of different qualifications, and emerging findings from the best evidence synthesis show specific characteristics of qualifications to be linked to student achievement outcomes.

There are methodological problems in the research and contextual variations in findings across different countries that we cannot resolve in relation to the New Zealand context because we do not have outcomes-linked evidence. In a survey for the Education Review Office (1999) 45 percent of primary and 40 percent of secondary principals were seeking higher entry-level standards for teacher training in New Zealand. Primary principals' reported experiencing difficulty in recruiting New Zealand teachers who had at least successfully completed their Year-10 mathematics courses.

9.4.4 Tertiary inputs

The Single Data Return, described in section 9.1.3 above, is the primary data source for tertiary labour inputs information, along with the data already used in the government and national accounts.

9.5 Education: complementary indicators

This sub-section sets out a number of complimentary indicators that might be useful in helping to interpret education output, inputs, and productivity indicators, as discussed in section 5.4.3.

Education serves a variety of purposes for the individual student, for families, and for society at large. Not all of these are reflected in a measure of economic productivity. Some of them negatively impact economic productivity by requiring a trade-off between economic efficiency and other goals, as in the choice to keep rural schools open so that children can go to school in their home community. There is no consensus, domestically or internationally, on the relationship between these factors and education quality. Different users apply differing weights to these factors, depending on their perspective as parents, community members, educational policymakers, labour economists, etc. Some of these factors are presented below, with suggestions for complementary measures to capture them.

It bears repeating that output is not the same as outcome, as discussed at some length in sections 5.3 and 5.4. Education outcomes as defined by in the Ministry of Education's 2008 *Statement of intent* are as follows:

- All children develop strong learning foundations
- All young people participate, engage, and achieve in education
- Learners have access to high-quality Maori language education that delivers positive language and learning outcomes
- The education system produces the knowledge and develops people with the skills to drive New Zealand's future economic and social success

- Education agencies work efficiently and effectively to achieve education outcomes.

Access

One of the missions of the education system is to provide access to a standard quality of free, secular education to New Zealanders, regardless of geography, race, and socio-economic background. Supporting this principle of equity of access can be costly and less efficient in the short run, but is believed to be better for society in the long-run by enabling individuals to contribute to the fullest of their abilities. It requires preserving schools' viability by preventing schools from becoming so small that per-student costs are unacceptably high and school performance is compromised. Growth of some schools can affect the rolls of others, impacting on their viability. Students who attend schools with viability concerns may have their access to quality education compromised.

Distance: Small rural schools lack the economies of scale experience by larger schools. They require similar buildings, transportation, and services to larger schools, but serve fewer students at a much higher marginal cost. What is optimal for the school system as a network may not be optimal for students and their families, who value schooling close to where they live. An ongoing measure of mean distance travelled between home and school would provide users with information about the changes in geographic distribution associated with changes in educational productivity.

Guaranteed quality: The Ministry of Education is committed to the principle that 'every school should be a good school'. Rather than reallocating resources and students to high-performing schools, resources are targeted to improve quality at poorly performing schools. A variety of initiatives, for student engagement and learning environment development, target schools as a unit rather than individual teachers or students.

Access to ECE: Research shows that time spent in early childhood education (ECE) enhances future learning. Additionally, it frees up parents of young children to participate in the workforce. These outcomes are sufficiently desirable that the government has subsidised the cost of early childhood education to increase participation. The Ministry of Education already publishes an indicator of ECE participation rates going back to 1990²²

Affordability of tertiary education: Another principal of equal access suggests that students with the interest and aptitude should be able to continue their education and fulfil their potential as an individual and as a member of society, regardless of socio-economic background. The Ministry of Education has published analysis of the affordability of tertiary education since 1997. This question is answered by looking at the overall cost of tertiary education relative to incomes, as well as the balance of public and private financing of tertiary education. While important for analysing the distribution of educational services, this question is not clearly related to economic productivity.

Target populations: Māori and Pasifika education are priority areas of work for government and the Ministry of Education, which have specific strategies and performance targets^{23 24}. These metrics can provide information about the ethnic

²²http://www.educationcounts.govt.nz/indicators/student_participation/early_childhood_education/1923.

²³ <http://www.educationcounts.govt.nz/themes/maori-education/31351>.

²⁴ http://www.educationcounts.govt.nz/themes/pasifika_education.

distribution of educational services and outcomes, which are outside of the scope of economic productivity.

In the classroom

It goes without saying that actions in the classroom, on both the student and teacher side, have a substantial influence on educational outcomes. These can have positive and negative impacts on economic productivity. If not specified in the quantity or quality of inputs and output, these changes will come through in the productivity residual as disembodied technical change.

Student participation and engagement: Research shows that more engaged students have better outcomes for the same number of hours of education. It has been suggested in the output section of this paper that output be adjusted for attendance; if it is not, attendance should be considered as a complementary statistic. Student engagement is a subjective state that is difficult to measure. The Ministry of Education has opted to measure secondary manifestations of engagement: student retention and school disciplinary actions such as suspensions, stand-downs, and expulsions²⁵. Efforts to reduce these disciplinary interventions increase educational output if it is defined as attendance-adjusted.

Effective teachers: Teacher qualifications, academic skill in the subject taught, experience, and teaching skills have a strong influence on student experience in the classroom, increasing engagement and overall outcome. The Ministry of Education data on initial teacher training and ongoing development, reported in the inputs section above, can be incorporated into a quality-adjusted labour input measure, or it can be reported as a complementary statistic.

Class size: International opinion on the relationship between class size and educational outcomes is mixed²⁶. It is important enough to merit inclusion as a quality-adjustment option in the draft OECD handbook on measuring education output, but has fallen out of favour as a determining factor in NZ education policy; as a result, research showing that effective teaching, regardless of class size, has a more powerful impact²⁷. Limited class sizes are desirable to some parents, but increase the marginal cost of educational output. Student-teacher ratio by level of schooling is not currently published as an indicator by the Ministry of Education, but could be published as a complementary statistic.

Access to ICT: Increasing the use of computers in the classroom is widely believed to be essential preparation for individuals in a knowledge-based economy. However, the research on the effect this has on educational outcomes is inconclusive as of yet. ICT represents a substantial capital expenditure that negatively impacts present capital productivity, in anticipation of future gain that may be realised only in other parts of the economy. The ratio of students to classroom computers, and the proportion of schools with broadband access would show changes in this access over time.

²⁵ http://www.educationcounts.govt.nz/indicators/student_participation.

²⁶ See Blatchford (2009) for a summary of the class size debate.

²⁷ See for example Hattie (2005).

Outside of the classroom

There are a variety of factors outside of the classroom which are known to improve educational outcomes, such as parental and community engagement in schooling. These fall outside of the production boundary, but may have a positive impact on productivity. Measures of engagement may help users understand changes in the productivity residual. The Ministry of Education has identified a number of predictors of family engagement, including educational attainment of primary caregivers, proportion of children in low-income or single-parent households, and early identification of hearing loss (which affects intellectual development if uncorrected).²⁸

²⁸ http://www.educationcounts.govt.nz/indicators/family_and_community_engagement.

10 Implementation around the world

10.1 Health care output

Following publication of the current SNA, the *System of national accounts 1993* (UN 1993), a number of countries put in place work programmes to implement the changed guidance on the measurement of non-market output in the National Accounts. Whereas the previous SNA had recommended that non-market output in both current price as well as volume terms should be on the basis of the sum of the inputs, SNA 1993 recommended that the volume measure of non-market output should, where possible, be estimated directly as actual change in output (the guidance on current price estimates remains the same).

Thus, towards the end of the 1990s, some countries introduced direct measures of non-market output into their National Accounts. New Zealand, Australia, and the UK were amongst the countries that have had direct measures of health care output incorporated in their National Accounts since then.

Following publication of the *Handbook* on price and volume measures for the national accounts, the European Commission embodied its recommendations into law: implementation for all EU countries but Denmark (which has a derogation until 2012) was required for National Accounts data relating to the year 2006 and onwards.

This legal requirement, along with growing interest in understanding the performance of the non-market sector (perhaps generated by the *Atkinson review* and the fact that OECD is currently drafting a manual on the measurement of health and education production for the National Accounts), has acted as a spur to European countries to ensure that their National Accounts methods were consistent with the recommendations in the *Handbook*.

Table 44 sets out the current state of play in OECD countries with measures of change in the volume of health care output.

Table 44 State of play in OECD countries' National Accounts practices for measuring change in the volume of health care output volumes

State of play in measurement practice	Countries
Quality adjusted quantity measure for both primary and secondary care	None
Quantity measure only for either primary and secondary care, no quality adjustment	Australia, Czech Republic, Finland, Sweden, UK
Quantity measure only for secondary care, no quality adjustment; 'output=inputs' for primary care	Austria, France, Germany, Greece, Hungary, Italy, Netherlands, New Zealand , Norway, Slovak Republic
'Output=inputs' for primary and secondary care	Belgium, Canada, Denmark, Iceland, Ireland, Japan, Korea, Luxembourg, Poland, Portugal, Switzerland, US

Source: Joint Eurostat/OECD survey, 2006

The rest of this section briefly reviews the state of play in measurement of health care output estimates in a number of OECD countries: New Zealand, the United Kingdom, Australia, Germany, and Denmark. For each country, information is given on: output quantity change; output quality change; and output weights.

10.1.1 New Zealand

See section 6.2.4 for a description of current National Accounts practice in measuring volume change in health care output.

10.1.2 United Kingdom

The United Kingdom's 'second generation' methods for measuring change in the volume of health care output, inputs, and productivity are the direct result of work driven by the recommendations and principles set out in the *Atkinson review*. Of the many improvements made, the most significant have been:

- a great increase in the level of disaggregation, from 16 types of health care output to, nowadays, some 2,000 different types;
- increase in coverage of health care activities provided to patients, from 63 percent in 1994/95 to around 80 percent in 2005 (in terms of expenditure);
- incorporation of information on Northern Ireland (previously, only English data were used. Work continues on incorporation of data specific to Scotland and Wales);
- better cost weights based on health service accounting systems; and
- measurement of general practice (GP) contacts using GP databases rather than household survey (with much improved accuracy).

Table 45 provides a brief overview of the current state of play in the methods used for measuring change in the volume of health care output in the UK.

Table 45 Overview of health care output measures in the UK

Component of method	State of play in latest estimates
Output quantity	Activity, rather than health care pathway, based 80 per cent coverage Distinction between 2,500 types of activity Classification used is DRG
Output quality	For the National Accounts: No quality change adjustment (although the level of disaggregation captures some aspects of quality change) For productivity analyses: Measures are included of change in survival, health benefits from treatment, health effects from shorter waiting times; improved management of some chronic conditions in Primary Care, and patient satisfaction. The model used to combine quantity and quality measures is simple: it assumes growth in the separate indicators of quality and quantity change are equally valuable.
Output weights	Costs available from health service accounting systems Some work carried out to illustrate difference between cost and value weights for a few activities

10.1.3 Australia

Australia's methods for measuring change in the volume of health care output were implemented in the late 1990s, after publication of SNA 1993. Currently, the Australian Bureau of Statistics is looking into ways of improving its measures, drawing on the recent improvements made in other countries and the forthcoming OECD manual.

Table 46 provides a brief overview of the current state of play in the methods used for measuring change in the volume of health care output in Australia.

Table 46 Overview of health care output measures in Australia

Component of method	State of play in latest estimates
Output quantity	Activity, rather than health care pathway, based Covers primary, secondary, and residential care Classification used is DRG
Output quality	None
Output weights	Cost weights are a mix of DRG costs, subsidy rates and fees

10.1.4 Germany

Table 47 provides a brief overview of the current state of play in the methods used for measuring change in the volume of health care output in Germany.

Table 47 Overview of health care output measures in Germany

Component of method	State of play in latest estimates
Output quantity	Activity, rather than health care pathway, based Covers secondary, and residential care Classification used is DRG
Output quality	Explicit quality adjustment
Output weights	Cost weights are a mix of DRG costs, subsidy rates and fees

10.1.5 Denmark

Table 48 provides a brief overview of the current state of play in the methods used for measuring change in the volume of health care output in Denmark.

Table 48 Overview of health care output measures in Denmark

Component of method	State of play in latest estimates
Output quantity	Current: Deflation with input price index Planned for 2012: Deflation using unit costs per treatment Classification is DRG
Output quality	None
Output weights	Unit costs

10.2 Health care inputs

As with government health care and education productivity studies, the measurement of inputs into production of government health care and education is in its infancy, and few countries have published specific studies and estimates. While the measurement of government output in volume terms is required for the National Accounts, there is no similar requirement for the measurement of government inputs in volume terms. There are few countries, therefore, which have published studies or estimates of the volume of inputs used in producing government health care or education.

The UK has published a sequence of articles on the productivity of a number of different functions of government, including health care and education.

10.2.1 New Zealand

See sections 6.3.2 (labour) and 6.3.7 (capital services) for a description of Statistics NZ's current practice in measuring volume change in inputs (although neither health care nor education).

10.2.2 United Kingdom

The United Kingdom's methods for measuring change in the volume of health care inputs are the direct result of work driven by the recommendations and principles set out in the *Atkinson review*.

Table 49 provides a brief overview of the current state of play in the methods used for measuring change in the volume of health care output in the UK.

Table 49 Overview of health care inputs measures in the UK

Component of method	State of play in latest estimates
Labour	Measured as change in the number of full time equivalents Full time equivalents calculated according to contracted hours Distinction made between different types of staff Weights used are wages & salaries
Capital	Measured using capital consumption as a proxy Weights used are current price capital consumption
Intermediate consumption	Measured by deflating expenditure Expenditure and price information used at a detailed level

10.3 Education output

This section briefly reviews the state of play in measurement of health care output estimates in a number of OECD countries: New Zealand, the United Kingdom, Australia, Finland, and Italy. For each country, information is given on: output quantity change; output quality change; and output weights.

Table 50 State of play in OECD countries' National Accounts practices for measuring change in the volume of education output volumes

State of play in measurement practice	Countries
Quality adjusted quantity measure for ECE, schooling and tertiary education	Sweden
Quantity measure only for secondary and tertiary education, with quality adjustment	Austria, France, Hungary, Italy, Latvia, Lithuania, Malta, Norway, Spain, UK
Quantity measure only for schooling and tertiary education, no quality adjustment	Australia, Belgium, Finland, Germany, Greece, New Zealand
Quantity measure only for schooling, no quality adjustment; 'output=inputs' for tertiary education	Czech Republic, Netherlands, Slovakia
'Output=inputs' for all education	Canada, Denmark, Japan, Korea, Luxembourg, Switzerland, US.

Source: Joint Eurostat/OECD survey, 2006

The rest of this section briefly reviews the state of play in measurement of education output estimates in a number of OECD countries: New Zealand, the United Kingdom, Australia, Germany, and Denmark. For each country, information on is given on: output quantity change; output quality change; and output weights.

10.3.1 New Zealand

See section 7.2.2 for a description of current National Accounts practice in measuring volume change in education output.

10.3.2 United Kingdom

The United Kingdom's 'second generation' methods for measuring change in the volume of education output, inputs and productivity are the direct result of work driven by the recommendations and principles set out in the *Atkinson review*. Significant improvements include:

- Output definition changed from pupil numbers to pupil attendance;
- increase in coverage of education services to include initial teacher training, health professional courses, government-funded pre-school, and City Technical Colleges;
- introduction of cost weights for different levels of education services;
- increase in coverage to include Scotland and Northern Ireland, and the introduction of country weights that allow the production of chain-linked output indices for England, Scotland, Wales, and Northern Ireland;
- introduction of a 'multiplicative model' which assumes that pupils' progress through school each year is a multiple of previous progress (rather than an addition to).

Table 51 provides a brief overview of the current state of play in the methods used for measuring change in the volume of education output in the UK.

Table 51 Overview of health care output measures in the UK

Component of method	State of play in latest estimates
Output quantity	Based on pupil attendance where possible, else numbers. Covers: government-funded ECE child FTEs; attendance-adjusted pupil numbers at government-maintained primary, secondary and special schools; student numbers in initial teacher training and health professional training. (Excludes other post-secondary education)
Output quality	For the National Accounts: An explicit annual quality adjustment of 0.25 percent is made, based on the historical rate of improvement in GCSE results from the mid-1990s For productivity analyses: Adjusted by change in uncapped average point scores of GSCE exams relating to the attainment of pupils at end of Year 11. The model used to combine quantity and quality measures is multiplicative and assumes that pupils' progress through school each year is a multiple of previous progress (rather than an addition to)
Output weights	Expenditure shares by level of education

10.3.3 Australia

Australia's methods for measuring change in the volume of education output were implemented in the late 1990s, after publication of SNA 1993. Currently, the Australian Bureau of Statistics is looking into ways of improving its measures, drawing on the recent improvements made in other countries and the forthcoming OECD manual.

Table 52 provides a brief overview of the current state of play in the methods used for measuring change in the volume of education output in Australia.

Table 52 Overview of education output measures in Australia

Component of method	State of play in latest estimates
Output quantity	Based on pupil numbers and number of research publications Stratified by level of education and field of tertiary study Covers ECE through tertiary Classification used ANZSIC
Output quality	None
Output weights	Expenditure.

10.3.4 Finland

Table 53 provides a brief overview of the current state of play in the methods used for measuring change in the volume of education output in Finland.

Table 53 Overview of education output measures in Finland

Component of method	State of play in latest estimates
Output quantity	Based on student numbers, taught hours, number of credits and student-years, depending on the stratum Very detailed stratification that separates upper and lower secondary, separates vocational from general curricula, and specifies field of tertiary education Focuses on economic unit, rather than product; university research estimated by number of publications Covers ECE through tertiary, and adult education
Output quality	None
Output weights	Cost weights.

10.3.5 Italy

Table 54 provides a brief overview of the current state of play in the methods used for measuring change in the volume of education output in Italy.

Table 54 Overview of education output measures in Italy

Component of method	State of play in latest estimates
Output quantity	Based on enrolment numbers Detailed stratification that separates upper and lower secondary, specifies type of upper secondary institute and field of tertiary education Activity based: Separates university activity into separate education and research activities, includes subsidiary

	services to education like meals and dormitories Covers ECE through tertiary
Output quality	Coefficient based on class size for schooling, degrees per enrolment for tertiary faculties
Output weights	Cost weights

10.4 Education inputs

10.4.1 New Zealand

See sections 6.3.2 (labour) and 6.3.7 (capital services) for a description of current Statistics NZ's current practice in measuring volume change in inputs.

10.4.2 United Kingdom

The United Kingdom's methods for measuring change in the volume of education inputs are the direct result of work driven by the recommendations and principles set out in the *Atkinson review*.

Table 55 provides a brief overview of the current state of play in the methods used for measuring change in the volume of education inputs in the UK.

Table 55 Overview of education inputs measures in the UK

Component of method	State of play in latest estimates
Labour	Measured as change in the number of full time equivalents for 94 percent of education labour and deflated current price labour expenditure for the remaining 6 percent Full time equivalents calculated according to contracted hours Distinction made between teaching and support staff Teaching staff adjusted for actual hours worked Weights used are average wages
Capital	Measured using capital consumption as a proxy Weights used are current price capital consumption
Intermediate consumption	Measured by deflating expenditure Expenditure and price information used at a detailed level.

10.4.3 Australia

Table 56 provides a brief overview of the current state of play in the methods used for measuring change in the volume of education inputs in Australia.

Table 56 Overview of education inputs measures in Australia

Component of method	State of play in latest estimates
Labour	Total hours worked estimated by multiplying employee counts by average hours worked
Capital	Measured using capital consumption as a proxy Productive capital stock estimated with a perpetual inventory model Weights used are derived user cost of capital by asset
Intermediate consumption	Measured by deflating expenditure Expenditure and price information used at a detailed level

11 Recommendations

This section gathers together the recommendations made throughout this report for ease of access. They are presented in three separate groups: general recommendations, and those specific to health care and education. For clarity, each recommendation has been identified with a letter (G, H, or E, respectively), number, description, and a page number indicating where it appears in the body of the report.

11.1 General recommendations

Number	Recommendation	Page
G1	Any implementation of this study should be clear what the question(s) associated with any requested productivity measure is (are), with particular emphasis on the perspective of the measure.	12
G2	A first step in implementing this study should be to address the industry perspective, to provide estimates of government productivity that are consistent with Statistics NZ's existing market sector productivity estimates.	12
G3	Consistent terminology should be adopted and consistently used to avoid ambiguity and confusion. In this <i>feasibility study</i> , the term 'quality' relates to change in the set of characteristics of the units being measured.	13
G4	A cautious approach should be taken in combining measures of quantity and quality change in health care and education output, with wide and transparent discussion of options and careful building of a consensus before decisions on methods are adopted. Until then, quality change should not be incorporated into measures of quantity change in output.	14
G5	Statistics NZ and the Ministries of Health and Education should explore further what level of disaggregation is most suitable in the New Zealand context, to understand the impact on estimates of output and productivity and to inform the choice of this level. The choice of which to adopt should be reached after wide discussion and consensus building.	15
G6	In order to weight together the growth rates of different types of health care and education in a composite measure of total output, the relative weights should be total cost weights.	17

	Examining the impact of other types of weight may be useful in understanding different perspectives, for example in cost / benefit analyses.	
G7	Any measure of output should be as comprehensive as possible in terms of the coverage of the types of health care provided to patients or education provided to students.	18
G8	Where quantitative information on change over time is not available for some types of services, there may be qualitative information about change which can be used to make informed decisions about the use of proxy measures (for example, growth in some types of activity for which figures are available may be considered to be representative of the growth rates for other types of activity for which figures are not available). For those types of services for which neither quantitative nor qualitative information on change over time is available, growth should be assumed to be the same as growth in measured activity, or labelling would need to be clear about how partial the measure is.	18
G9	A staged approach to implementation is recommended, giving higher priority to those areas of measurement that take little resource and have large impact.	18
G10	Statistics NZ should garner user views on the relative priorities of the productivity-specific questions and decide which one(s) should to be answered.	19
G11	Statistics NZ should review the desirability of using different index number methodologies for the numerator and denominator of the productivity equation.	20
G12	Statistics NZ should consider how best to inform users about the statistical quality of any government productivity measures it publishes, bearing in mind both quantitative and qualitative means.	23
G13	Statistics NZ should consider what are the appropriate ways for ensuring on ongoing dialogue with users, to ensure that the statistics provide (at least part of) an answer to specific user questions, and that any external expertise and experience can be drawn on to improve the development work.	23

G14	In order to deal with complications associated with separating between government output and private sector output if the scope of the productivity measure is defined according to who is paying, then the distribution by source of financing should be used to calculate how much of the inputs and output are government and how much are private.	24
G15	The scope of inputs must match that of output in the productivity equation. Where apportionment is not feasible, inputs should be spread across the industry on a pro-rata basis.	25
G16	Measurement of productivity for the government sector should follow as closely as possible that of the market sector where data sources and user needs allow.	25
G17	To help improve statistical quality, where information exists to compile output estimates using both deflated expenditure and a direct volume approaches, the sources, methods, and results should be compared and contrasted with the better quality aspects of both approaches being drawn on, to form a single best method	26
G18	Statistics NZ should consider what the appropriate rate of return should be for calculating the user cost of capital used in the government sector.	26

11.2 Recommendations for health care

Number	Recommendation	Page
H1	The available information on the number of day patients should be incorporated into the existing method of calculation of Statistics NZ's health care output.	36
H2	Revisions to estimates of casemix-adjusted throughput should be incorporated into the existing method of calculation of Statistics NZ's health care output.	36
H3	Changes in the number of day patient discharges should be broken down by type of service. Along with information on average costs of these different types of service, this information will help to introduce an element of quality change into Statistics NZ's measure of day patient output.	36
H4	Consideration should be given to combining the number of inpatient and day patient activities, where these are substitutes, in order to improve the price / volume breakdown.	37
H5	Revisions to estimates of the number of day patients treated should be incorporated into the existing method of calculation	37

	of Statistics NZ's health care output.	
H6	Consistent with recommendation 5.3.5 on comprehensiveness and representativeness, consideration ought to be given to incorporating all of the available information on activities in hospitals and other settings in order to maximise the comprehensiveness of Statistics NZ's measure of health care output.	37
H7	The number of bed-nights should not be used as part of a measure of health care output for all types of hospital patient. It might be appropriate to consider using number of bed-nights as an appropriate indicator of the volume of health care output associated with 'boarders'.	38
H8	The weighting scheme should be updated, possibly as frequently as annually, to reflect the changing relative costs of providing the different services.	38
H9	The method for aggregating the different sub-components of the health care output index should conform to the standard method involving weighting together changes in the volume of different activities using relative weights (rather than weighting together different index series).	38
H10	Given the development infancy of system-level measures of change in the quality of health care provided in New Zealand, and until there is broad discussion and agreement on how to construct such measures and combine these with the existing quantity measures, care should be taken in presenting such information.	115
H11	New Zealand should draw on the guidance already available globally on how to construct system-wide measures of change in the quality of health care provided in New Zealand, in deciding exactly what specification is appropriate for New Zealand.	115
H12	Statistics NZ should formally register its interest in information on the effectiveness of hospital treatment as part of an information suite that could be used in measuring health care output at the national level.	117
H13	Statistics NZ and the Ministry of Health should study the relationship between the WIES weights and total hospital costs, including all sources of funding, to confirm whether use of WIES weights as the measure of relative importance of different types of hospital inpatient and day care activities introduces any bias.	120

11.3 Recommendations for education

E1	Consideration must be given to consistently applying definitions of government and private education across all levels. The definition selected should fit the question government productivity measures are intended to answer.	50
E2	Most education involves a certain degree of co-financing through fees and donations, and integrated schools through privately owned capital. Care is required to treat this consistently in accordance with the principles laid out in this report.	52
E3	Statistics NZ's volume measures for education should be aligned as closely as is practicable with recommendations representing international best practice.	61
E4	The appropriate output measure of ECE education should be full-time student equivalents, disaggregated by service type. The definition of full-time at the ECE level should be consistent over time and across service types.	63
E5	If quality-inclusive output measure is desired, data are available to compare ECE hours enrolled with ECE hours delivered in census weeks.	63
E6	Stakeholders should be engaged in defining the boundary between education and care in a manner consistent with the question these measures are intended to answer.	68
E7	At a minimum, full-time student equivalents by level should be used to estimate school output quantity.	68
E8	A decision is required to include or exclude international students in accordance with the question these measures are intended to answer. International students must be treated consistently on both the inputs and output side, and should be treated consistently at the school and tertiary level.	70
E9	Alternative education programmes and teen parent units represent a sufficiently different service from mainstream secondary education that they merit separate treatment. This requires identifying them in the data on the inputs and output side so that they can be included or excluded as required by scope.	71
E10	A decision is required on how to treat the Correspondence School. It should be applied consistently on both the inputs and output side so that it can be included or excluded as required by scope.	73
E11	The most desirable output measure available for New Zealand's tertiary education is credits completed, broken down by: subsector (university, polytechnic, etc), qualification level, domestic/international, broad field of study, and public/private.	74
E12	Universities, polytechnics and wananga provide distinct and separable educational services, and should be treated as such. Care should be taken with the treatment of Auckland University	75

	of Technology, which moved from the polytechnic category to the university category.	
E13	The funding of tertiary education is complex and involves a large amount of co-financing across government and across the public/private split. Care should be taken to define the scope in a manner consistent with the question these measures are intended to answer, and to treat it consistently in both inputs and output.	76
E14	Research is recognised as an important output of universities, with an income stream that is increasingly separate and identifiable. However, identifying research funding in a longer time series may be impossible at this time. Stakeholders should be engaged in discussion about whether to explicitly include or exclude research within the productivity estimates.	82
E15	Research is acknowledged as an important output of universities that involves extensive co-funding and co-production. Given the lack consistent data and the uncertainty of research's treatment in the National Accounts, it would be difficult to create a robust measure for it at this time. A decision will be required to either include or exclude identifiable research on both the inputs and output side.	84
E16	Consideration must be given to consistently applying definitions of government and private education across all levels. The definition selected should fit the question government productivity measures are intended to answer. There is the strong possibility that no 'other education' providers should be legitimately included in the government sector.	87
E17	The most desirable output measure for industry and targeted training is credits completed by level.	88
E18	On the basis of its small size and poor data availability, it is recommended that adult and community education be excluded from productivity estimates.	88
E19	Labour devoted to tertiary research should be estimated and treated in a manner consistent with the treatment of research output.	93
E20	Student attainment data are available for estimating output quality, but pose challenges in continuity (qualifications) and periodicity (achievement tests). Stakeholder engagement is recommended around any decisions on the suitability of adjusting for attainment, and the correct distribution of point-in-time achievement over a pupil's schooling career.	145
E21	If used, qualification achievements must not be treated as a continuous measure in which each level of attainment has equal value that can be summed together. Care must also be taken around the discontinuity in the qualifications series marked by the introduction of NCEA in 2002.	145
E22	The available quality assessments by the National Education Monitoring Project and the Educational Review Office are not	168

	sufficiently quantitative or longitudinally consistent to be used in indexes of quality change for adjustment of educational output quantity.	
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Appendix 1 Acronyms

ACC	Accident Compensation Corporation
DHB	District Health Board
DRG	Diagnosis Reference Group
ED	Emergency Department
FTE	Full time equivalent
ICD-10	International Classification of Diseases, version 10
NMDS	National Minimum DataSet
NNPAC	National Non-Admitted Patient Collection
NPP	National Pricing Project
PAM	Performance and Assessment and Management
PHO	Primary Health care Organisation
PU	Purchase Unit
PVS	Price Volume Schedule
WIES	Weighted Inlier Equivalent Separation

Appendix 2 Evaluating Data Sources

Data sources can be evaluated using the following criteria, based on New Zealand's Official Statistical System definitions of data quality (SNZ 2007) and ONS (2008).

Relevance

What is the concept being measured?

Is the concept clearly defined, and by whom?

Why do we want to measure it?

Is the concept likely to change?

Who are the key users, and how does this concept relate to their needs?

How well do the available data fit the concept?

Accuracy

What is the proportional coverage of the available data?

How are missing data dealt with what is the impact on the estimates?

If sample survey

- What is the sample frame and how does it fit the population of interest?
- What is the sample size?
- What is the response rate?
- How is the population parameter established?
- What is the estimated sampling error?

If administrative data

- Are there concerns about completeness?
- How well does the original collection purpose fit the current concept?
- How likely are distortions from changing definitions over time or incentives on improving completeness of data recording?

Timeliness

What is the time lag from reference date to supply?

What time periods are the data available for?

Are the data punctual?

What additional data would be required to forecast as required to match other sources?

Accessibility

Are data available for the whole country? Are the definitions consistent?

Are data available for a back series?

Is the source expected to be available in the future?

Are the data readily available?

Coherence/Consistency

Are other data available for the same concept? Do they have the same story?

Interpretability

What metadata are available to help interpret the data?

Are there current or expected changes in definitions or methodology within the time series?

Appendix 3 National Health Collections

General Medical Subsidy Collection (GMS)

The General Medical Subsidy Data Warehouse (GMS) is used by Ministry of Health analysts and DHBs to monitor contracts with providers, support the forecasting and setting of annual budgets, analyse health needs and assess policy effectiveness. Further information is available at <http://www.nzhis.govt.nz/moh.nsf/pagesns/50>

Health workforce information

The Health Workforce Data Collection consists of 13 stand-alone databases of annual survey information for each of New Zealand's registered health professions: doctors, nurses, dentists, chiropractors, medical laboratory technologists, medical radiation technologists, optometrists, dispensing opticians, psychologists, occupational therapists, dieticians, podiatrists and physiotherapists.

Hepatitis B Screening Programme (Hep B)

The Hepatitis B data warehouse was established for the Hepatitis B Screening Programme pilot to support policy formation, performance monitoring, and review. The pilot has been conducted for three years with two primary care providers, and has now been extended to capture secondary care data. Further information is available <http://www.nzhis.govt.nz/moh.nsf/pagesns/51>.

Laboratory Claims Collection (Labs)

The Laboratory Claims Collection allows the Ministry of Health and DHBs to monitor the primary-care test subsidies. Further information is available at <http://www.nzhis.govt.nz/moh.nsf/pagesns/52>.

Maternity and Newborn Collection (MNIS)

The Maternity and Newborn Collection provides information relating to maternity and newborn services up to nine months before and three months after a birth. Further information is available <http://www.nzhis.govt.nz/moh.nsf/pagesns/53>.

Medical Warnings System (MWS)

The Medical Warnings System is a value added service closely aligned with the National Health Index. It is designed to warn health care providers of the presence of any known risk factors that may be important when making clinical decisions about patient care. Further information is available <http://www.nzhis.govt.nz/moh.nsf/pagesns/54>.

Mental Health Information Collection (MHDW)

The Mental Health Information Collection was established to enable NZHIS information analysts to carry out reporting and ad hoc queries independently of the monthly validation and updating processes taking place in the MHINC database. It is a high-level national database that allows the Ministry of Health to manipulate and report data to monitor the implementation of the national mental health strategy, and provides data extracts for research into the provision of mental health services. Further information is available <http://www.nzhis.govt.nz/moh.nsf/pagesns/55>.

Mental Health Information National Collection (MHINC)

The Mental Health Information National Collection is a national database of information on secondary mental health and alcohol & drug services purchased by the government. It is collected by the Ministry of Health to support policy formation, monitoring, and

research.

Further information is available <http://www.nzhis.govt.nz/moh.nsf/pagesns/56>.

Mortality Collection

The Mortality Collection has been established to provide data for public health research, policy formulation, development and monitoring, and cancer survival studies. A complete data set of each year's mortality data are sent to the World Health Organization each year to be used in international comparisons of mortality statistics. Further information is available <http://www.nzhis.govt.nz/moh.nsf/pagesns/57>.

National Booking Reporting System (NBRS)

The National Booking Reporting System provides information by health speciality and booking status on how many patients are waiting for treatment, their assigned priority, their booking status and also how long they have been waiting. Further information is available <http://www.nzhis.govt.nz/moh.nsf/pagesns/58>.

National Booking Reporting System Data Warehouse (NBRS DW)

The National Booking Reporting System Data Warehouse was established to consolidate information from the NBRS inpatient database, summary statistics, and cost weighted discharge information from the NMDS and HealthPAC. This consolidated view of the data supports the monthly production of Elective Services Performance Indicator (ESPI) reports and ad hoc queries. Further information is available <http://www.nzhis.govt.nz/moh.nsf/pagesns/59>.

National Health Index (NHI)

The National Health Index is the cornerstone of health information in New Zealand. It was established to provide a mechanism for uniquely identifying every health care user by assigning each a unique number (known as the NHI number). Further information is available <http://www.nzhis.govt.nz/moh.nsf/pagesns/60>.

National Immunisation Collection (NIR)

The National Immunisation Collection has been established to provide data for monitoring immunisation coverage and the progress of immunisation campaigns such as Meningococcal B. This collection also supplies the Safety Monitoring Report for the Meningococcal B campaign. Further information is available <http://www.nzhis.govt.nz/moh.nsf/pagesns/61>.

National Minimum Dataset (Hospital Events) (NMDS)

The National Minimum Dataset is used for policy formation, performance monitoring, research and review. It provides statistical information, reports, and analyses about the trends in the delivery of hospital inpatient and day patient health services both nationally and on a provider basis. Further information is available <http://www.nzhis.govt.nz/moh.nsf/pagesns/62>.

National Non-admitted Patient Collection (NNPAC)

NNPAC provides national consistent data on non admitted patient (outpatient and emergency department) activity. Its primary use will be for the calculation of Inter District Flows (IDFs) but may also help provide information to measure health outcomes and inform decisions on funding allocations and policy. Further information is available <http://www.nzhis.govt.nz/moh.nsf/pagesns/63>.

New Zealand Cancer Registry (NZCR)

The New Zealand Cancer Registry is a population-based register of all primary malignant diseases diagnosed in New Zealand, excluding squamous cell and basal cell skin cancers. Data are used in research, and in monitoring and evaluating cancer screening programmes.

Further information is available <http://www.nzhis.govt.nz/moh.nsf/pagesns/64>.

Pharmaceutical Collection (Pharms)

The Pharmaceutical Collection is a data warehouse that supports the management of pharmaceutical subsidies. It is jointly owned by the Ministry of Health and Pharmac.

Further information is available <http://www.nzhis.govt.nz/moh.nsf/pagesns/65>.

Primary Health Organisation Enrolment Collection (PHO)

The PHO Enrolment Collection provides a national collection that holds Primary Health care System patient enrolment data. It is used for monitoring patient enrolment and for research.

Further information is available <http://www.nzhis.govt.nz/moh.nsf/pagesns/66>.

Appendix 4 NZQA National Qualifications Framework

LEVEL	PROCESS	LEARNING DEMAND	RESPONSIBILITY
1	Carry out processes that: are limited in range are repetitive and familiar are employed within closely defined contexts	Employing: recall a narrow range of knowledge and cognitive skills no generation of new ideas	Applied: in directed activity under close supervision with no responsibility for the work or learning of others
2	Carry out processes that: are moderate in range are established and familiar offer a clear choice of routine responses	Employing: basic operational knowledge readily available information known solutions to familiar problems little generation of new ideas	Applied: in directed activity under general supervision and quality control with some responsibility for quantity and quality with possible responsibility for guiding others
3	Carry out processes that: require a range of well developed skills offer a significant choice of procedures are employed within a range of familiar contexts	Employing: some relevant theoretical knowledge interpretation of available information discretion and judgement a range of known responses to familiar problems	Applied: in directed activity with some autonomy under general supervision and quality checking with significant responsibility for the quantity and quality of output with possible responsibility for the output of others
4	Carry out processes that: require a wide range of	Employing: a broad knowledge	Applied: in self-directed activity

	<p>technical or scholastic skills</p> <p>offer a considerable choice of procedures</p> <p>are employed in a variety of familiar and unfamiliar contexts</p>	<p>base incorporating some theoretical concepts</p> <p>analytical interpretation of information</p> <p>informed judgement</p> <p>a range of sometimes innovative responses to concrete but often unfamiliar problems</p>	<p>under broad guidance and evaluation</p> <p>with complete responsibility for quantity and quality of output</p> <p>with possible responsibility for the quantity and quality of the output of others</p>
5	<p>Carry out processes that:</p> <p>require a wide range of specialised technical or scholastic skills</p> <p>involve a wide choice of standard and non-standard procedures</p> <p>are employed in a variety of routine and non-routine contexts</p>	<p>Employing:</p> <p>a broad knowledge base with substantial depth in some areas</p> <p>analytical interpretation of a wide range of data</p> <p>the determination of appropriate methods and procedures in response to a range of concrete problems with some theoretical elements</p>	<p>Applied:</p> <p>in self-directed and sometimes directive activity</p> <p>within broad general guidelines or functions</p> <p>with full responsibility for the nature, quantity and quality of outcomes</p> <p>with possible responsibility for the achievement of group outcome.</p>
6	<p>Carry out processes that:</p> <p>require a command of wide-ranging highly specialised technical or scholastic skills</p> <p>involve a wide choice of standard and non-standard procedures, often in non-standard combinations</p> <p>are employed in highly variable routine and non-routine contexts</p>	<p>Employing:</p> <p>specialised knowledge with depth in more than one area</p> <p>the analysis, reformatting and evaluation of a wide range of information</p> <p>the formulation of appropriate responses to resolve both concrete and abstract problems</p>	<p>Applied:</p> <p>in managing processes within broad parameters for defined activities</p> <p>with complete accountability for determining and achieving personal and/or group outcomes</p>
7	<p>Carry out processes that:</p> <p>require a command of highly specialised technical or scholastic and basic research skills across a</p>	<p>Requiring:</p> <p>knowledge of a major discipline with areas of specialisation in depth</p> <p>the analysis,</p>	<p>Applied:</p> <p>in planning, resourcing and managing processes within broad</p>

	<p>major discipline</p> <p>involve the full range of procedures in a major discipline</p> <p>are applied in complex, variable and specialised contexts</p>	<p>transformation and evaluation of abstract data and concepts</p> <p>the creation of appropriate responses to resolve given or contextual abstract problems</p>	<p>parameters and functions</p> <p>with complete accountability for determining, achieving and evaluating personal and/or group outcomes</p>
8	<p>Involves skills and knowledge that enable a learner to:</p> <p>provide a systematic and coherent account of the key principles of a subject area; and</p> <p>undertake self-directed study, research and scholarship in a subject area, demonstrating intellectual independence, analytic rigour and sound communication</p>		
9	<p>Involves knowledge and skills that enable a learner to:</p> <p>demonstrate mastery of a subject area; and</p> <p>plan and carry out - to internationally recognised standards - an original scholarship or research project.</p> <p>Demonstrated by:</p> <p>The completion of a substantial research paper, dissertation or in some cases a series of papers.</p>		
10	<p>Involves knowledge and skill that enable a learner to:</p> <p>Provide an original contribution to knowledge through research or scholarship, as judged by independent experts, applying international standards.</p>		

Source: NZQA <http://www.nzqa.govt.nz/framework/levels.html>