STUDY REPORT

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Measuring construction industry productivity and performance

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Preface

This report is the culmination of a number of smaller work projects and additional primary research into the questions of industry and sub-industry level productivity and performance measures.

In addition to the results of new investigations completed as part of BRANZ Economic Research project QR0027, this report includes relevant inputs from Study Report 283 *Construction industry data to assist in productivity research Part Two* and Study Report 290 *Building industry performance measures Part Two*, which were studies produced to answer a range of different productivity questions.

Acknowledgments

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Measuring construction industry productivity and performance

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Ian Page and David Norman

Abstract

The issue at hand is how to improve productivity and performance in the industry that produces around 40% of all capital formed in New Zealand and that is vital for New Zealand's overall economic performance. To improve productivity and performance, we must first be able to describe and measure them.

Technically, **productivity** refers to the output or production of an industry or business divided by its inputs (labour and capital). Although business owners often talk about productivity, they typically mean productivity in the non-technical sense, meaning improving the **performance** of their firm. Performance is how effectively something achieves its intended purpose. In the case of the firm, this means how well it operates and maximises profits for shareholders.

Traditional measures of productivity, including labour, capital and multi-factor productivity suggest that there has been practically no growth in construction productivity in the last 20 years. There are many possible reasons for this, including failure to pass on price increases, the mix of what is built, how the industry responds to demand, uncertainty over workloads, and how quality, capital and labour units are measured. But firms have little control over these factors.

In reality, **most firms are concerned with maximising returns for shareholders**, rather than technical measures of productivity. To do this effectively (i.e. to perform well), a firm must maintain and develop its workforce, use time effectively, adopt new technologies and so on, all of which have the additional effect of boosting overall industry productivity. In other words, by focusing on running a business well and maximising performance, individual firms contribute directly to raising GDP through greater profitability, and therefore directly contribute to improved productivity.

Monitoring a firm's performance is crucial to its success. This study introduces a number of performance measures that focus on **financial viability**, **worker retention**, **innovation** and **client satisfaction** as a starting point for monitoring firm performance.

More work needs to be done on how to encourage uptake of these measures across firms, and the development of more comprehensive tools for improving project management, which builders have specifically identified as an area hindering performance.

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1. EXECUTIVE SUMMARY

This report is the culmination of a number of projects and additional primary research into the questions of industry and sub-industry level productivity measures and performance measures. It brings together our key findings to provide a summary of the key questions and recommendations for measuring productivity and performance.

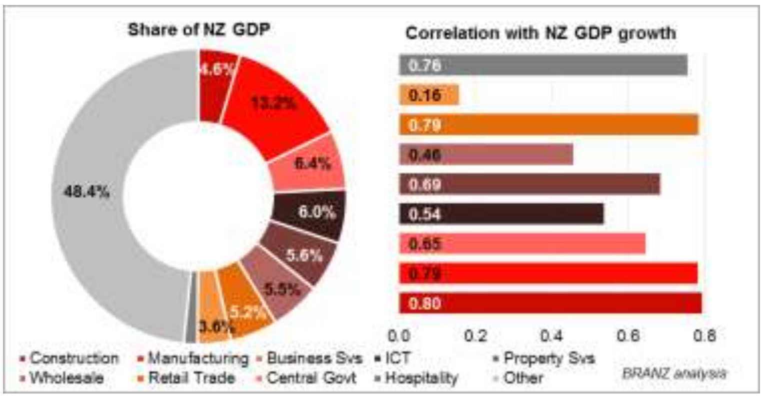
What we mean by productivity and by performance

Technically, **productivity** refers to the output or production of an industry or business divided by its inputs (labour and/or capital). Productivity measures (such as dollars of GDP generated per worker) are not very meaningful on their own; trends in productivity across time or industry comparisons are required to understand whether a productivity value is good or not.

Performance focuses on effectiveness, or how well something achieves its intended purpose. There is an overlap between performance and productivity; typically where performance of the firm or industry improves, productivity in the technical sense also improves. It is important to note that business owners often talk about "productivity" in a non-technical sense, where they really mean improving the "performance" of their firm (achieving better results as a business by using resources more efficiently, for example). In this study, we use the word "productivity" in the technical sense. We use "performance" to describe what business owners may colloquially refer to as productivity.

Why construction productivity matters

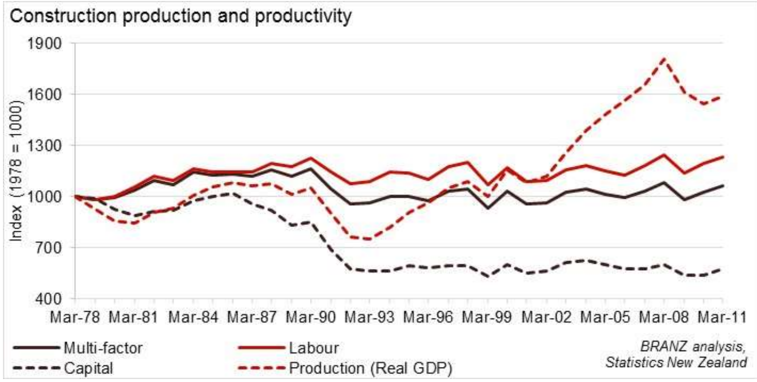
The construction industry accounted for 4.6% of New Zealand GDP in the March 2013 year. Yet the industry produces around 40% of all capital formed in New Zealand, and is more closely aligned with the overall performance of the New Zealand economy than any other industry.



Changes in production (or real GDP) in the industry have a 0.80 correlation with changes in the national economy, despite the small size of the construction industry. This is likely because the New Zealand construction industry is so dominated by residential building activity, and what happens in the residential construction sub-sector is indicative of the level of confidence in the New Zealand economy more generally.

In other words, the issue at hand is improving productivity and performance in the industry that forms 40% of all new capital in New Zealand, and that helps provide stability and confidence in the New Zealand economy overall.

Traditional measures suggest our productivity is poor



Traditional measures of productivity including labour, capital and multi-factor productivity suggest that there has been little growth in construction productivity since 1990.

Increases in production (GDP) appear to have been almost exclusively the result of increases in the number of workers and/or hours worked during boom times, rather than an increase in efficiency.

Why productivity appears to have been limited

There are a number of possible explanations for the near-zero growth in official productivity measures over the last 20 years. These include:

- **Failure to pass on price increases**: Prices the industry charges for its outputs have risen more slowly than what it is charged for its inputs.
- **What we build**: The New Zealand construction industry is based on residential construction, which is subject to large fluctuations in demand, and has lower labour productivity than other sub-sectors.
- **How the industry responds to demand**: Construction businesses hoard workers during downturns, leading to sharp declines in productivity, with the opposite true in upturns. Small businesses, which often don't benefit from the productivity improvements that come with scale and are less resilient to economic hardship, tend to proliferate during boom years and fail in bust years.
- **Uncertainty over workloads**: The industry has lacked the certainty of workload to invest in people, plant and technology.
- **Labour quality:** Hourly productivity has remained flat in construction although capital use has increased, suggesting no improvement in skill levels.
- **Measurement challenges**: Accurately excluding changes in quality from estimates of construction industry price increases is challenging, and if not successfully done, will lead to an underestimate of real GDP (and therefore productivity) growth. Similarly, measuring capital units accurately is hard.

From productivity to performance

Few firms are concerned with productivity in the technical sense (i.e. GDP divided by labour and/or capital units). The primary objective for commercial businesses is to maximise returns for shareholders. To meet this objective effectively, the business must do things such as maintain and develop its workforce, use time effectively, and adopt new technologies, all of which have the additional effect of boosting productivity. In other words, by focusing on running a business well and maximising performance, individual firms contribute directly to raising GDP through greater profitability, and therefore directly contribute to improved productivity.

This means that a focus on performance to ensure sustained profitability for individual firms is likely to lead to an improved contribution to productivity.

What really matters to the construction business owner

Previous work by BRANZ has already highlighted a number of factors that construction businesses believe hinder performance. These include a lack of skills, limited project management capability, and design detail challenges. These are all factors that reduce the efficiency with which the firm operates, negatively affecting the performance of the firm.

But there are a number of other factors that must be monitored to successfully run a business, beginning with a basic **understanding of the solvency, profitability, and return on assets** of the business. Added to these are the need to create **satisfied clients**. One key finding of our New Home Owner’s Survey has been that post-occupancy service is poor, with most homeowners needing to call back the builder, and satisfaction with how defects are fixed is low. The result is fewer **recommendations**, and therefore fewer **repeat and new clients**, which are other important performance measures.

A firm’s ability to **retain and develop skills** can be easily monitored and compared to industry averages. More difficult to measure in a quantitative sense, but no less important, are the steps a firm takes to **innovate across its management, marketing, services and operations**. The impacts of some of these improvements can be measured, such as the reduction in downtime or lost hours through adopting a project management tool that helps run a project more efficiently.

Where to from here?

This study introduces a number of performance measures that can be monitored at the firm level. Questions that remain for further work include:

- What can be done to encourage uptake of these types of measures across firms?
- What specific tools can be implemented to improve project management?

These are questions we intend to cover in a Research Project in the 2014/15 year.

2. INTRODUCTION

The construction industry adds around 5% to GDP, but more significantly, puts in place 40% of all capital formed in the economy.

However, official measures of productivity in particular suggest growth is sluggish. Yet these measures only go so far. Value added as an industry, or value added per worker, may not always account for changes in the **quality** of construction work put in place, and do not directly indicate good or bad performance by the industry.

Perhaps more importantly, few businesses care about **productivity** in the **technical** sense. Their focus is on productivity in the everyday sense, using resources at their disposal to maximise the success and profitability of the firm. This view of productivity is better defined as **performance**, which is the effectiveness with which something achieves its intended purpose (in this case, running a profitable, sustainable business).

This study therefore begins by considering a number of **traditional production and productivity measures** (as produced by Statistics New Zealand). In doing this, it draws on several previous reports completed by BRANZ on the topic, as well as adding additional new perspectives on the topic.

However, productivity measures only go so far in that they do not include the primary measures used at the firm level to determine success, or performance. Individual firms should be more concerned about factors such as:

- profitability
- return on assets / investment
- repeat business through customer satisfaction
- staff retention
- innovation and new technologies.

We therefore examine a number of **indicators of performance** at the firm level, commenting on the possibility of adopting these at the firm level to better monitor performance. Our contention is that if individual businesses get these key performance indicators (KPIs) in place, monitor them and act upon them, they will already be acting to improve the profitability of the firm. Improving the profitability of the firm will, by definition, improve technical productivity across the industry (all else held equal).

Making sense of technical terms

While this report aims at being as non-technical as possible, some technical terms are unavoidable. A glossary of technical terms is provided at the end of the report.

3. TRADITIONAL MEASURES OF PRODUCTIVITY

Statistics New Zealand (SNZ) produces labour, capital and multi-factor (also called total factor) productivity measures by industry. These are the headline figures that are often used to compare value added by various industries relative to other industries.

Official statistics do not provide sub-sector productivity estimates for the construction industry. Estimates of the three productivity measures are the basis of much of the discussion of low productivity growth in the construction industry. This report highlights several other ways to think about productivity and performance, but we start with the traditional measures.

3.1 Introducing three measures of productivity

The total **production** in the economy is referred to as Gross Domestic Product (GDP), which can be defined in at least three different but equivalent ways (income, expenditure and production definitions). The most appropriate definition of GDP in thinking of the firm or industry, is that GDP is: *the sum of operating surpluses before tax, interest and depreciation; and gross salaries*.

Total **productivity** is measured by dividing total production (output or GDP) by some measure of input (such as labour units and/or capital units).

Figure 1 Three measures of productivity

Labour productivity divides the GDP generated by the economy as a whole or any one industry by the number of paid hours of work (labour units) in the economy.

Capital productivity divides GDP by the volume of assets (such as buildings, machinery, computers and IT, and land measured in standardised "capital units") used to produce that output. An increase in capital productivity means more output (GDP) is being produced per unit of capital than previously.

Multi-factor productivity (MFP) accounts for changes in total productivity not caused by changes in the number of labour and capital inputs. MFP typically covers factors such as long-term technology changes; improved skills, management and training; and economies of scale.

3.2 Measuring the three types of productivity

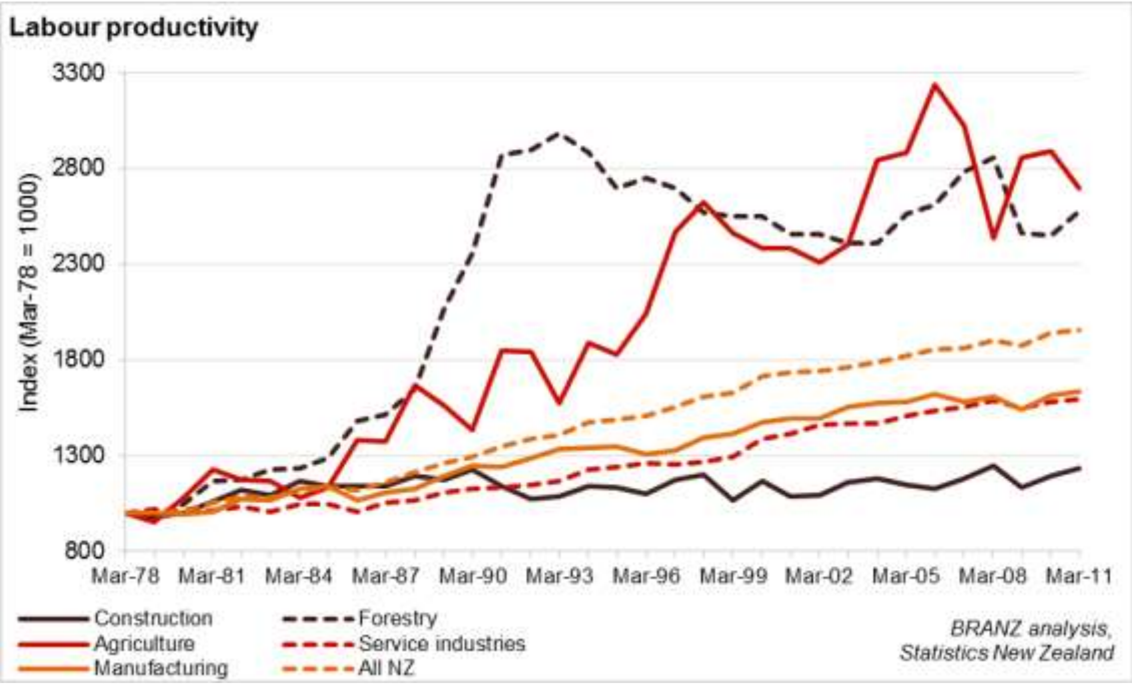
SNZ has produced estimates of changes in the three measures of productivity for the 33 years to 2011 at industry level. We analyse the numbers and comment on the implications for the construction industry.

3.2.1 Labour productivity

Labour productivity is arguably the most commonly-used measure of growth in productivity, as it measures how much value a worker adds to the economy in one hour of work, a relatively easily understood concept.

Figure 2 shows the growth in labour productivity indices for a number of comparator industries in New Zealand and the economy as a whole over the 33 years to 2011.

Figure 2 Labour productivity for comparator industries



Across the whole economy, production per hour of work has grown by 96% since 1978, or 2.1% per year. However, at the industry level, results have been far more mixed. According to these SNZ figures, productivity in the agriculture industry is up 170% since 1978 and in forestry, nearly 160%.

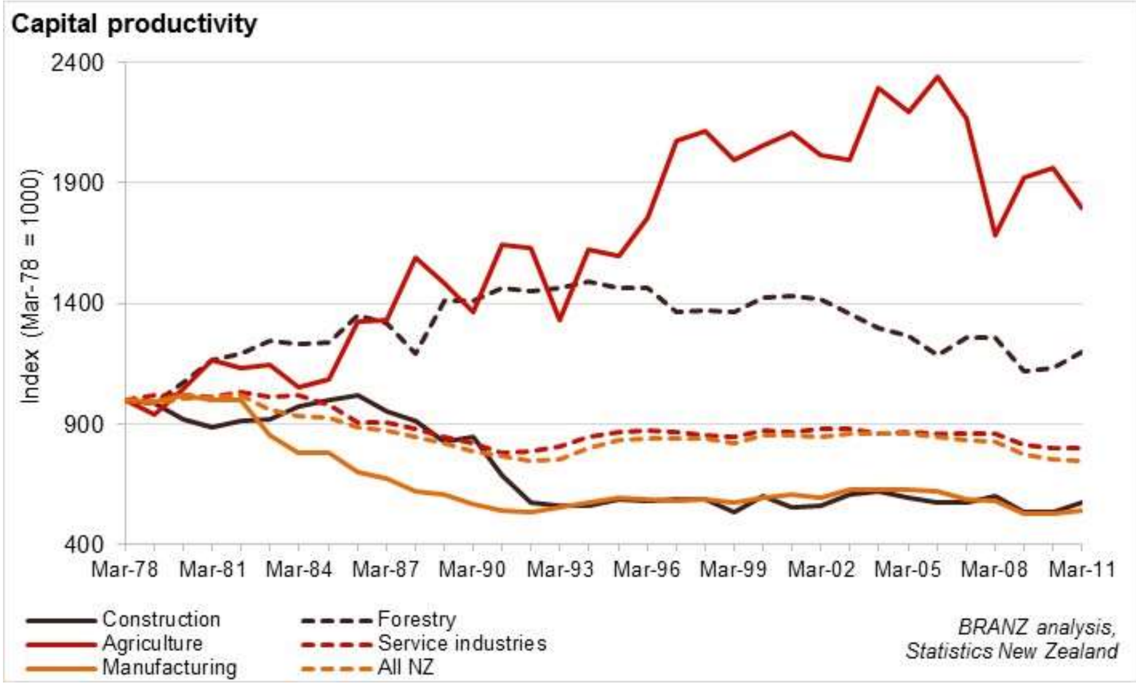
Labour productivity growth in construction has been among the lowest across all industries in New Zealand.

Labour productivity in the construction industry has lagged behind, with growth of just 23% over 33 years. Only a small number of manufacturing and service sub-industries (not shown on the graph) have grown more slowly. Nevertheless, manufacturing overall has seen growth of 1.5% a year, or 63% over 33 years.

3.2.2 Capital productivity

Capital productivity figures are typically used far less regularly as they are harder to understand conceptually and to measure accurately. Figure 3 shows the growth in capital productivity indices for a number of comparator industries in New Zealand, and the economy as a whole, over the 33 years to 2011.

Figure 3 Capital productivity for comparator industries



Trends here are not dissimilar to those for labour productivity. The agriculture industry, and to some extent forestry, appear to have dramatically improved the use of capital to boost productivity.

The rest of the economy, however, has not seen the same growth. Production per unit of capital in New Zealand has fallen by 25% since 1978. This in and of itself is not necessarily a worrying sign. A recent OECD report points out that capital productivity has fallen in most developed countries in the last 15 years, as capital has declined in cost relative to labour inputs.[1] As a result of this drop in relative cost, more capital units (particularly new technologies with constantly falling prices) have been used per unit of labour. This rapid increase in the use of capital units has led to a lower capital productivity.

> The fall in construction industry capital productivity has not been accompanied by improvements in labour productivity as more capital per unit of labour is employed.

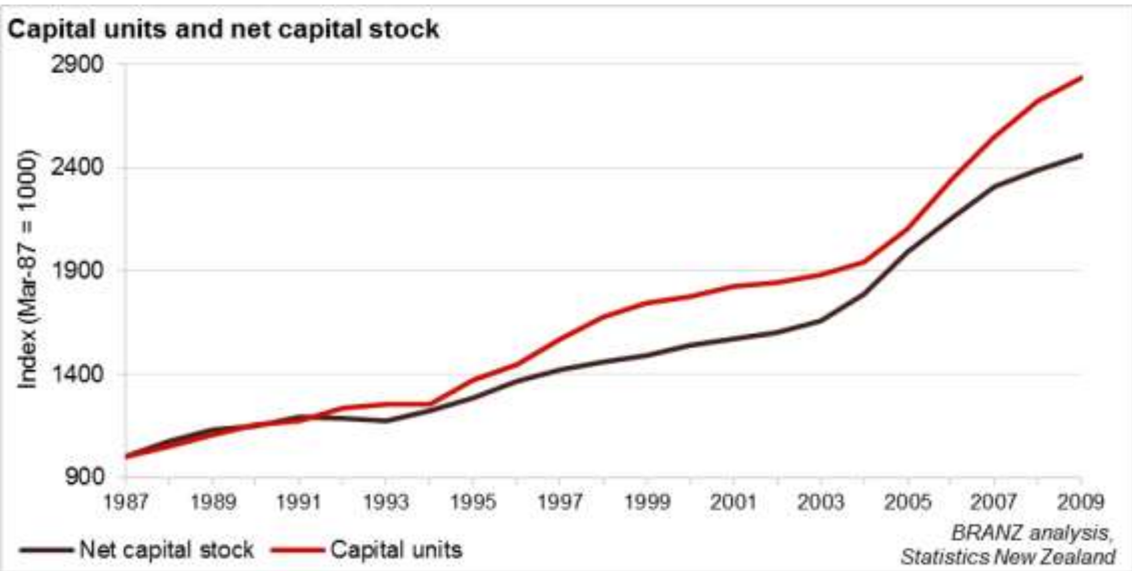
The construction industry has seen capital productivity fall further than most industries, down 42% over 33 years. Again, it is important to note that a fall in capital productivity is not necessarily bad in and of itself, if it is mostly the result of increased use of capital relative to labour resulting in greater **labour** productivity, as has been seen in the manufacturing industry.

[1] OECD. (2013). *OECD compendium of productivity indicators*.

However, in the construction industry, the decrease in capital productivity has been coupled with slow labour productivity growth. These figures suggest that cheaper technology (and associated greater spending on capital, which reduces capital productivity per capital unit) has not been accompanied by stronger growth in labour productivity in construction. If, as the OECD suggests, the fall in capital productivity is a result of the sharp uptake of capital, we would hope to see this translate into large improvements in labour productivity, but this has not been the case.

These estimates of capital productivity are reliant on accurate measurement of the number of capital units used by the industry in a given year. This raises further questions as to how capital units are estimated. A comparison of the SNZ estimates of capital units (indexed to 1987) relative to net capital stock in the construction industry yields a close relationship, but certainly not a one-to-one relationship, as highlighted in Figure 4.[2]

Figure 4 Estimated capital units have not risen at the same rate as net capital stock



The SNZ construction net capital stock index grew more slowly (in real terms) than the increase in capital units employed. This implies that the current measure of capital productivity is lower than would be the case if another measure like net capital stock was used to estimate capital productivity.

Accurately estimating the capital units in a given period (the "capital services" provided by an existing capital stock) requires the accurate estimation of a number of factors including:

- Mix of asset types within an industry
- Efficiency of each asset within each asset type in the year of analysis
- Asset life
- Age of the asset at the given time of analysis
- Nominal Gross Fixed Capital Formation (GFCF)[3]

[2] See the Glossary for an explanation of capital stock and capital units.
[3] We discuss GFCF in significant detail later. See also the Glossary for a technical definition.

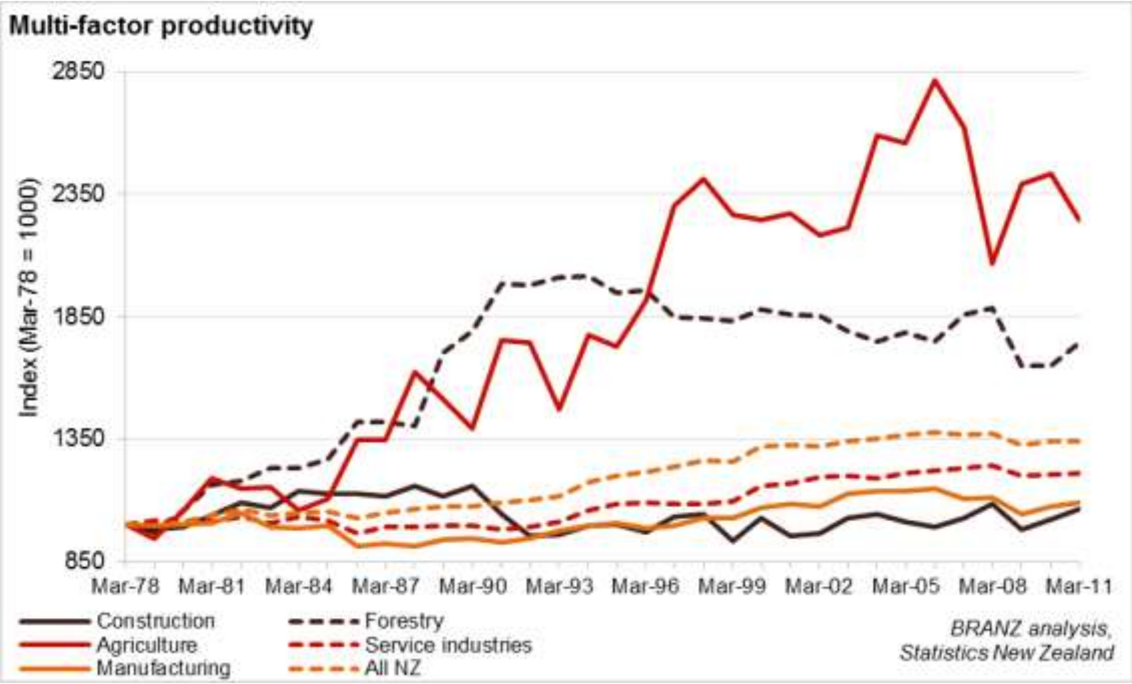
- GFCF price deflators to render constant price GFCF.[4]

3.2.3 Multi-factor productivity

MFP measures the influence of **management** and **technology** on output. It is a measure of performance after allowing for changes in labour and capital inputs and hence takes into account the impacts of managerial, process and technological efficiency.

Figure 5 compares MFP for the same group of industries examined in the sections on labour and capital productivity.

Figure 5 Multi-factor productivity for comparator industries



The all-industry MFP is shown in Figure 5 as the orange dashed line. With many sectors recording relatively low MFP growth, it is evident that much of the all-industry improvements come from the agricultural sector. Agriculture is one of the strongest performers mainly because of increases in agricultural prices (in real terms) in recent years but also because the industry has adopted several technologies that have dramatically improved efficiency. These have allowed, for instance, milk solids per cow to rise by 41% and milk solids per hectare to rise 57% in just 19 years since 1993.[5]

MFP growth in construction is hampered by the small scale of many operations, the volatility of the industry, and resultant limited investment in skills and technology.

Manufacturing and construction are bottom of the table, highlighting real challenges in terms of skills development and management. In the case of construction, this slow improvement is likely to be at least partially the result of the small scale of operations in New Zealand

[4] Statistics New Zealand. (2012). *Productivity statistics: Sources and methods (Eighth edition)*.
[5] Livestock Improvement Corporation. (2013). *New Zealand Dairy Statistics 2011-12*.

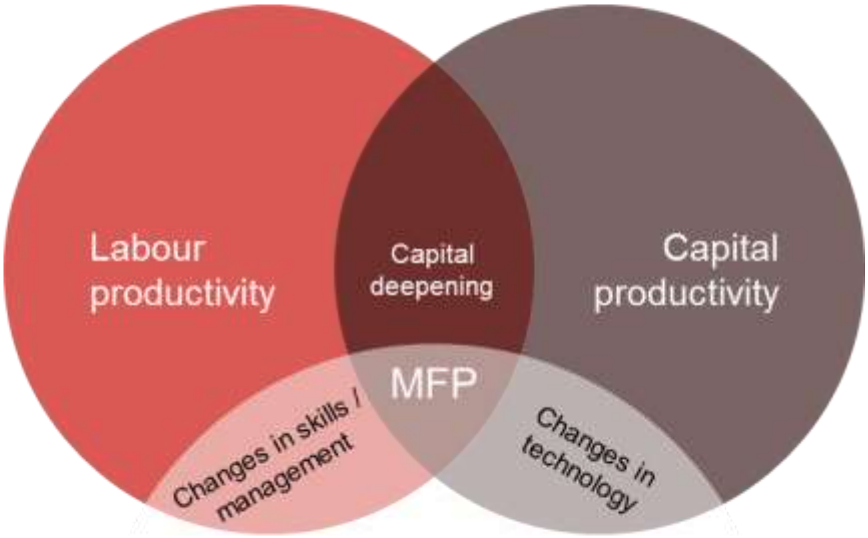
and the uncertainties associated with the boom-bust nature of the industry.[6] The small scale is exacerbated in construction by the "bespoke" nature of output with limited standardisation in buildings and even in horizontal construction.

3.3 Putting it all together: what does this all mean?

The previous section highlighted the fact that on the three traditional measures of productivity, the construction industry has performed poorly compared to the New Zealand economy overall since 1978.

The measures of productivity are inter-related, as graphically highlighted in Figure 6.

Figure 6 How labour, capital and multi-factor productivity (MFP) fit together



Total production changes as a function of changes across the three measures of productivity. For example, changes in labour productivity are a function of changes in the use of capital (capital deepening) and changes in skills (as captured under MFP). Capital productivity is a function of changes in labour inputs per unit of capital (capital deepening), and improved technology (as captured under MFP).

Figure 7 summarises the three measures again for the purposes of this discussion, as well as showing the change in construction GDP in real terms.

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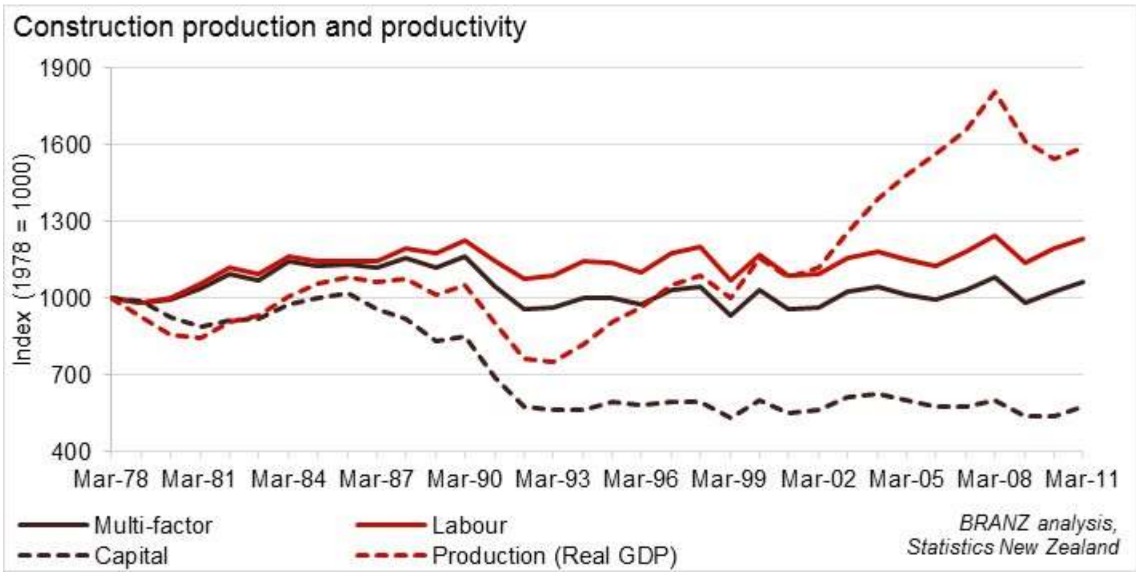
[6] See for instance PwC. (2011). *Valuing the role of construction in the New Zealand economy*.

Figure 7 Construction productivity indices



Most concerning is the flat-lining of all three measures since the early 1990s, suggesting the following:

- **Labour productivity**: The industry has been unable to significantly increase the GDP contributed by each hour of work through up-skilling, better processes, or better use of capital. This indicates that the unprecedented rise in production between 2002 and 2008 was a function of more labour units (hours worked) rather than an increase in the value added per worker. This is borne out by statistics that show that the construction industry added one in seven new jobs in New Zealand between 2000 and 2010.
- **Capital productivity**: This measure has all but halved, which means in effect that twice as many capital units are used per unit of production today as in 1978. The biggest fall in capital productivity occurred between 1986 and 1992. During this period, and most notably between 1990 and 1992, production also fell sharply, indicating that the decrease in capital productivity was at least partly due to a **reduction in production**, rather than an increase in capital units employed.
- **MFP**: This measure has been flat across time, and indicates that, according to this official measure, up-skilling, improved processes, adoption of new technology and better management have been all but absent in the industry over the last 33 years.

The lack of MFP growth suggests better organisation of labour and improved use of technology and skills development offer the most scope for efficiency gains.

In summary then, while there has been an increase in the official production (GDP) measure, this can be largely explained by a rise in the number of workers in the industry, rather than strong gains in labour productivity. If anything, capital units appear to be less productively employed than in the past, while the lack of MFP growth suggests technology and people skills have not grown as much as would be desired. Better organisation of labour and improved use of technology and skills development appear to offer the most scope for efficiency gains.

3.3.1 Looking to the future

The target of the Building and Construction Sector Productivity Partnership (2010) is to lift productivity by 20% by 2020.

Our analysis introduced above suggests that to do this, the focus will need to be on improving MFP, including improving quality, uptake of innovation including prefabrication and standardisation, and management expertise.

> To meet the industry's goal of 20% productivity improvement by 2020, the focus will need to be on altering the trajectory of MFP growth.

The improvement in MFP is to be measured as a trend rather than using any particular year as the base point. One approach to measuring this MFP growth would be to establish a five-year productivity index average to 2010 as the base and target a 20% improvement for the five years centred on 2020. This would suggest a target for MFP of 1226 in the five years to 2022, up from an average of 1022 in the five years to 2010.

4. FACTORS AFFECTING PRODUCTIVITY

Given the mediocrity of construction industry growth on all three official measures of productivity, it is worth exploring some of the possible reasons for the poor performance. This chapter explores reasons including:

- **Failure to pass on price increases**: Prices the industry charges for its outputs have risen more slowly than what it is charged for its inputs.
- **What we build**: The New Zealand construction industry is based on residential construction, which is subject to large fluctuations in demand, and has lower labour productivity than other sub-sectors.
- **How the industry responds to demand**: Construction businesses hoard workers during downturns, leading to sharp declines in productivity, with the opposite true in upturns. Small businesses, which often don't benefit from the productivity improvements that come with scale and are less resilient to economic hardship, tend to proliferate during boom years and fail in bust years.
- **Uncertainty over workloads**: The industry has lacked the certainty of workload to invest in people, plant and technology.
- **Labour efficiency:** Over time, labour should be better able to employ capital, management and skills to increase output per hour worked in real terms, but this has not been the case in construction.
- **Measurement challenges**: Accurately excluding changes in quality from estimates of construction industry price increases is challenging, and if not successfully done, will lead to an underestimate of real GDP (and therefore productivity) growth. Similarly, measuring the number of capital units accurately is hard.

4.1 Factor One: Failure to pass on price increases

Evidence suggests that input prices for the construction industry have risen sharply over the last several years, and that the rise in input costs have not all been passed onto the purchaser of construction services, meaning that the profitability (and therefore measured productivity) of the industry has been affected.

> The cost of business has increased faster than prices charged for construction, reducing productivity.

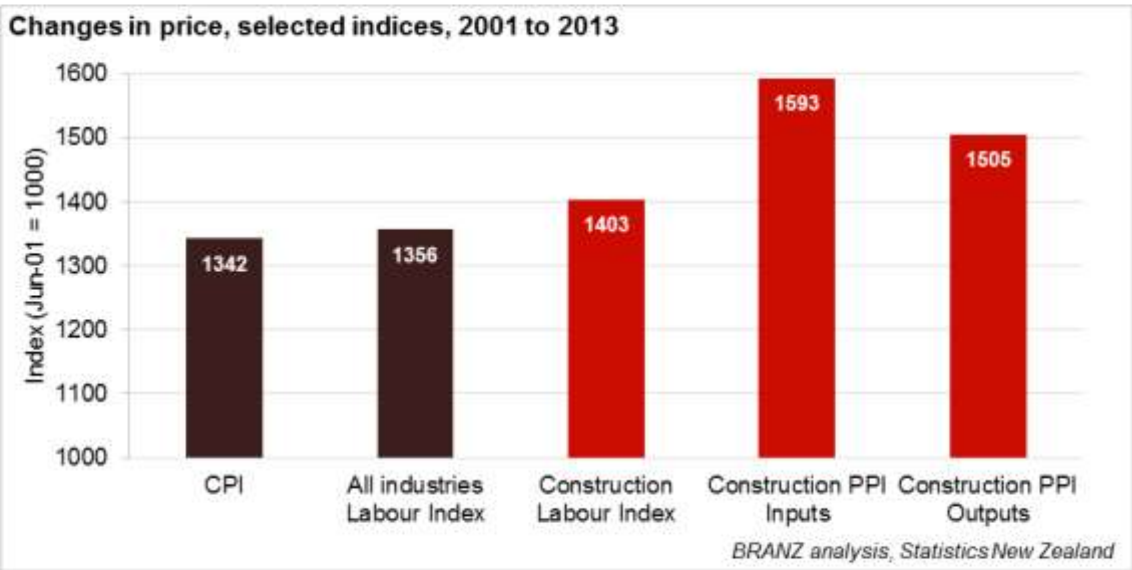
Figure 8 highlights changes in some of the key price indices over the last 12 years.

Put simply, the costs of producing what the construction industry makes – houses, commercial buildings, and non-building infrastructure – has increased rapidly, according to official statistics.[7] As input prices have risen, these costs have not all been passed on, meaning lower profitability, and therefore productivity within the construction industry.

[7] SNZ produces a series of quarterly indices collectively known as the Producers Price Indices (PPI). The **input** index (PPI:Inputs) measures cost of production including sub-contractors but excluding direct labour costs. The **output** index (PPI:Output) measures the prices received by the industry for its outputs.

The Consumers Price Index (CPI), the main indicator of the cost of living in New Zealand, grew 34% over the last 12 years. Economy-wide labour costs grew slightly faster, but both labour costs and input costs (PPI Inputs) into the construction industry grew faster (40% and 59% respectively). As a result, construction industry output prices (PPI Outputs) rose sharply, up 50%.

Figure 8 Construction input prices have risen sharply between June 2001 and June 2013



Why these cost increases have not all been passed on is an interesting, but separate question. While we do not examine it here, economic theory suggests that producers typically absorb price increases only in the case of competition, or reduced demand for their goods and services. This does seem to fit with the experience of the construction industry in New Zealand, where rises in input costs have exceeded rises in output prices at times when the construction industry has been slow (see Figure 11). The trend tends to be reversed in boom years.

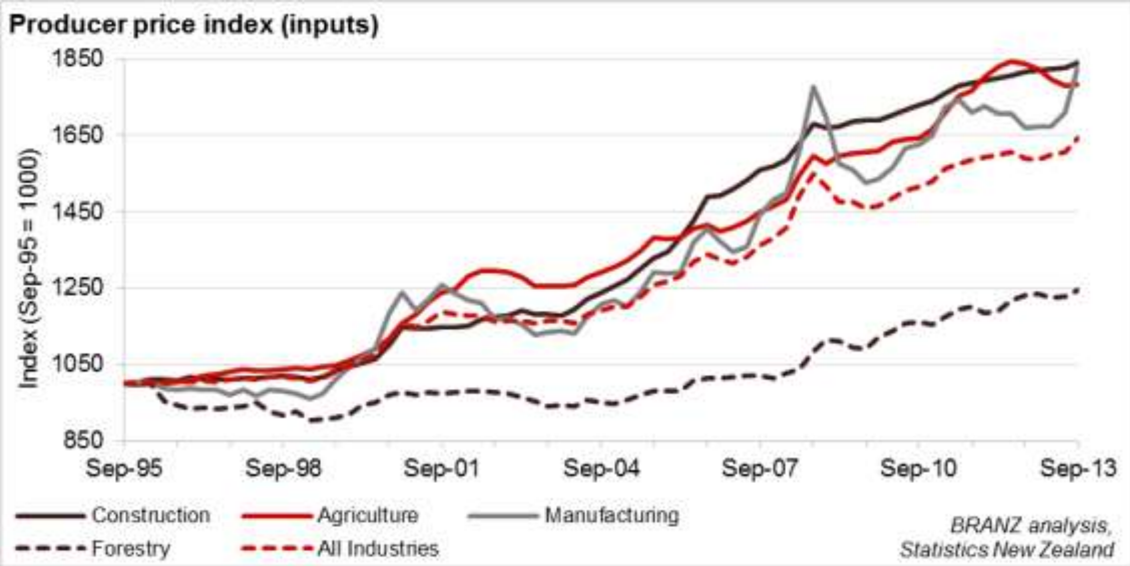
We now examine theses cost and revenue categories in greater detail.

4.1.1 Inputs into production: Passing costs on

Naturally, if the costs of producing a product (such as a house or a road) increase faster than the price charged for that product, the returns to the producer fall in real terms, and productivity will fall. An important question is therefore whether input prices in the construction industry are rising faster than output prices.

Figure 9 presents growth in producer input prices for a number of industries and for New Zealand overall for the last 18 years.

Figure 9 Construction input prices have risen faster than in comparator industries

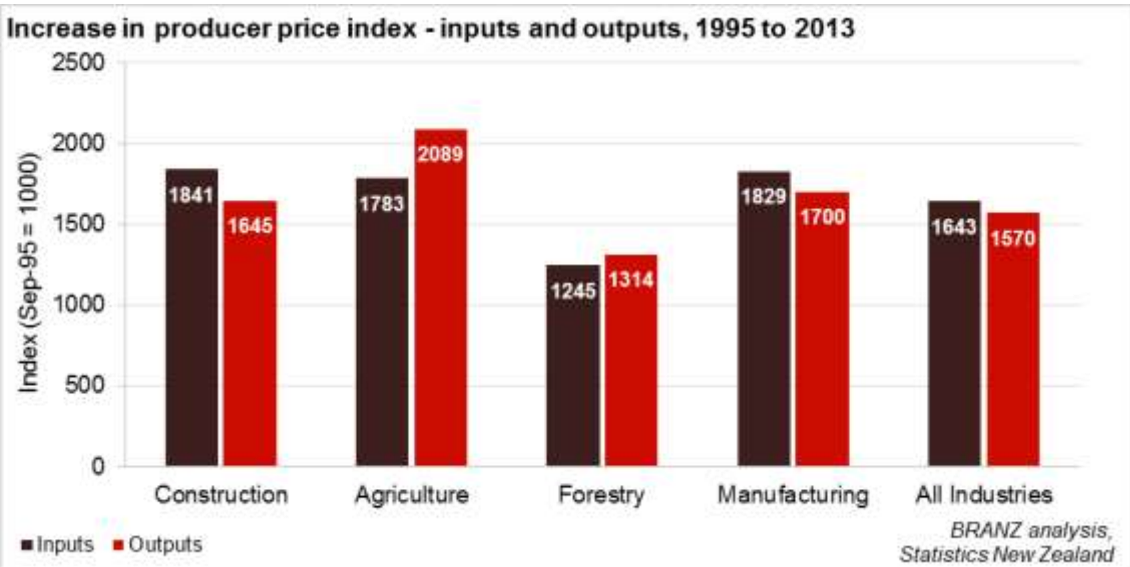


Since 1995, official statistics indicate that input prices into the construction industry have risen by 84%, or 3.4% per year, higher than the key comparator industries, and 20% higher than the national average for all producer prices. To provide further perspective, over the same period, the CPI rose only 49%, or just 2.2% a year.

This raises the question of whether the industry is able to pass on these input price increases to the purchasers of its products. We are able to answer this question by considering changes in the PPI outputs index relative to the PPI inputs index over the last several years.

Figure 10 presents changes in the PPI for both inputs and outputs for comparator industries for the period from 1995 to 2013.

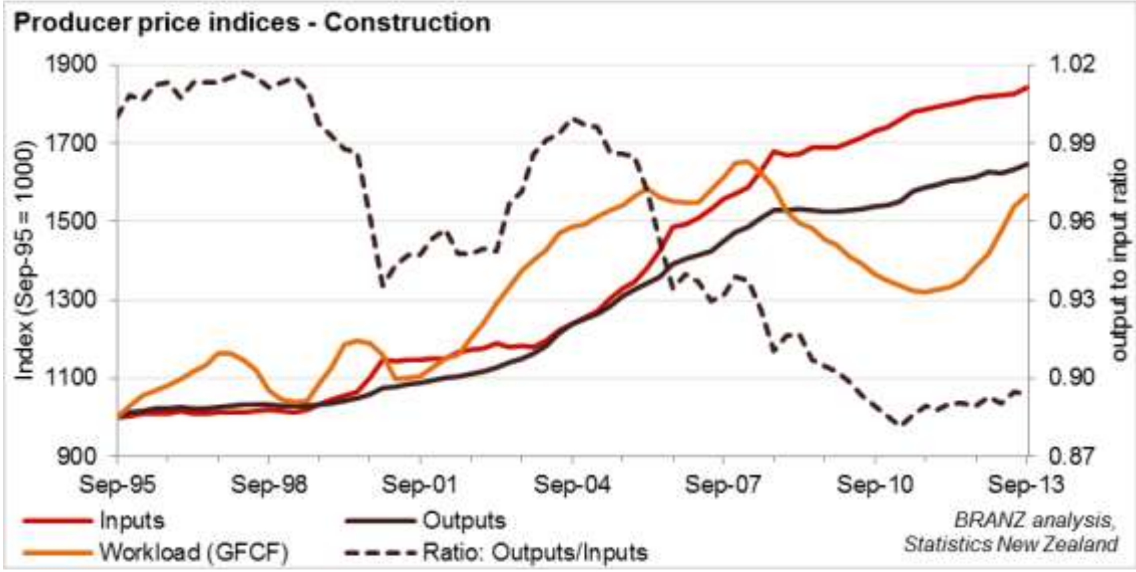
Figure 10 Input prices have risen fastest relative to output prices in construction



Interestingly, across the economy as a whole, input prices have increased faster than output prices, meaning that overall, profit margins have been squeezed. Yet the gap between input price rises and output price rises is by far the widest in the construction industry, with input prices rising 16% more than output prices.

We examine this point in greater detail below because a ratio of output prices to input prices for the industry is potentially another measure of efficiency. Figure 11 presents the two PPI indices and the ratio of changes in output prices to input prices.

Figure 11 Construction businesses are less able to recoup input costs than before



Over the last 18 years, construction industry **input** prices have grown faster than **output** prices. This means that the construction industry has not passed on all the price increases it has faced on its inputs. This will likely be reflected in **lower profit margins**, which in turn reduce the value added by the industry in the official measure of productivity.

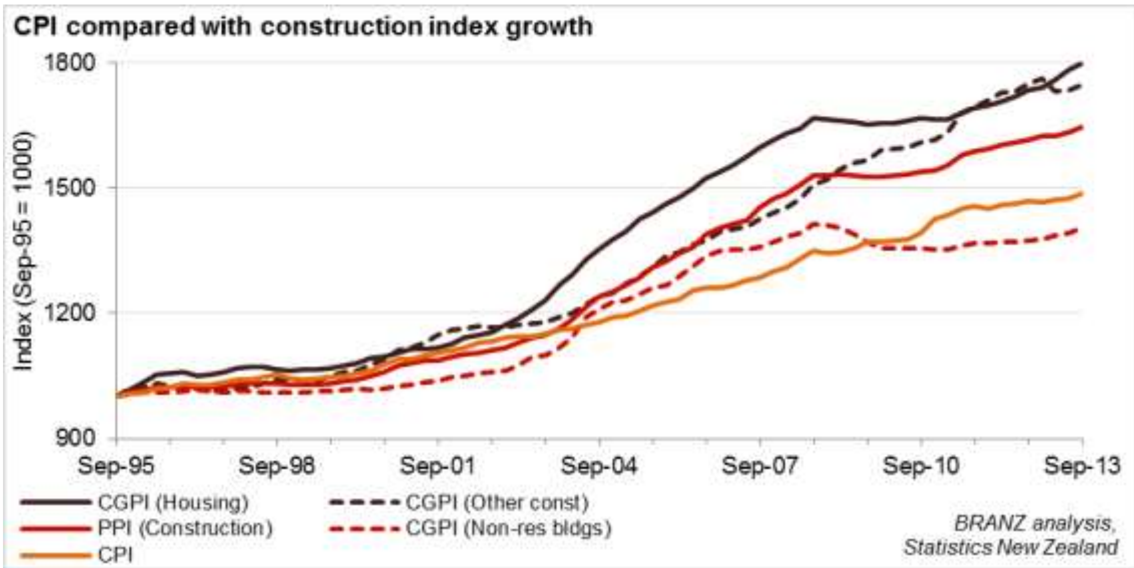
The extent to which input prices rise faster than output prices appears to depend to some extent on the point in the economic cycle. The slower years from 1999 to 2003, and from 2007 to 2012 have seen input prices increase faster than output prices, while the boom years of 2003 to 2006 saw the trend reversed.

> The PPI indicates that input costs have risen faster than output prices charged by the construction industry. This translates into lower profitability for businesses, and therefore lower productivity.

Price increases have been passed on at different rates across the different sub-sectors of the construction industry, making it harder to identify if prices have increased as the result of genuine changes in nominal prices, or as a result of **quality improvements** that have not been successfully separated out from price increases.

Figure 12 compares the PPI and three sub-sector Capital Good Price Indices (CGPI) with changes in the overall cost of living as measured by the CPI. The CGPI measures changes in the cost of producing **a "standard" basket of outputs** from each sub-sector, such as a "standard house" produced by large-scale builders across the country. The PPI measures the change in **output prices** for the industry (rather than for a particular product like housing).

Figure 12 Construction price indices have risen faster than the CPI



Over the 18 years to September 2013, the CPI rose by 2.2% a year. The CGPI for housing rose 50% faster over the time period, at a rate of 3.3% a year. The PPI (construction), as a price index of the outputs of the whole industry, unsurprisingly rose at a rate midway between the CGPI indices.

The reasons for the large increase in the CGPI (Housing) above the CPI after 2003, may reflect a jump in profits during the housing boom in the mid- 2000s, but may also include additional compliance costs associated with leaky building measures, new health and safety regulation, and new energy efficiency requirements among other things.

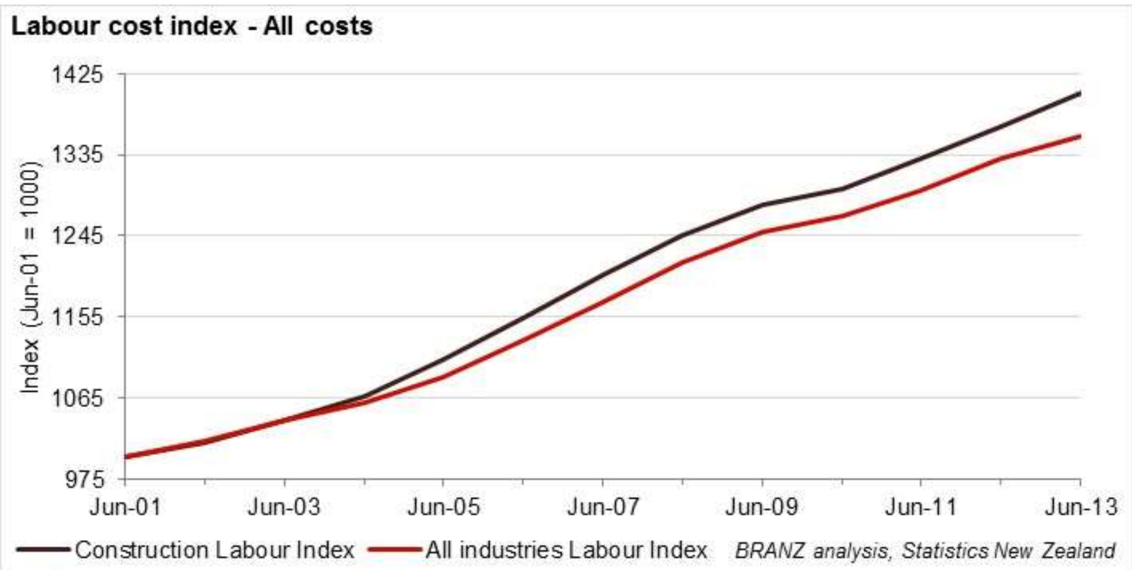
This begs the question of whether the price changes recorded in the PPI and CGPI only reflect a change in nominal prices, or in fact also count quality changes (such as improved energy efficiency), that should not be captured as price changes, as they are a genuine improvement in the quality of the product. In other words, some changes in the price of a construction output over the last 20 years may be the result of receiving a better product rather than a simple price increase.

The short answer is that SNZ makes an effort to exclude quality changes from its estimates of price increases, but this is very challenging to do. We explore this question in greater detail in section 4.5.

4.1.2 Wage rates

Construction wage rates have risen fast over the last 12 years relative to other industries shows, as highlighted in Figure 13.

Figure 13 Labour costs in construction have risen faster than the economy-wide average



Since 2001, construction labour costs have risen by 40%, or 2.9% per year. Part of this is due to strong demand and the accompanying shortage of construction workers New Zealand experienced during construction booms in the mid 2000's. However, it is surprising that even during the slowdown in the construction industry, the premium in wage increases experienced in the industry remained, such that by June 2013, wage rates in construction had risen around 5% more than the economy-wide average.

The implications of this above-average performance in wages for construction industry workers and the fact that wages form a large component of GDP mean at least one the following:

- Labour productivity in the industry has risen such that the wage increases achieved by workers are justified, a possibility that is in conflict with the official statistics that suggest productivity growth in the industry has lagged other industries in recent years.
- An ongoing shortage of suitably qualified people even during the economic downturn allowed construction workers to command a premium for their services, meaning businesses have been passing on more of their surpluses to workers, resulting in lower profits for businesses.

> Wage rates have risen fast in the construction industry, indicating either that productivity has grown and official statistics don't capture this, or that workers are capturing a greater share of business profits.

4.2 Factor Two: What we build

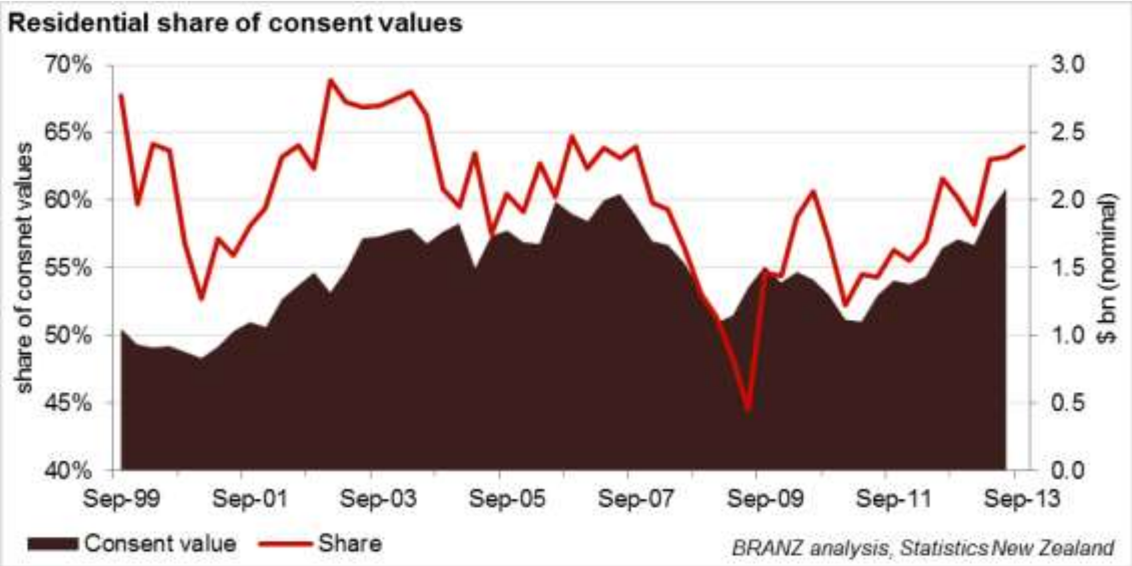
What is built at different times across the economic cycle also affects total production (or value added) and therefore productivity. Changes in residential building activity (the cornerstone of the New Zealand construction industry) appear most strongly linked to changes in the industry's overall labour productivity. This appears to be because residential construction firms are least likely to lay off excess capacity as work dries up, which means the residential sub-sector has most to gain from increased production per worker when demand recovers (see section 4.3.1 for instance).

The quality of houses built during economic downturns also appears to improve, as the lower end of the market falls away, leading to a rise in the proportion of larger, higher quality houses. As a result, the dollar value per square metre of consents issued has consistently risen faster than the cost to build a “standard” house (as determined by the Capital Goods Price Index for housing) even during the economic downturn. In other words, the average value per square metre of housing put in place in the last six years has grown at a rate that suggests a significant quality improvement in addition to price rises.

4.2.1 Types of construction work

Productivity may be affected by the types of construction work being undertaken, and by the ability of the workforce to move between different sub-sectors. Figure 14 presents how the mix of consent types (residential, non-residential, and non-building) have fluctuated over the economic cycle for the last 14 years.

Figure 14 The residential share of consent values dominates but has varied across time



Residential construction consent values clearly dominate the construction industry, but the value of residential construction consents has fluctuated between 69% (in December 2002) and 45% (in March 2009) of all building consent values. In other words, residential construction accounted for 33% less of the total value of new work being consented in 2009 compared with 2002, a major change.

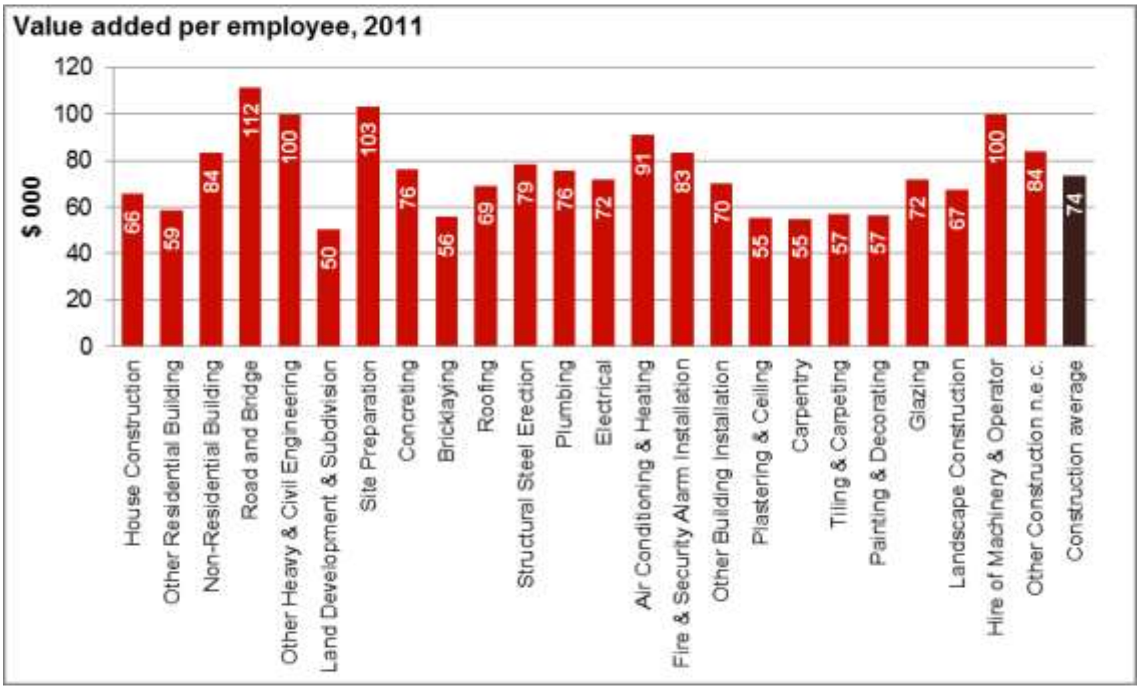
If there are major variations in the **labour productivity** of different sub-sectors, the switch from residential to non-residential construction and back again may explain some of the sluggishness in productivity growth, as large numbers of workers have to migrate across sub-sectors. Alternatively, if skills are not transferrable from one sub-sector to another, there may be labour shortages in different sub-sectors across the economic cycle.

To supplement the official productivity data at industry level, SNZ uses tax information to calculate labour productivity for 24 sub-industries in the construction industry. Labour productivities for 2011 and 2012 are shown for each of these sub-industries in Figure 15.

Labour productivity varies quite markedly between sub-industries. Most notably, the non-residential and non-building construction industries tend to have far higher labour productivities. This will in part be because these sub-industries are more capital-intensive than others and they will have higher labour productivities as a result.

At the other end of the spectrum, the finishing trades such the plastering, tiling, carpentry and painting sub-industries use little capital equipment and have comparatively low productivity.

Figure 15 Residential construction has one of the lowest labour productivities



Labour productivity in the residential sub-sector was around $60,000 per worker in 2011, compared with an average of around $100,000 in non-residential and non-building construction.

We investigated a number of potential relationships between factors that may explain why productivity rises or falls at certain times of the economic cycle as construction activity switches between sub-sectors. The list of variables is set out in Figure 16. We discovered few strong relationships.

Figure 16 A number of productivity–work type relationships were investigated

Y-axis (dependent variable)	X-axis (independent variable)
• Labour productivity • Capital productivity • MFP • Changes in labour productivity • Changes in capital productivity • Changes in MFP	• Residential gross fixed capital firmation (GFCF) • Non-residential GFCF • Other construtcion GFCF • Total GFCF • Residential GFCF lagged 3, 6, 9, 12 months • Non-residential GFCF lagged 3, 6, 9, 12 months • Other GFCF lagged 3, 6, 9, 12 months • Total GFCF lagged 3, 6, 9, 12 months • Switch between residential and non-residential GFCF • Changes in Residential GFCF • Changes in Non-residential GFCF • Changes in Other construction GFCF • Changes in Total GFCF • Residential consent values this year, and lagged by 3, 6 and 9 months • Non-residential consent values this year, and lagged by 3, 6 and 9 months • Other construction consent values this year, and lagged by 3, 6 and 9 months

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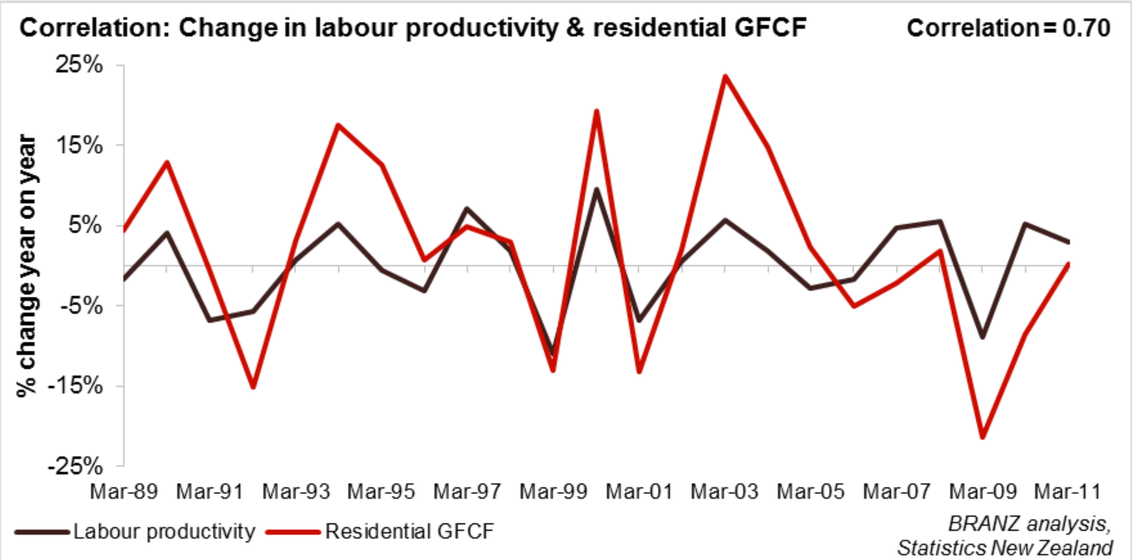
In fact the only strong correlation was between the **annual changes** in residential gross fixed capital formation (GFCF) and **annual changes** in the three measures of productivity.[8]

The relationship between changes in **residential** GFCF and **labour** productivity is highlighted in Figure 17.

Figure 17 Changes in residential GFCF and labour productivity are strongly correlated

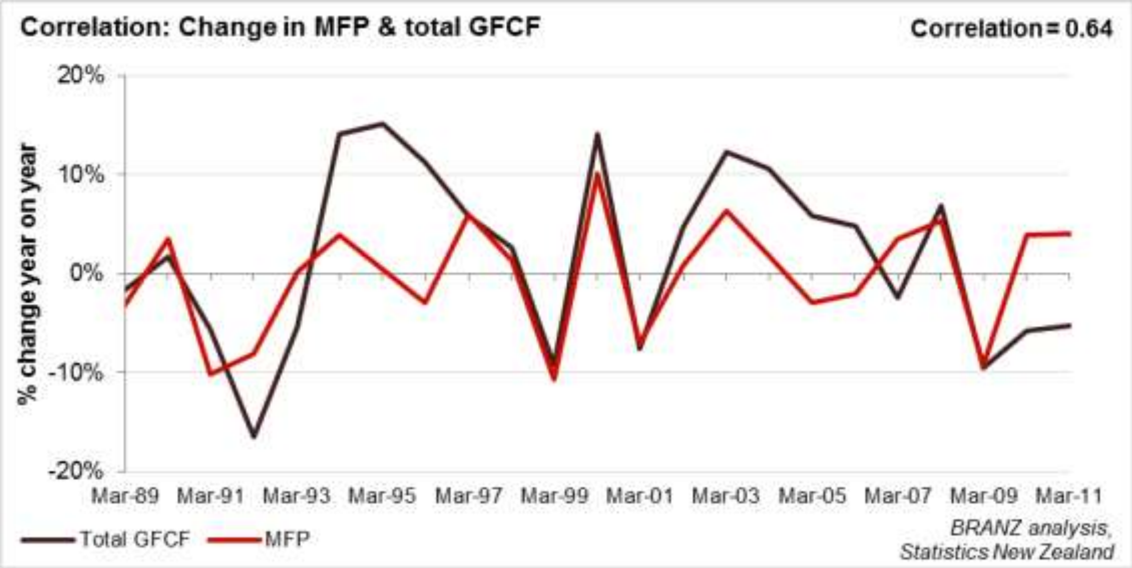


Over the 22 years to March 2011, as residential work put in place (GFCF) fell in real terms, labour productivity tended to fall. The relationship was particularly evident in the rises and falls between 1989 and 1991, between 1996 and 1998, between 1999 and 2001, and between 2006 and 2010.

Another interesting correlation exists between changes in **MFP** and **total** GFCF, as presented in Figure 18.

[8] The value of new residential buildings put in place within a certain time (usually a year).

Figure 18 Changes in MFP and construction workloads are correlated



With a few notable exceptions (such as the period from 1994 to 1997), changes in MFP have been closely aligned to changes in capital put in place (GFCF). The figure indicates that, in general, MFP rises as output rises. The logical explanation for this trend is that there are **large numbers of under-utilised labour units** that rapidly increase in productivity during times of stronger construction demand.

Changes in the residential sub-sector workload appear most closely correlated with changes in labour productivity. Changes in labour productivity also appear to have the most meaningful impact on MFP.

The reasons for reaching this conclusion are:

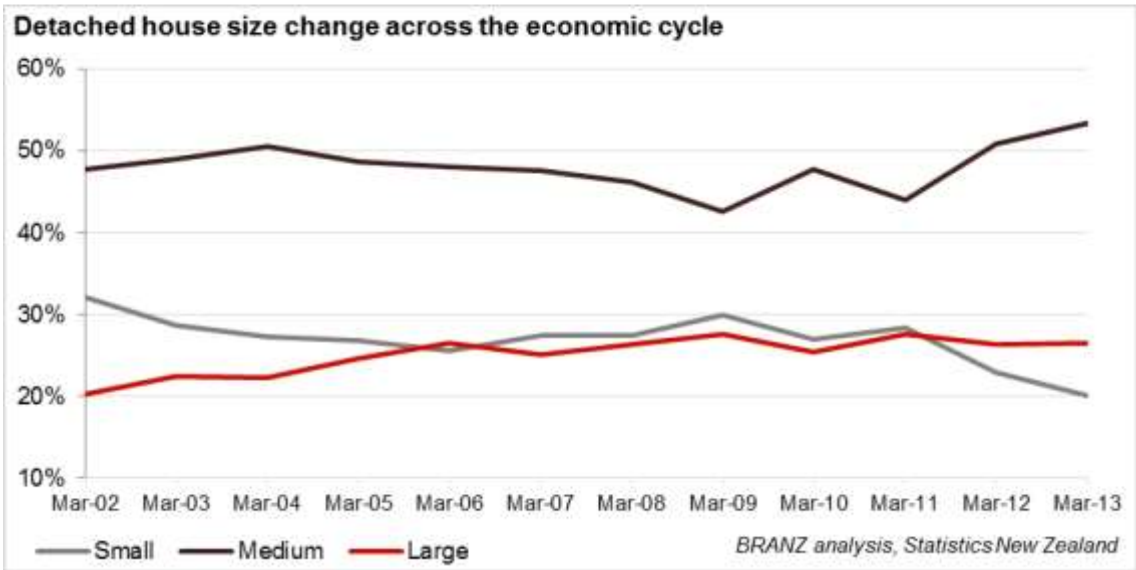
- The strong correlation between workloads and jobs filled (see later discussion and Figure 22) suggesting workers are under-utilised during downturns (rather than being made redundant or moving to other industries)
- The mathematics of calculating MFP: Production divided by the sum of capital and labour units, with the weighting of labour units being far higher than capital units (e.g. 76% versus 24% in 2011). This means the relationship between number of workers, labour productivity, GFCF and MFP is particularly strong.
- The SNZ assumption that capacity utilisation rates remain constant for capital units, which means the most important variable in the MFP equation is simply the number of labour units. Anecdotal evidence suggests that expensive plant such as earthmovers and tower cranes have long periods of no use.

4.2.2 Size and quality of houses

It is not only the type of construction being undertaken – residential, non-residential, or non-building – that might affect productivity. Even what is built **within** the residential sub-sector for instance, may affect productivity.

It is worth considering changes in residential building across the economic cycle. The size mix of detached houses has changed in recent years, as shown in Figure 19. In the figure, small houses are defined as houses under 150 square metres. Large houses are larger than 250 square metres.

Figure 19 Even in the downturn, the shift toward larger houses continued



Over the 11 years since 2002, the percentage of small houses has dropped from over 30% of houses to around 20%, while the proportion of large houses has risen from around 20% to 27%. Medium sized houses account for a little over 50% of new detached houses, up from 48% in 2002. Most interestingly, the economic downturn has, if anything, **increased** the proportion of medium and large houses being built. In particular, the proportion of medium houses has grown sharply after a brief dip in the early part of the downturn from 2007 to 2009.

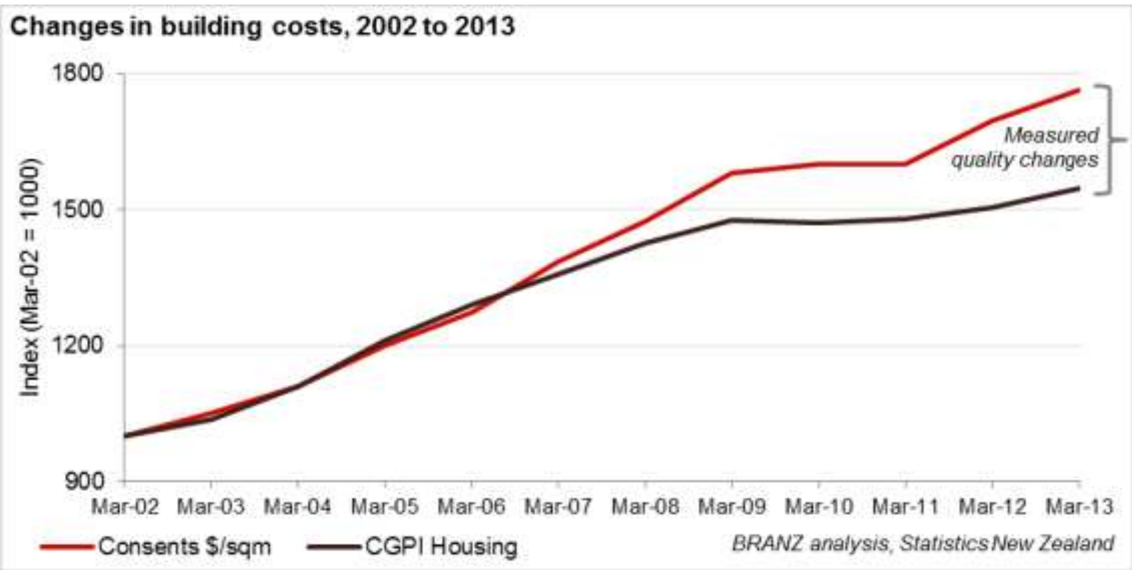
In other words, the proportion of larger houses has risen across the economic cycle, including during the downturn from 2007 to 2012. One explanation may be the asymmetric impact of the slowdown, with the lower end of the new build market being hit harder than the upper end of the market.

Across the downturn, the proportion of larger (medium and large) size houses being built grew as the lower end of the market fell away.

If the cost per square metre to build a house was the same across all house sizes, or even dropped due to economies of scale on larger houses, this trend toward larger houses suggests the dollars per square metre estimates on building consents should show little or no growth over the last 11 years.

Yet this is not the case, as evidenced by Figure 20, which shows the average cost per square metre of consented detached houses across New Zealand in the 11 years to 2013. The figure also shows changes in the Capital Goods Price Index (CGPI) for housing for the same period.

Figure 20 Consent values per square metre have risen faster than the CGPI (Residential)



The average cost per square metre of consents for detached houses issued over the 11 years has risen 76%, or 5.3% per year. The flattening out in the dollars per square metre coincides with the flattening out in house sizes being built between 2009 and 2011, before the acceleration again toward larger houses highlighted in Figure 19.

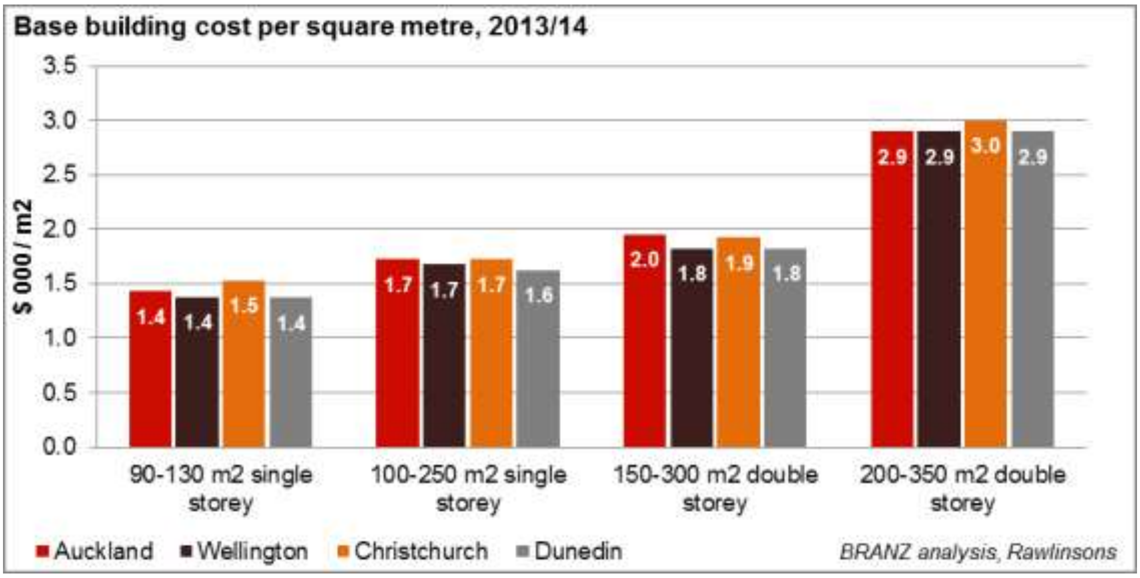
Over the same period, the CGPI for housing has risen more slowly. The CGPI measures the changes in costs to build a "standard" house from house plans used by large and medium builders, and an apartment model. The SNZ survey of builders used to estimate changes in the CGPI is structured in a way that aims to capture quality changes separately from nominal price changes.

While the CGPI tracked quite closely with the price per square metre of consented detached houses between 2002 and 2007, the gap has widened significantly since then. This suggests that **some quality improvements** especially since 2007 (such as the introduction of improved insulation requirements) **have been successfully separated out of the CGPI**. As a result, the dollar value per square metre of consented detached housing grew almost 22% more than the CGPI for housing over the 11 years to March 2013. This gap between the two indices indicates a rise in the quality of new housing.

> Cost per square metre grew faster than official estimates of price increases in the house-building sub-sector, as quality improvements (both enforced and elective) occurred.

One explanation for cost per square metre rising as larger houses become more common is that larger houses tend to have an upper storey, which increases the cost per square metre. Other reasons are likely to include the fact that larger houses often have higher specifications for materials and finishes than smaller houses. Both these explanations are highlighted in Figure 21.

Figure 21 Base building cost per square metre tends to rise with house size



Smaller, simple houses have a base cost of around $1,500 a square metre to build, according to Rawlinsons (2013).[9] Double storey houses introduce an additional level of complexity, pushing prices to around $1,800 a square metre. But large houses (between 200 and 350 square metres in size) tend to see a large increase in quality, yielding far higher costs per square metre.

The move toward larger, higher quality houses therefore suggests a significant overall rise in the quality of houses being built over the last several years.

4.3 Factor Three: How the industry responds to demand

This section further explores how construction firms respond to changes in the economic cycle and how that may affect productivity.

Employment appears to be sticky; declines are not as sharp as might be expected during downturns. Larger firms tend to be more resilient to tougher economic times, and workers tend to be less geographically mobile than anecdote suggests.

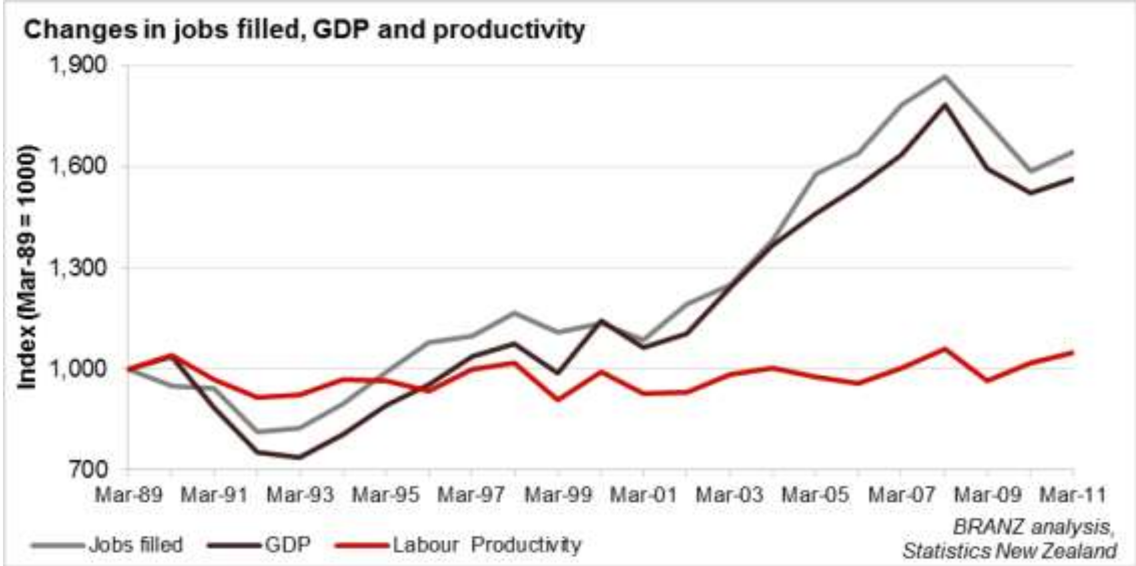
4.3.1 Workloads versus employment

Figure 22 presents changes in the number of jobs filled, GDP and labour productivity over the 22 years to March 2011.

As this report has already highlighted, labour productivity has been flat over the last 22 years. However, the trends in employment and overall economic activity in the industry are worth considering in greater detail. The figure shows that at no time since 1991 has employment growth been in line with GDP growth, other than in the March 2000 year. In other words, when demand in the industry falls, there has been a consistent attempt to retain skills in the industry.

[9] Rawlinsons. (2013). *Rawlinsons New Zealand Construction Handbook 2013/14 (28th Edition)*.

Figure 22 Labour productivity is flat as job numbers move with GDP changes



In the downturns from 1991 to 1993, 1998 to 1999, and 2008 to 2010, the number of jobs filled held up more strongly than GDP, which is why labour productivity fell in all three cases. In upturns, the trend is reversed although it is somewhat surprising to see the extent of employment growth relative to GDP growth in the upturn from 2001 to 2008.

One likely explanation of this relationship is that businesses tend to keep workers as long as they can when the work dries up, leading to under-utilised labour, and that labour productivity recovers when residential work picks up again. It is somewhat surprising that the correlation is strongest between residential GFCF and labour productivity, rather than between total construction GFCF and labour productivity (see Figure 17). This relationship suggests that:

Businesses appear to hoard workers when work slows, leading to less productive labour, while better utilisation during boom years improves labour productivities again.

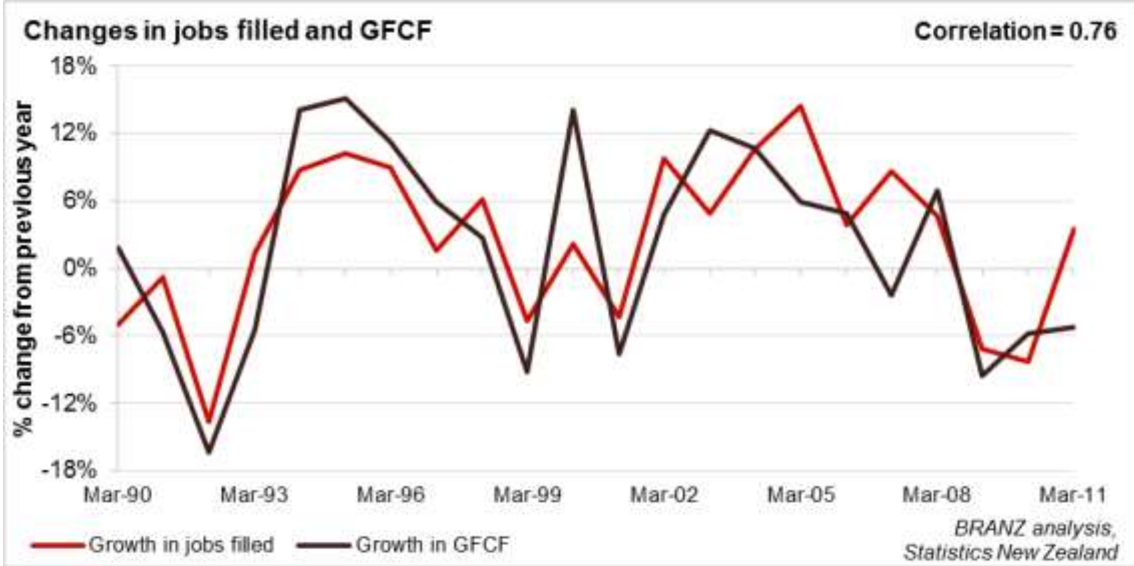
- Residential construction firms may respond differently from non-residential and horizontal infrastructure firms in employment decisions across the economic cycle
- The dominance of the residential sub-sector within the construction industry means what happens in that sub-sector is the most important determinant of changes in official labour productivity measures at the industry level.

We would expect to see employment vary as workloads (as measured by GFCF) change. This trend is confirmed by Figure 23. With a correlation of 0.76, changes in employment do move strongly in step with changes in workload.

However, there are some points at which growth in employment and GFCF diverged substantially, most notably from 1994 to 1996, from 1999 to 2001, and from 2004 to 2006.

Nevertheless, as highlighted in Figure 23, while annual percentage changes in GFCF and jobs filled may vary, in volume terms, the two curves do move closely together, but with jobs growing rapidly in boom years and shrinking less than production in slower years.

Figure 23 Employment and the amount of work being done are closely related



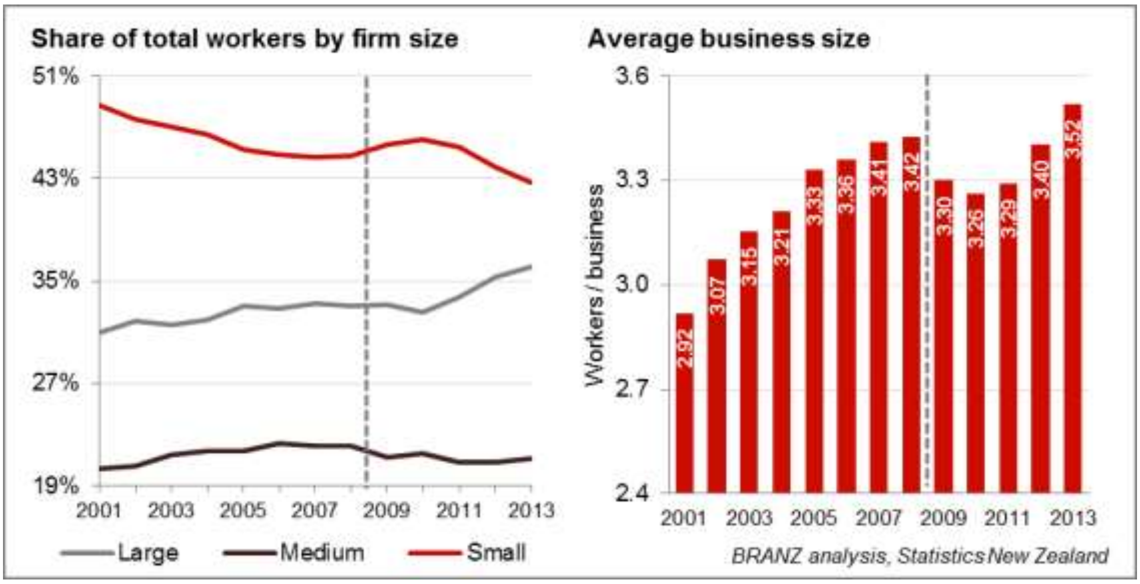
4.3.2 Scaling up and down

Changes in firm size across the business cycle also have the potential to affect productivity. Larger firms are more likely to have the scale to implement scale efficiencies and introduce new technology and machinery. They are also often better prepared to respond to a shrinking pipeline.

Monitoring the change in industry structure provides an insight into how the industry scales up or down in the face of prevailing economic conditions.

Figure 24 shows changes in the share of total employment across firms with five or fewer employees (small), 6 to 20 employees (medium), and over 20 employees (large).

Figure 24 Average business size is rising as the proportion of small businesses falls



The reduction in size of many firms is best highlighted by considering the bump in the proportion of small firms seen between 2008 and 2011, reversing the trend of the previous eight years. Over the boom years from 2002 to 2008, there was a commensurate increase in the proportion of people working at large and medium construction businesses, with each category rising by around 1.5 percentage points.

However, in the slower years to the right of the dotted line on Figure 24, trends varied significantly. In the year to 2009, large firms were able to weather the downturn relatively well, maintaining their share of total employment. Medium sized firms appear not to have had the same wherewithal to withstand the downturn, leading to a decline in the number of medium sized businesses as they shed workers to become small(er) sized businesses.

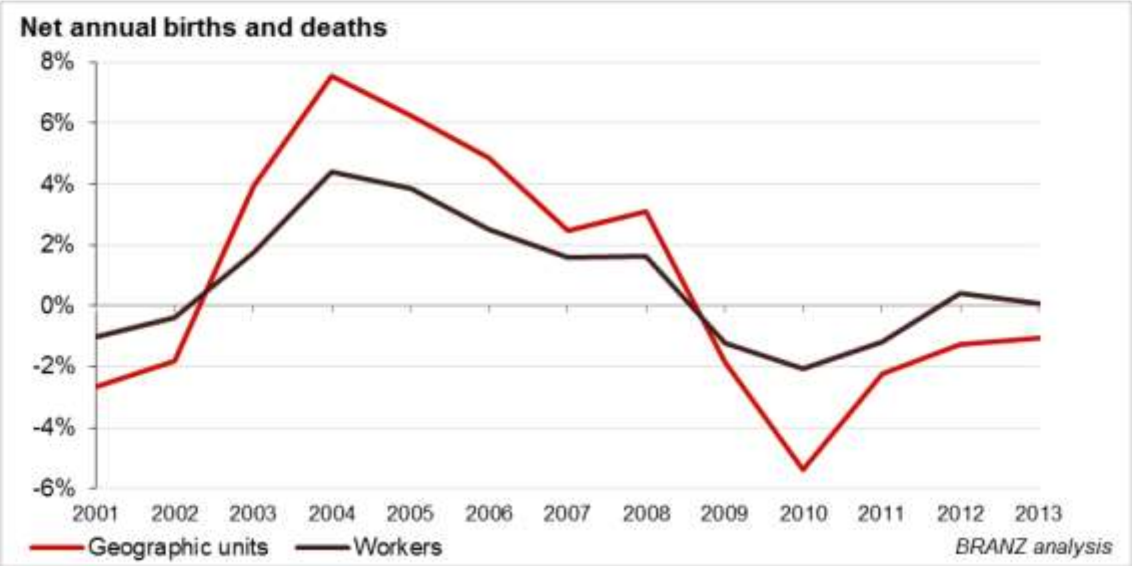
Larger firms are better able to weather downturns. The overall size of construction firms is rising, meaning businesses may be more resilient in future.

In the second year of the slowdown, the resources large firms had with which to weather the storm were depleted to the point that they began to reduce worker numbers. As a result, some large firms shrank to become medium sized firms, leading to a slight rise in the proportion of medium firms.

The average business size, as measured by workers per business, grew steadily through the boom years to 2008 despite the proliferation of smaller businesses (see Figure 25). Average business size fell slightly between 2008 and 2010 as first medium and then large firms shed workers, even as the number (but not proportion) of small businesses declined. But even during the relatively subdued economic times of 2011 and beyond, the trend toward larger average firm size resumed, suggesting firms may in future have more of the scale needed to withstand slowdowns.

Figure 25 clearly shows the rate of net firm births and deaths over the economic cycle, and the associated changes in employment.

Figure 25 New, small businesses proliferate in upturns



In the years of strong demand for construction services between 2002 and 2008, the annual change in the net number of geographic units[10] was rapid. For instance, the net gain in business units in the year to February 2004 was nearly 8%. Although employment growth was also strong as the boom took off, growth in employment was significantly lower, at just over 4% in 2004.

In other words, as demand for construction services picks up, there is a proliferation in the number of new businesses, while the number of new workers does not rise as fast, meaning the **new businesses** tend to be smaller. When demand shrinks, small firms that are less able to withstand economic shocks rapidly decline in number. As a result, the number of business units declines further than the number of workers, as between 2009 and 2013.

During boom years, small construction businesses proliferate, but these are first to disappear when demand slows.

4.3.3 Regional differences and mobility

A further factor linked to how firms respond that may affect productivity is regional mobility, or lack thereof. Anecdotal evidence suggests that there is a significant difference between changes in demand in major urban centres and provincial New Zealand. If there are substantial differences between the timing of upturns and downturns across different parts of the country, this would create the opportunity to limit reductions in production if labour and capital are highly mobile.

Displaying changes in demand for construction services over time for all 16 regions would be particularly hard to interpret. For simplicity' sake, we present changes in **residential** consent demand for Auckland, Canterbury, Other New Zealand, and New Zealand overall in Figure 26.

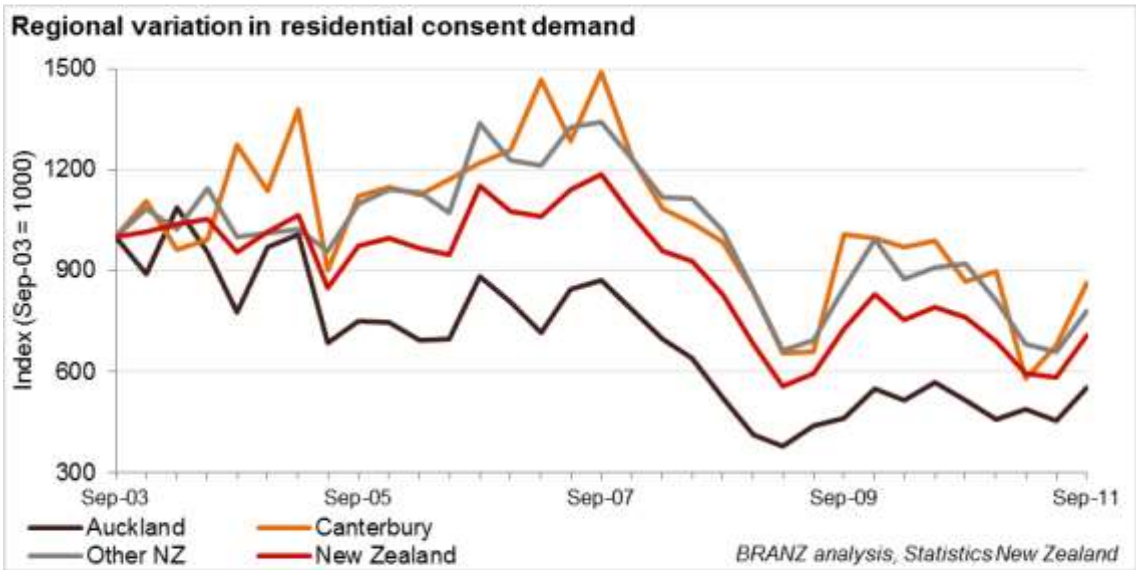
Changes in workloads vary dramatically across the country. Better geographic mobility of the workforce may help maintain productivity nationally.

Auckland has been particularly susceptible to large variations in residential consent activity over the last 10 years, with demand falling 62% by March 2009. While the general trends across the rest of the country were similar, declines were substantially less dramatic. Meanwhile, demand in Canterbury experienced several additional peaks not seen elsewhere in the country, most recently related to the rebuild.

The question is what happens to workers in Auckland, for example, when the amount of work in the pipeline plummets as it did in 2008. If some of these workers were able to move to parts of the country where construction activity remained stronger, they could perhaps be used more productively. However, the Christchurch experience post-earthquake suggests that worker mobility is a real challenge in the industry.

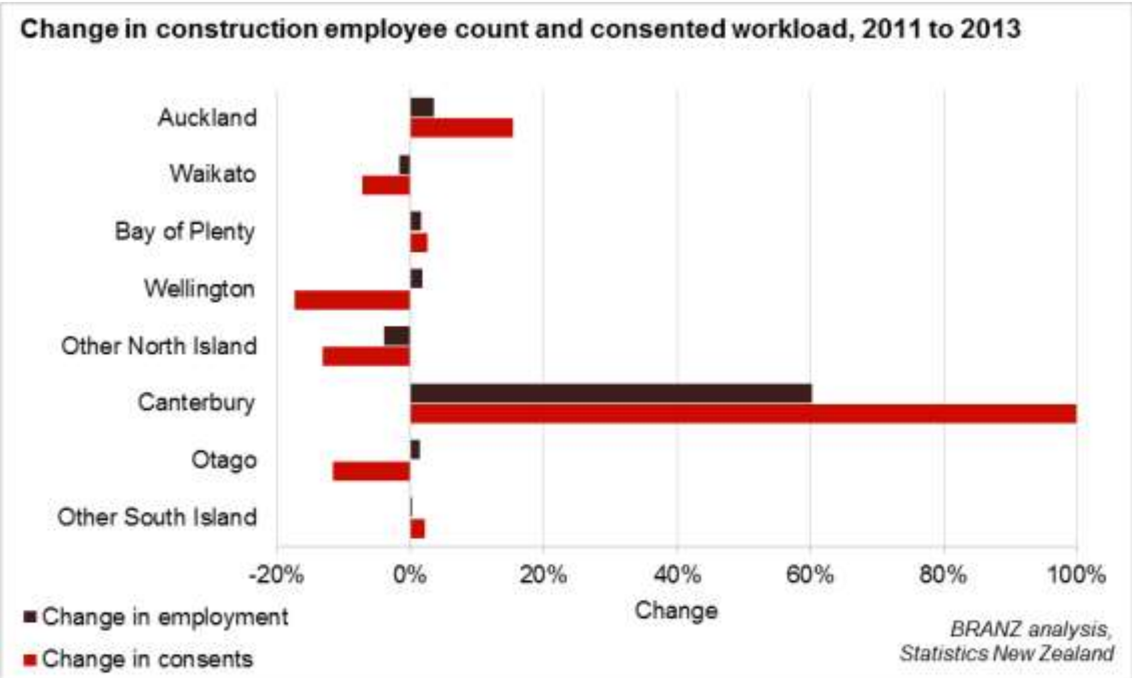
[10] Geographic units can be best understood as the number of business "front doors". In other words, it would count each office of a multi-office firm. A decline in net firm births means more local offices closed their doors than opened new offices.

Figure 26 The residential work pipeline has varied widely over the economic cycle



Changes in the number of employees by selected region and consented workloads (residential, non-residential and other construction) for the year to March 2013 compared to the year to March 2011 are presented in Figure 27. The top six regions by consent value are shown, as well as Other North Island and Other South Island.

Figure 27 Changes in employment by region do not match changes in workload



The value of work consented in Canterbury has risen 100% due to the rebuild, while the number of employees has risen just 60%. In Auckland, the picture is similar, with large growth in the pipeline (15%) but far lower growth in employment (3.5%).

The situation in most of the remainder of the country is in stark contrast to these two growth areas. In Wellington, for instance, the value of consents issued in the March

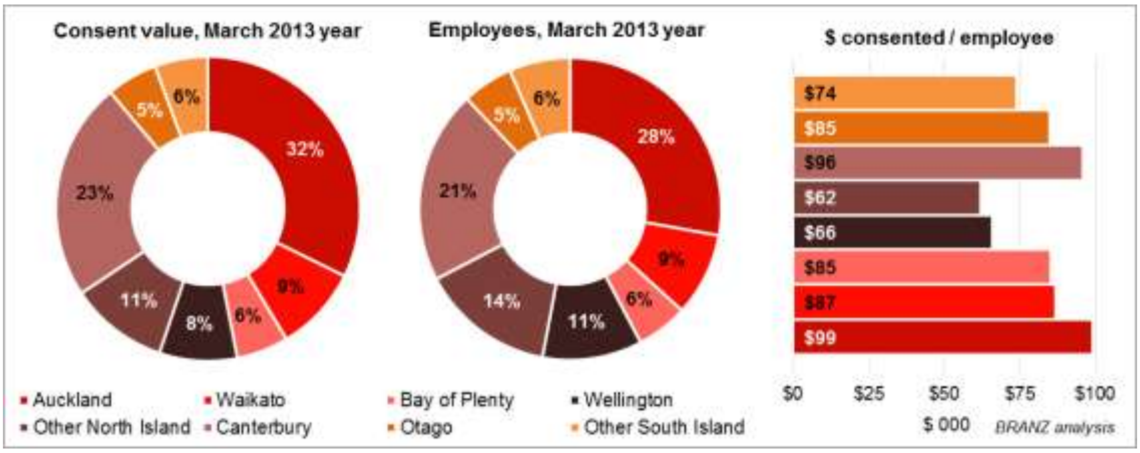
2013 year was 17% lower than in the March 2011 year, yet employment was almost flat. Similar scenarios have played out in Otago, the Waikato, and the rest of the North Island.

Canterbury has gained 9,700 construction employees over the last two years, but little of this growth appears to have come from workers moving to Canterbury from other parts of New Zealand, given the trends highlighted in Figure 27. Instead, most growth appears to have come from other sources such as international migration, natural increases in the size of the workforce, and a switch to construction from other industries in Canterbury.

Little of Canterbury's construction employment growth appears to have come from workers moving there from other parts of New Zealand.

The apparent "geographical stickiness", where **workers tend not to migrate** to areas of the country where the work is, is highlighted further in Figure 28.

Figure 28 The workload pipeline and where workers are don't always match



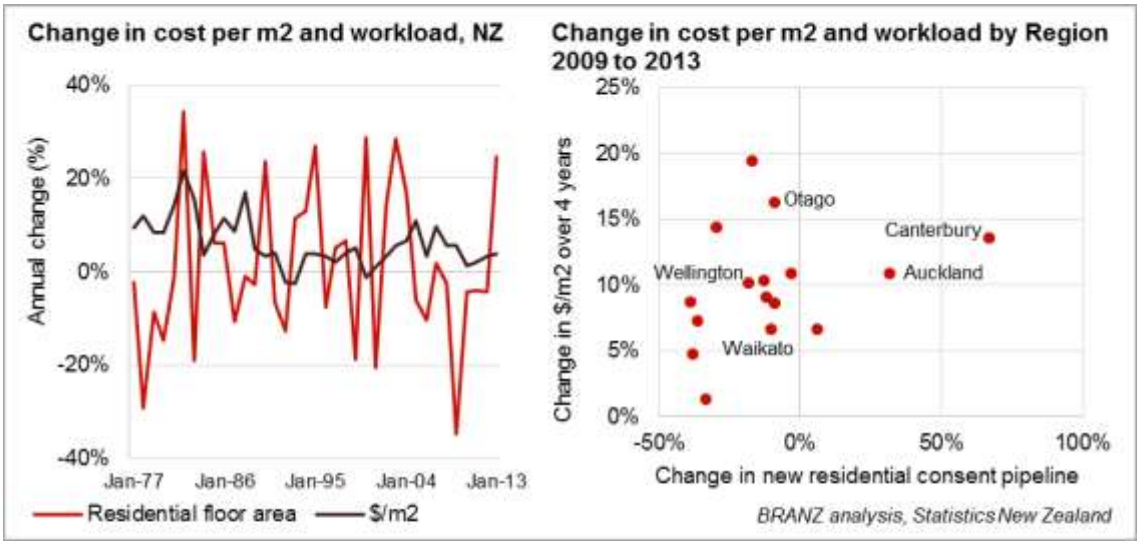
Wellington and the Other North Island are two examples of areas where the pipeline is limited, but where workers remain. Only 8% of consented values were recorded in Wellington in 2013 (and down 17% on two years before, as Figure 27 highlighted), yet 11% of construction workers remained there. Meanwhile, Auckland and Canterbury appear to be under-resourced.

As the bar graph in Figure 28 points out, this results in large variations in the value of consented (pipeline) work relative to the number of employees across different regions. Wellington and the Other North Island have particularly low dollars consented per employee, well below the national average of $85,300.

An argument could be made that the overall productivity of the industry could be better balanced at a regional and national level if workers moved more freely between areas where demand was lower and areas where demand was higher.

The opposing argument, that differentials in demand allow construction activity in areas of greater demand to make higher profits, appears baseless, as Figure 29 suggests. Focusing on the residential sub-sector, it considers changes in national consented floor areas and cost per square metre on the left, and changes in dollars per square metre relative to changes in consent values since the bottom of the national building trough in 2009 on the right.

Figure 29 There is no clear relationship between demand and cost per square metre



There appears to be no clear relationship between changes in the residential workload and changes in cost per square metre at a national level left side of Figure 29). Similarly, comparing changes in residential workload and changes in cost per square metre at the regional level for the March 2013 year compared with the March 2009 year (the first year that national residential consents declined markedly) indicates no correlation.

Costs have risen sharply in places like Otago (up 16%) despite a decline of almost 10% in the pipeline. In Wellington, a decline of 18% in the pipeline has been accompanied by a 10% increase in prices. Yet in Canterbury, where workloads have increased 67% since 2004 in large part due to the earthquakes, costs per square metre have risen only 14% (less than in Otago). This indicates that price rises have not been largely a matter of higher demand leading to increased wages and profits.

Price rises have not been largely a matter of higher demand leading to increased wages and profits.

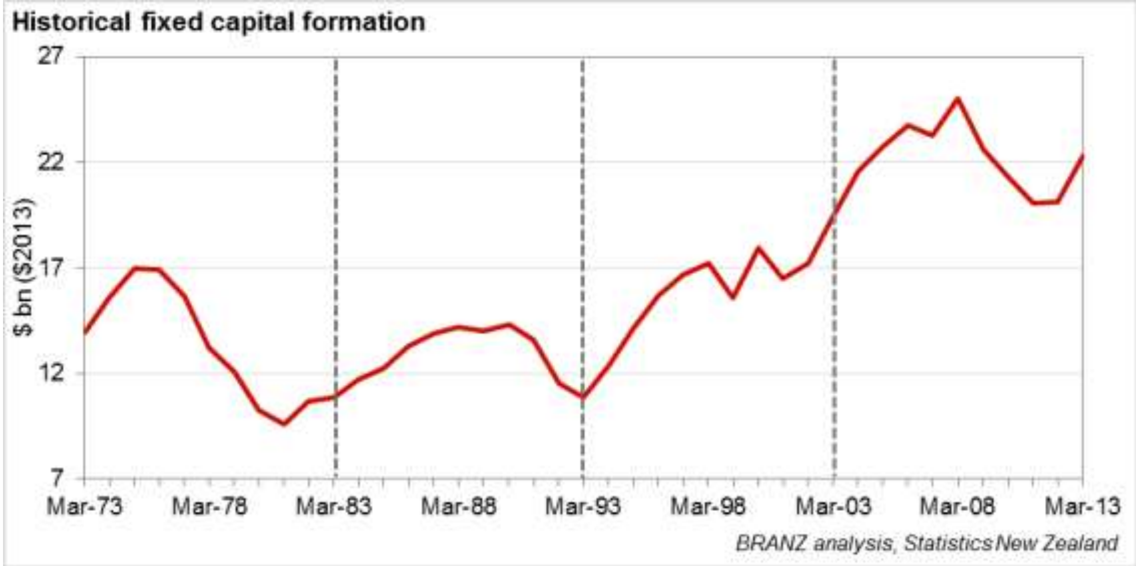
4.4 Factor Four: Uncertainty over workloads

The industry is characterised by some of the worst demand volatility of any industry in New Zealand. This uncertainty has traditionally made investment in people, plant and technology unattractive. The certainty of workload created by the Canterbury rebuild, nationwide earthquake strengthening, leaky buildings remediation, and major infrastructure projects provides a unique opportunity to transform the performance of the industry through longer-term planning and investment.

4.4.1 Historical trends in workloads

Figure 30 presents changes in fixed capital formation in real terms over the last 40 years, divided into 10-year periods by the dotted lines.

Figure 30 Work done over the last 40 years has varied between $9.6 billion and $26 billion



The 10 years from 1973 to 1983, and from 1983 to 1993 each roughly comprise a business cycle. However, the sustained period of growth from 1993 continued to 2008, constituting 15 years of growth (with three small declines) before the sharp downturn of 2009 to 2012.

A big challenge for the industry is the huge fluctuation in activity, from large growth in some years, to rapid declines the next.

Previous work commissioned by the Construction Strategy Group found that perhaps the biggest challenge for the industry is the huge **fluctuation** in activity, from large growth in some years, to rapid declines the next, rather than the overall growth or decline.[11] In other words, it is the scale of change, rather than the size of the overall task that makes long-term planning hard.

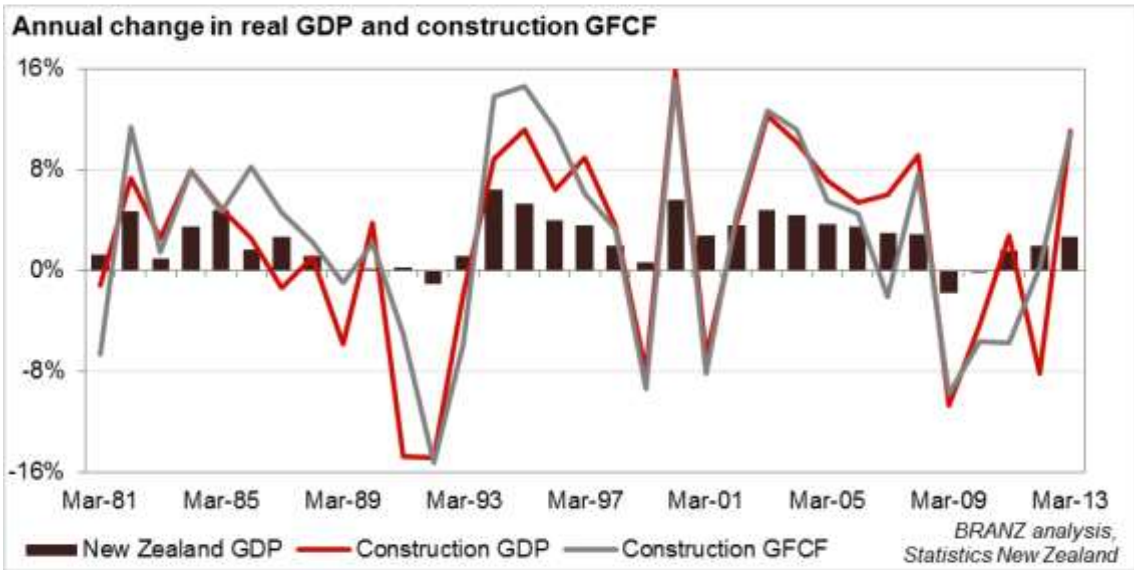
While the years from 1993 to 2008 were, in hindsight, a long period of sustained growth, there was no way to anticipate this growth would eventuate at the time.

Figure 31 highlights the variations in **growth rates** the industry has faced over the last 33 years. It shows annual changes in construction GDP and construction GFCF (two measures of construction industry activity) and New Zealand GDP.

At no time in the last 33 years has New Zealand GDP grown by more than 6.4% in a given year, yet construction GDP and GFCF have grown by up to 15.8% and 15.3% respectively. In tougher economic times, New Zealand GDP has shrunk by up to 1.8% year-on-year (in 2009), but construction GDP and GFCF have fallen by up to 14.9% and 15.3% respectively, a huge decline on an annual basis.

[11] PwC. (2011). *Valuing the role of construction in the New Zealand economy*.

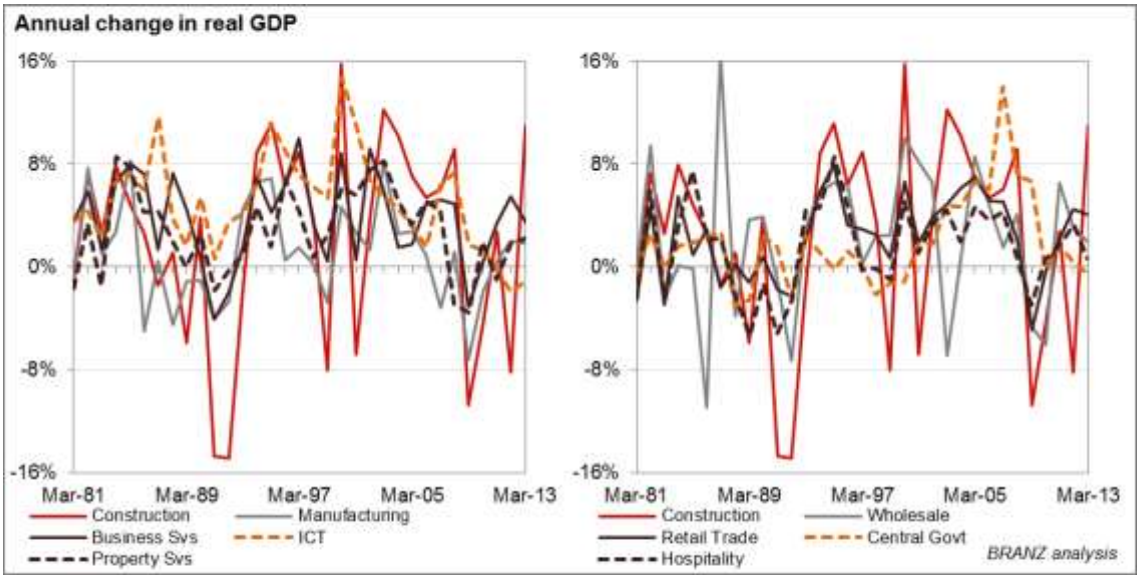
Figure 31 Workloads in construction vary far more than in the economy overall



In fact, in the last 33 years, in 12 years construction GDP has grown faster than the 6.4% that New Zealand GDP grew in its best year. On nine occasions, construction GDP has fallen by more than the worst annual decline in national GDP in the last 33 years.

As Figure 32 shows, the construction industry has experienced far more volatility than any of the other major industries in New Zealand, particularly on the down side.

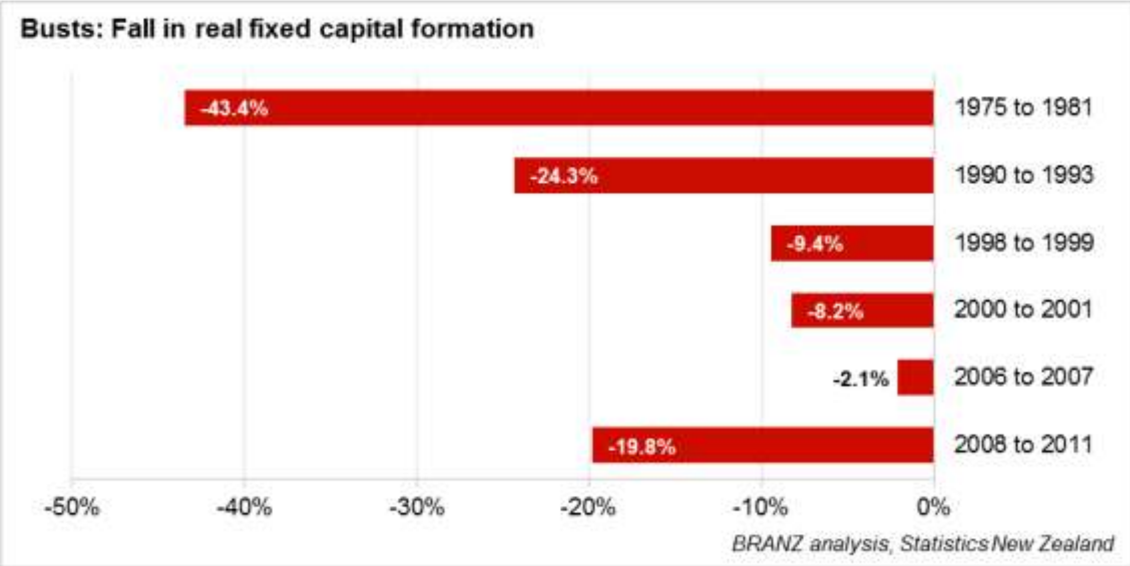
Figure 32 GDP growth is more volatile in construction than in other large industries



Downturns in 1991 and 1992, 1999, 2001, 2009 and 2012 have been significantly sharper than experienced by any other industry. Only the wholesale trade industry has had peaks and troughs of a scale similar to that of the construction industry. This wild fluctuation in fortunes including two major disruptions even midway through the elongated boom years of 1993 to 2008 means major uncertainty has been the norm in the construction industry.

Yet until the slowdown of 2008 and onwards, each construction downturn since 1974 has been smaller than the previous one, as highlighted by Figure 33.

Figure 33 Busts have varied markedly in scale and duration



The slowdown that started after March 1975 lasted six years before capital formation began to recover. The trough in 1981 was more than 43% below the peak of 1975. This decline was so large that volumes of work only returned to 1975 levels 23 years later.

Meanwhile, the industry experienced another bust, with workloads falling 24% between a peak in 1990 and the trough in 1993.

Three smaller declines occurred even in the growth years from 1993 to 2008. Workloads fell 9.4% and 8.2% respectively in the 1998 to 1999, and 2000 to 2001 busts. The 2006 to 2007 slowdown was tiny by comparison, at just a 2.1% fall in GFCF.

Yet the huge fall in workloads between 2008 and 2011 highlighted the fact that the industry was still susceptible to large fluctuations in fortunes, the likes of which had not been seen in 20 years.

> The uncertainty in growth rates in the industry makes investment in capital, technology, and more skilled labour a risky proposition.

This uncertainty in growth rates in the industry makes investment in capital, technology, and more skilled labour a risky proposition, as even in recent times, volatility remains. The 7.6% growth in production of 2008 (see Figure 31) was replaced by the 9.8% fall in production in 2009 with little warning.

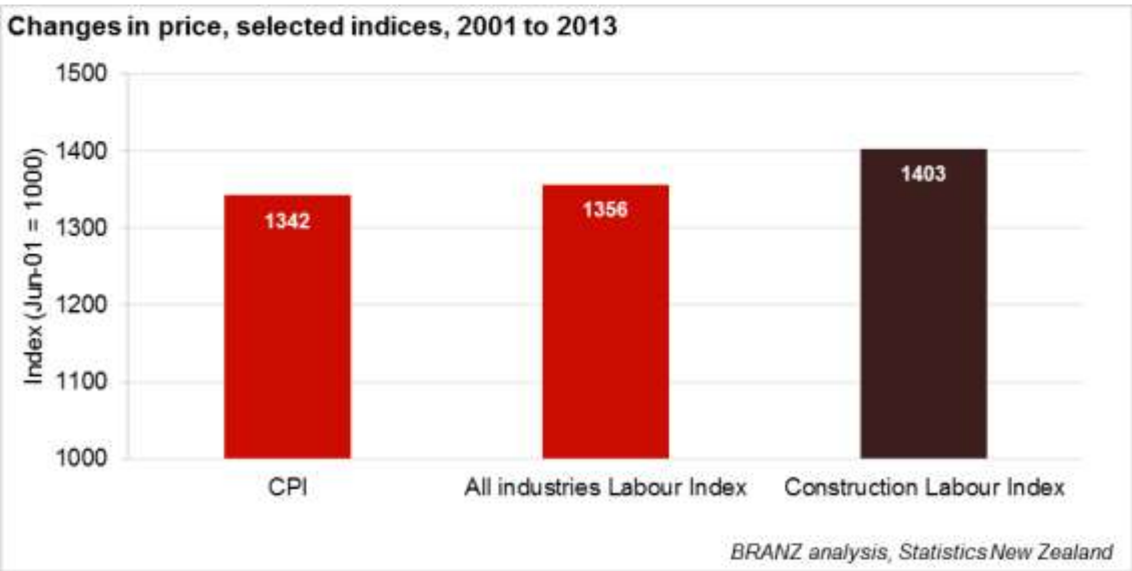
Labour investment and upskilling

Perhaps as a direct result of the uncertainty over workloads, the New Zealand construction industry does not appear to have invested in upskilling workers to make them more productive. This is partly reflected in labour productivity growth which has been flat for more than 20 years.

While labour productivity is influenced by other factors such as capital deepening, it is fundamentally a function of the “capability” input by each worker, using the capital and technology available, and making use of the skills of the worker. Over time, as an economy develops, skills deepen, more capital and technology are used, we would expect to see the real value added per worker increase. This has not been the case in construction, as already shown.

Yet construction workers are better compensated today relative to other industries and the cost of living than they were before, as highlighted in Figure 34.

Figure 34 Construction workers are better compensated than they were before

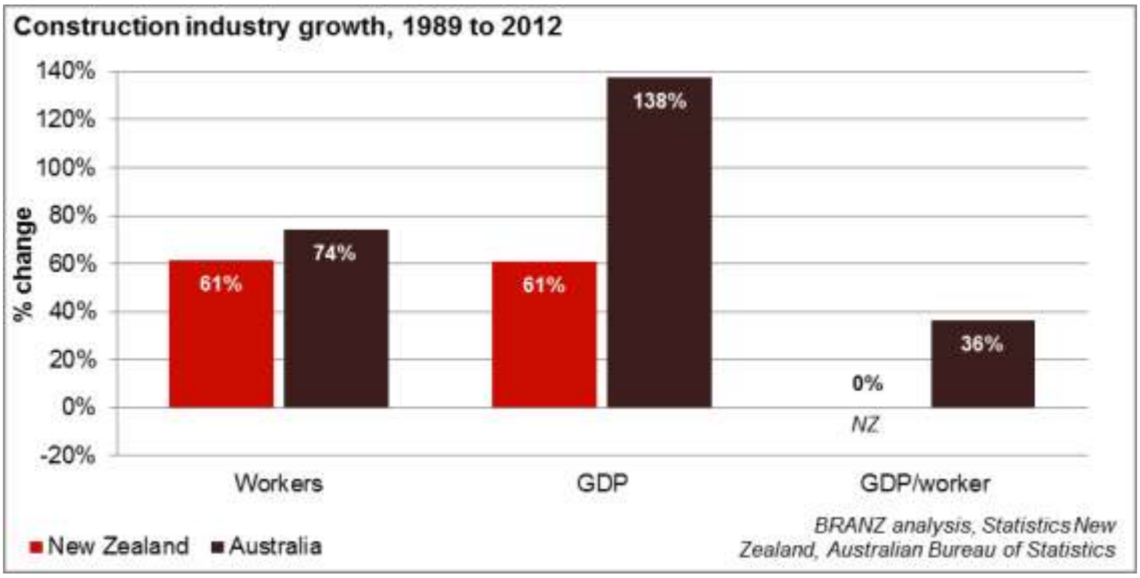


Since 2001, wages in construction have risen 40%, while the cost of living has risen 34% and incomes in other industries have risen 36%. This means that the economy has placed a greater premium on rewarding construction workers financially. But labour productivity growth has been near zero, suggesting that more of the GDP generated per construction worker has been paid to the worker rather than being kept as profits by the business. In other words, workers are capturing a bigger share of what would otherwise have been company profits, because they are only as productive as they were 12 years ago, but are better paid than they were 12 years ago in real terms.

Some argue that the reason labour productivity in construction has not risen in 20 years is because there is “only so much a worker can do in a work day”. Yet this is clearly not the case, as highlighted in Figure 35, which shows that, in contrast with their New Zealand counterparts, Australian construction workers have improved their productivity over the last 23 years.

Since 1989, the Australian and New Zealand construction industries have both seen large rises in employment. However, GDP in the Australian construction industry has surged by 138% in real terms, compared to just 61% in New Zealand. As a result, GDP per worker in Australia is up 36%.

Figure 35 Australian construction workers have increased productivity sharply



The reasons for this strong growth in Australia's construction labour productivity are beyond the scope of this study, but some studies suggest that overall growth in the Australian labour productivity is from a combination of capital deepening and MFP (i.e. improved technology, processes and management).[12]

Another possibility, that workers in Australia are simply working more hours than they were 23 years ago, can be discounted. Australian Bureau of Statistics data indicate that the average construction worker spent only 2.9% more time working in 2012 than in 1987 (or one hour a week).

In other words, it appears that Australia has been able to improve the quality of its labour significantly more than in New Zealand through improved use of capital, upskilling, and better processes and management.

International trends indicate New Zealand can improve labour productivity through upskilling, and better use of capital, processes, management and technology.

4.4.2 Looking to the future

A combination of circumstances have coincided to generate the potential for the greatest construction boom in history:

- **Canterbury rebuild**: The tragic events of September 2010 and the following February have created an immense opportunity for the construction industry through the massive task of rebuilding Christchurch and parts of wider Canterbury, at an estimated cost of $40 billion.
- **Earthquake strengthening**: The earthquakes in Canterbury and more recent quakes in Wellington have spurred government and private sector action on earthquake strengthening across New Zealand. Earlier government estimates put the bill for strengthening at around $2 billion over 15 years, but this estimate is based on incomplete information. For instance, many councils have no record of the

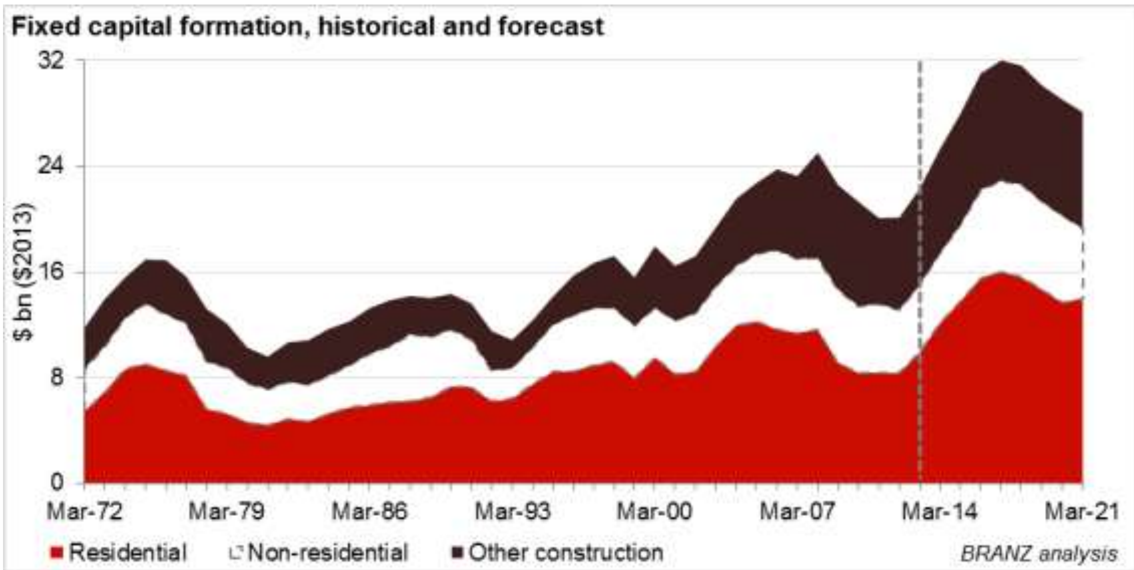
[12] Dolman, B; Lu, L; and Rahman, J. (2006). *Understanding productivity trends*.

number of earthquake prone buildings in their jurisdiction. The final figure is likely to be substantially higher.

- **Leaky buildings**: $12 billion in repair work on leaky buildings will add more demand for construction services.
- **More, better housing**: Rising net immigration and the resumption of trends toward fewer residents per dwelling (typically reversed during economic slowdowns) are expected to drive significant further demand for housing. Auckland will be at the forefront of this surge, with the scale of demand there expected to dwarf demand even in Canterbury. At the same time, a recovering economy and rising house prices drive the wealth effect, whereby people feel wealthier because their main assets have increased in value, and therefore spend on upgrades such as better insulation.
- **Major non-residential projects**: The Roads of National Significance (RoNS) including Transmission Gully and the Kapiti Expressway are worth billions of dollars (including more than $2 billion for the Wellington Airport to Levin Northern Corridor).

Taking into account all these factors yields the construction industry growth forecasts set out in Figure 36.

Figure 36 Construction workloads are forecast to rise 39% in three years



Led by residential demand, fixed capital formation is forecast to rise from $22.3 billion in 2013 to $31 billion by 2016, before peaking in about 2017. Demand is expected to remain buoyant across the forecast period to 2021.

Annual percentage changes in workload are expected to be large, at 10% to 14% a year over the next three years, followed by slower growth and then some declines of up to 5% a year.

The strong growth expected between 2013 and 2016 is not unprecedented. Growth in construction fixed capital formation between 1993 and 1996 was 45%, and 32% between 2002 and 2005. It is possible, however, that the wall of work will be such that supply of workers simply cannot meet demand over the next few years, in which case we could expect the growth in capital formation to be slightly flatter, with the peak taking on more of a plateau shape.

4.4.3 What this means for productivity

The level of certainty about the wall of work facing the construction industry presents a once in a lifetime opportunity to dramatically change how the industry operates, making better use of trained workers and capital to work more productively.

High workloads, and in particular the urgency of the Canterbury earthquake repairs, offer the opportunity for the industry to trial new ways of working that are known to have an influence on sector productivity. These opportunities include methods of procurement, new technologies, prefabrication, standardisation, training, supervision and inspection.[13]

Where in the past uncertainty has been a reason not to invest in people, plant, or technology, the new-found certainty in the industry provides the opportunity to do precisely that.

At the same time, knowing that $40 billion of Canterbury rebuild work must be done in the next 15 years, several billion dollars' more earthquake strengthening work must be done across the country in the next 20 years, and that contracts have been signed to build several major roads around the country provide confidence to the industry that is usually lacking.

Where in the past uncertainty has been a reason not to invest in people, plant, or technology, the new-found certainty in the industry provides the opportunity to do precisely that.

4.5 Factor Five: Measurement of quality, capital and labour units

Official measures of productivity (rather than productivity itself) can be skewed by some of the challenges related to measuring quality, and capital and labour units accurately. However, given the importance placed on the official measures in monitoring the performance of the industry, considering factors that affect the reliability of the official measures is worthwhile. The official measurements of productivity are only as good as their ability to separate out changes in price, quality and employment of capital and labour units.

4.5.1 Quality versus price

Theoretically, the CPI, PPI and CGPI measures should exclude changes in quality. For instance, the switch in regulations to double glazing for houses the late 2000s led to a "forced" improvement in quality of housing produced in New Zealand. This should not have led to a rise in the CGPI for residential building, or the component of the PPI Building Construction Index that covers residential housing, because this was a genuine improvement in quality, not a nominal price increase. Similarly, changes in consumer

[13] We note that already, the market has responded, with Mike Greer Homes announcing a prefabrication facility in Christchurch that will produce up to 1,000 homes a year.

preferences (such as cladding and heating choices) would need to be accounted for by excluding quality changes from price measures.

If the real dollar cost of changes in quality are not accurately understood, and are incorrectly captured by the PPI or CGPI, the official statistics are likely to overestimate changes in price, which means:

If quality improvements are not carefully separated out from price increases, changes in construction prices will be overestimated, leading to an underestimate of construction productivity.

- The PPI – outputs index for construction (and Building Construction in particular) will be over-inflated. This will mean the real GDP estimate for the construction industry will be under-estimated, meaning official productivity measures will be lower than actual productivity in the industry.
- Other indices such as the CPI, which is often used as a basis for wage increases, will also be impacted as they include a component for the cost of new housing.

Our discussions with SNZ have indicated that they attempt to exclude quality changes from price indices. Unfortunately, the nature of the information-gathering exercise is such that they are reliant on those they survey to accurately identify whether changes in output prices are the result of changes in costs for the same item, or changes in quality.

Again, double-glazing is a good example. In explaining why the price of building a standard house plan has increased, respondents to the SNZ survey may simply write that the "price of construction components" has increased, one of the options in the questionnaire. Unless the builder details in a later question that the reason for the change in construction component price is because of a change to double-glazing from single-glazing, this will simply be assumed to be a price change rather than a quality change.

It is most likely that the CPI (Purchase of new housing), PPI: Outputs and CGPI indices all overestimate price changes, and thus to some extent GDP and productivity are underestimated.

This change in input price, if it leads to a change in output price (usually the case) means that the PPI:Outputs index will increase unless a specific allowance is made for this increase in quality.

While double-glazing is an obvious, high-profile example (meaning it may have been well covered by SNZ quality adjustments), other smaller, less obvious changes may well go unreported by builders and therefore unaccounted for by SNZ. It is almost certain that the CPI (Purchase of new housing), PPI:Outputs and CGPI indices therefore all overestimate price changes, and thus to some extent GDP and productivity are underestimated.

4.5.2 Number of capital and labour units employed

Having estimated the real GDP produced by the industry, SNZ then estimates the **number** of capital and labour units employed. This allows SNZ to calculate labour and capital productivity, by dividing real GDP by the sum of the estimated units of labour and capital employed.

Estimating the number of labour units (hours worked) is relatively easy and is based on a range of survey data for the construction industry.

However, accurately measuring the employment of units of **capital** requires a number of assumptions about the types of capital employed and their relative value in increasing production, which is particularly hard to estimate. In addition, the SNZ approach assumes that capacity utilisation rates remain constant across the economic cycle.[14]

Measuring changes in notional capital units requires a number of assumptions that make accurate capital productivity and MFP estimates a challenge.

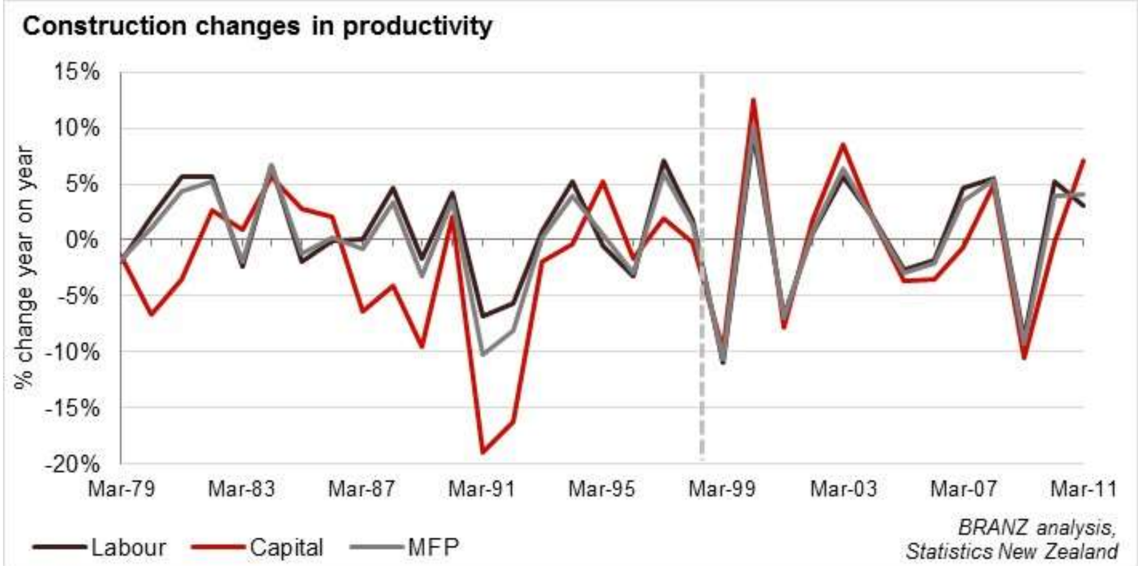
Similarly, MFP is challenging to measure as it requires not only a good estimate of capital units employed in the industry, but also an appropriate way to add together the number of labour and capital units.

The examination of correlation relationships between variables summarised earlier in this report identified strong relationships between annual change in residential GFCF and the three measures of productivity:

- Capital productivity: 0.69
- Labour productivity: 0.70
- MFP: 0.72.

The remarkable similarity of the relationship between residential GFCF and the three measures of productivity led us to investigate the relationship between the three measures more closely. Plotting annual percentage changes in each measure from 1979 to 2011 yielded the results in Figure 37.

Figure 37 Changes in three productivity measures have been very similar since 1999



The three official measures of productivity for the construction industry have tended to move in lock-step, particularly since March 1999 (indicated by the dotted line in Figure

[14] Statistics New Zealand. (2012). *Productivity Statistics: Sources and methods* (Eighth edition).

37). Indeed, apart from dramatic declines in capital productivity seen between 1986 and 1992, changes in the three indices have been practically identical.

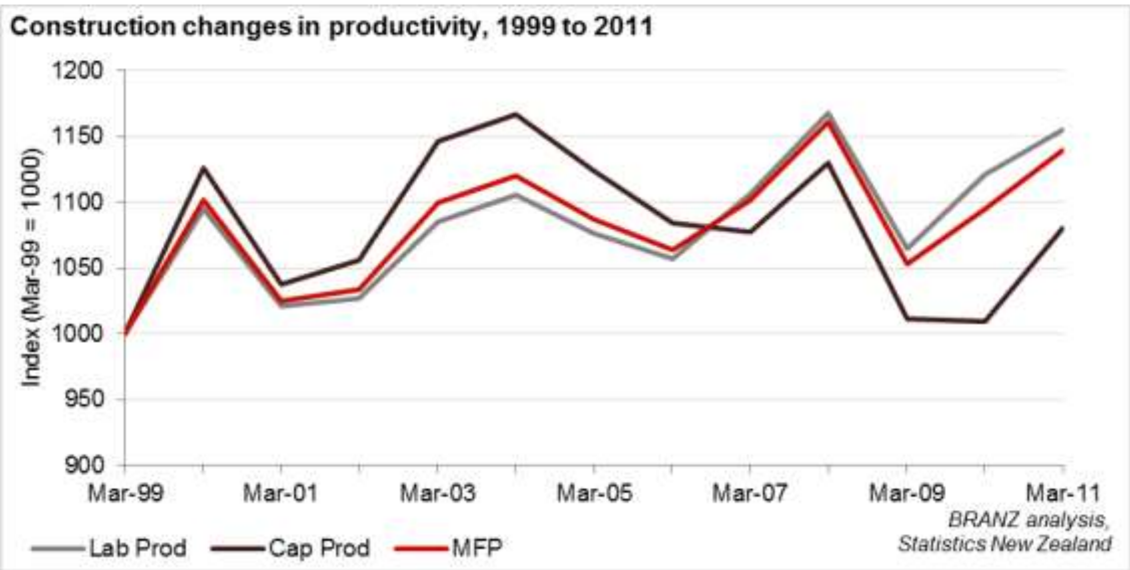
Because changes in GDP (production) are used as the numerator in calculations of all three measures of productivity, we would expect some similarity in how the indices move, but the similarity of the movements is nevertheless surprising. It indicates that the official measures have derived similar percentage changes in labour and capital units employed in the years between 1999 and 2011 in particular, yielding labour productivity results very similar to MFP results.

> Any inaccuracy in how capital units are measured, or how labour and capital units are added together, will have an impact on the measurement of capital productivity and MFP.

Another way of considering the changes in the indices is provided in Figure 38. Although this comparison of rebased indices does show larger variations in changes in the indices, the pattern of indices moving largely in lock-step remains.

The similarity of the MFP and labour productivity curves is particularly noticeable, and is likely a result of the approach used to add together units of labour and capital to determine MFP. Labour units are weighted far more heavily than capital units, meaning that changes in labour productivity tend to have a larger effect on MFP than changes in capital productivity.

Figure 38 The three measures of construction productivity move in lock-step



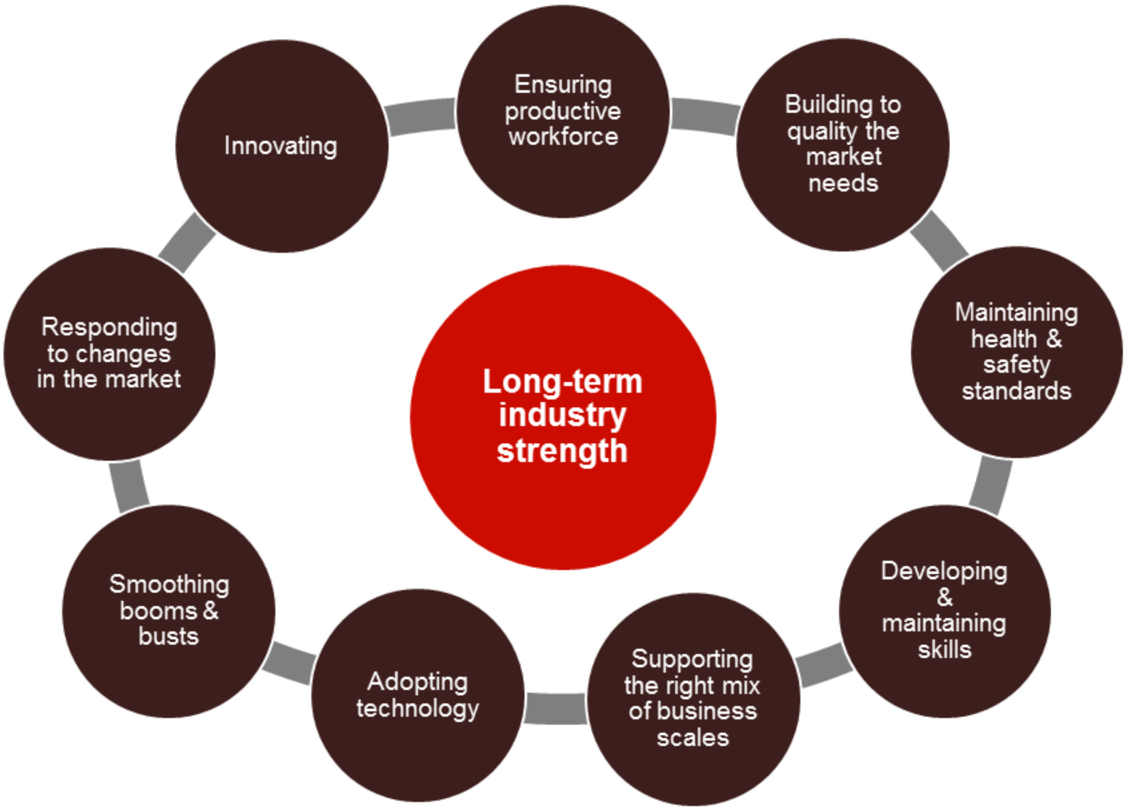
Thus any inaccuracy in how capital units are measured, or how labour and capital units are added together, is likely to have a smaller impact on the measurement of MFP than on capital productivity.

5. FROM PRODUCTIVITY TO PERFORMANCE

Productivity measures **how efficiently** inputs (capital, labour, intermediate goods, technology and the like) are used to produce outputs (houses, roads, warehouses and the like). Performance measures **effectiveness**, or how well something achieves its intended purpose. Performance, or effectiveness, means different things depending on whether we are considering the industry as a whole or an individual firm.

The industry overall is performing well if it is able to remain stable and sustainable over the long term. A number of factors such as those set out in Figure 39 are likely to contribute to this overarching objective.

Figure 39 Overall performance of the industry is affected by a number of factors

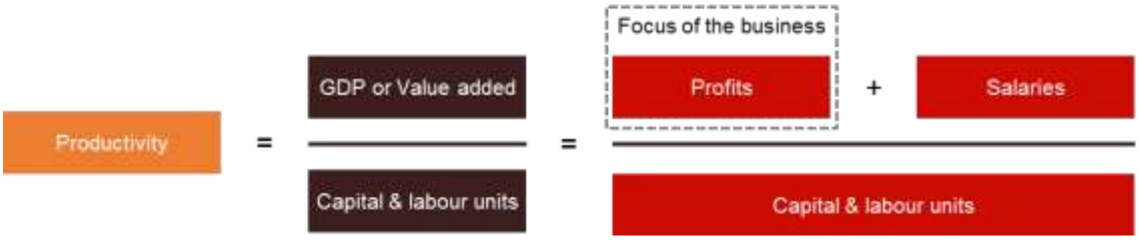


As Figure 39 highlights, productivity in a technical sense (production divided by capital and/or labour units) is not the ultimate goal of the industry. Yet many factors including adopting technology, smoothing booms and busts, and developing and maintaining skills would likely lead to better productivity in the technical sense.

5.1 Do firms care about productivity?

The point made in Figure 39 – that performance overall rather than productivity alone is what matters to the industry – is likely to be of even greater importance at the firm level. As Figure 40 highlights, the individual firm exists primarily to maximise value for its shareholders, whether an individual owner-operator or a large listed company.

Figure 40 There is a clear relationship between profits, GDP and productivity



Business owners often refer to aspects of productivity in their business, but they usually don't mean productivity in the technical sense as per the official measures. What they usually mean is how well their business uses its resources (people and capital) to produce profits for the business. We refer to this as **performance**, because maximising profitability is the key objective of running a commercial business.

Maximising profitability (increasing performance) is directly linked to productivity in that it is part of GDP, somewhat simplistically presented here as profits plus salaries. However, **productivity in and of itself is not the goal for the business**.

As Figure 41 shows, there are a number of ways to maximise profitability. The list here is not exhaustive, but gives an indication of factors that help improve profitability.

Figure 41 Commercial businesses exist to maximise value to shareholders

Each of the factors in the figure, while aimed at achieving improved profitability, will also improve productivity in the technical sense by boosting profitability. The next section of this study introduces a range of **measures of performance** at the firm level.

6. MEASURING PERFORMANCE AT THE FIRM LEVEL

Having argued that ongoing sustainability (profitability) matters most to businesses, this section examines several performance measures that can be monitored to identify progress and areas for improvement at the firm level. It considers the basic accounting measures to monitor the financial viability of individual firms before looking at other performance measures that support financial viability.

6.1 Financial viability: Basic accounting measures

At the heart of the sustainability of individual businesses is the need to achieve some basic accounting ratios that indicate the viability of the firm.

6.1.1 Solvency

A business is solvent when it can pay its debts on time. This means it can pay its suppliers because it has enough working capital. Two measures are commonly used to measure solvency:

- The stringent **Acid Test Ratio**. It is measured as follows:

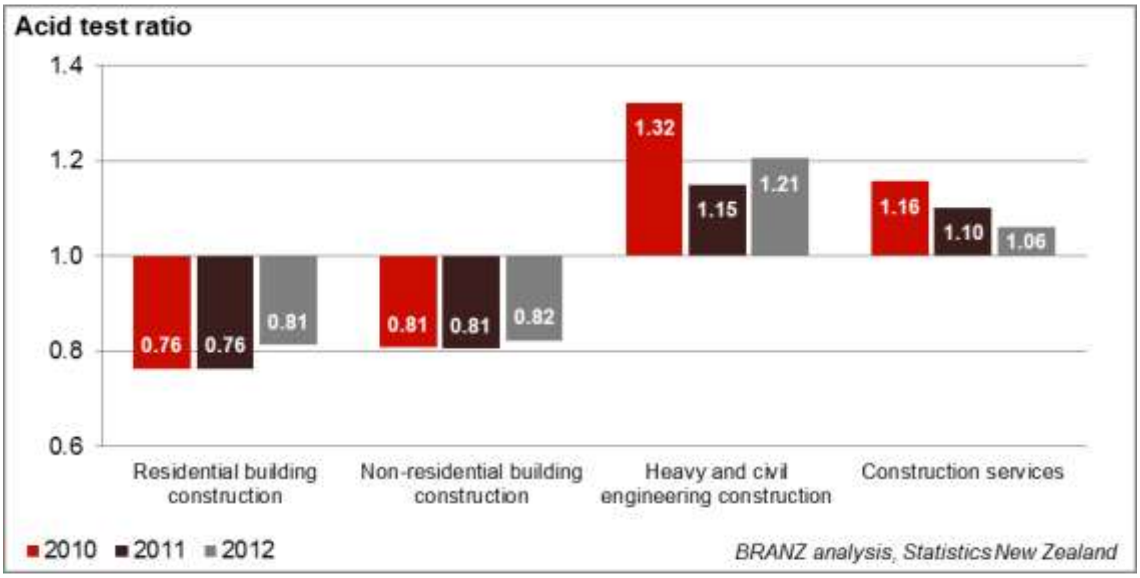
$$Acid\ Test\ Ratio = \frac{Cash + Accounts\ receivable + Short\ term\ investments}{Current\ liabilities^{15}}$$

- The less stringent **Current Ratio**. It is measured as follows:

$$Current\ Ratio = \frac{Current\ assets\ including\ stock}{Current\ liabilities}$$

Figure 42 compares the **acid test ratios** for four sub-sectors.

Figure 42 Acid test ratios vary from poor to adequate across sub-sectors



[15] Current liabilities are a firm’s debts that are due soon (usually within one year). They include short term loans, accounts payable, and accrued liabilities.

A ratio of less than 1.0 means a business cannot afford to pay its short-term debts, which is an indicator that the business is likely to have severe cashflow or liquidity problems. Both the residential and non-residential sub-sectors have poor acid test ratios of around 0.8. The construction trade services has a reasonable ratio of just over 1.0, while the civil engineering sub-sector is the only one with a strong ratio.

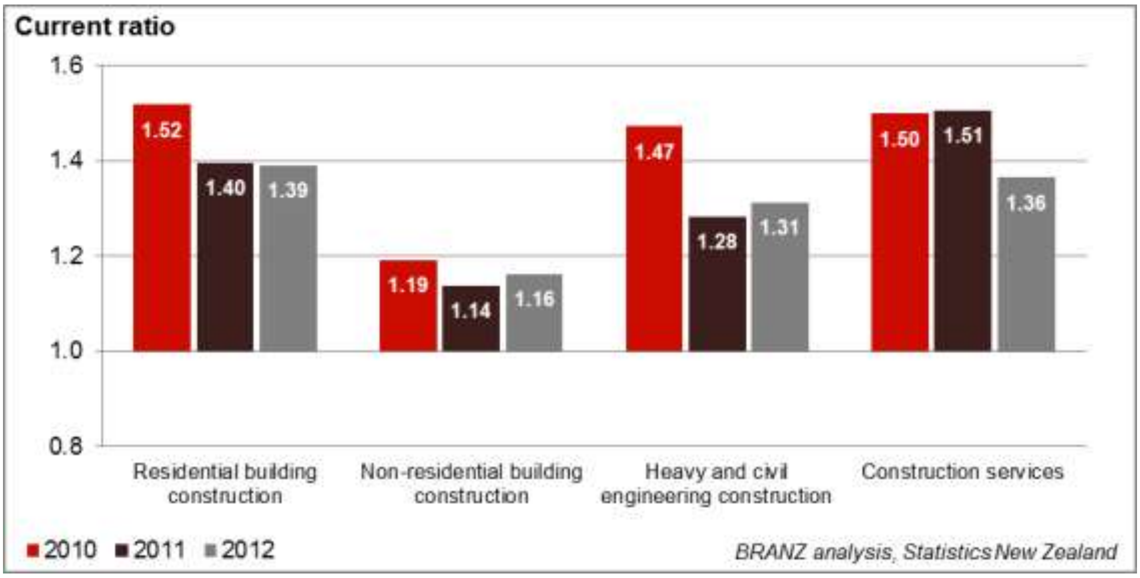
Yet in the case of the construction industry, it may be more appropriate to use the **current ratio** because much of the stock inventory held by construction firms will be materials purchased as part of the current build, but which have not been paid for yet by the client because of staged payments.

> The current ratio includes the stock inventory held by firms, much of which may be materials purchased as part of the current build, but which have not been paid for yet by the client.

For instance, the residential construction sub-sector had sales of $6.7 billion in 2012, and closing stock at the end of the financial year of $1.1 billion, or one-sixth of sales. This proportion fits quite well with the idea of staged payments as materials are put in place. For example, the builder purchases the framing for the house and installs that framing, and it is paid for a couple of weeks later through the next staged payment of the build.

The current ratios for the four sub-sectors are much better than the acid test ratios, as shown in Figure 43.

Figure 43 Current ratios for the four sub-sectors are better than acid test ratios



Non-residential construction had the lowest current ratio, at just under 1.2 in 2012, while the other sub-sectors had ratios between 1.3 and 1.4. When we compare these ratios with the acid test ratios, it is evident that the residential sub-sector has a far higher proportion of stock on hand than the non-residential sub-sector, which is why the current ratio measure of liquidity is so much better for the residential sub-sector.

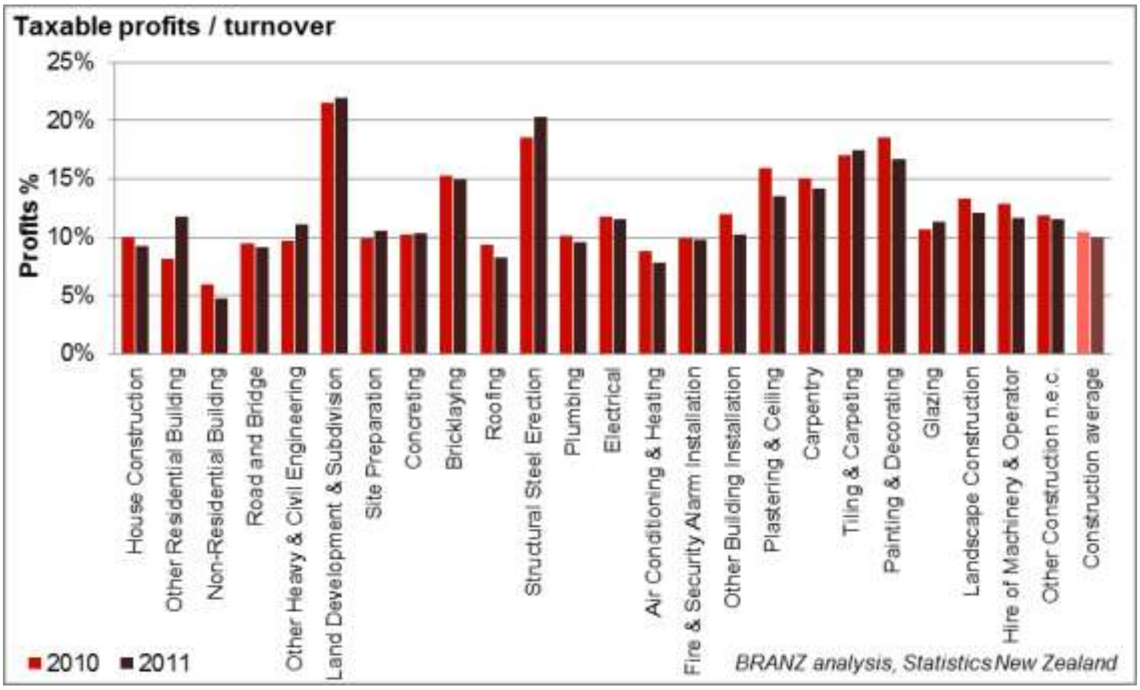
6.1.2 Profitability

Profitability refers to a firm's ability to generate earnings at a reasonable rate relative to its expenses or total turnover incurred during a specific period of time. The "reasonable" rate of earnings relative to expenses or gross turnover varies by the specific type of business and by the number used in the top line of the calculation. Examples of profitability measures include:

- **Gross profit margins**: Expressed in percentage terms, this measures gross profits (before tax, overheads, payroll or interest payments) divided by turnover (or sales).
- **Taxable profit margin**: Also expressed in percentage terms, this measures profits after overheads and payroll, but before tax and interest, divided by turnover.
- **Net profit margin:** Also expressed in percentage terms, this measures profits after tax, overheads, payroll and interest payments, divided by turnover.

Profit margins vary significantly across different sub-sectors of the construction industry, as highlighted by Figure 44, which shows Taxable profit margin by sub-sector.

Figure 44 Taxable profit margins vary significantly by sub-sector



Overall, taxable profit margins average around 10% in the construction industry. However, these profit margins do vary significantly, between 5% in non-residential building, and 22% in land development and subdivision.

This data is useful to firms because they can compare their profit levels with the average for their sub-industry, which provides a benchmark for their own profitability performance.

Unlike Figure 15, which showed labour productivities rising over the last two years, gross margins have fallen across most sub-sectors, suggesting firm profitability has fallen while the return to labour (wages and salaries) has increased.

As many as 33% of construction businesses that recorded either a profit or a loss recorded a loss in the March 2011 year.

Figure 46 (overleaf) shows that the taxable profit margin achieved by businesses across the industry varies by even more than is evident from Figure 44.

The size of the box represents the number of businesses in each sub-sector and profitability level. For instance, 10% of businesses in the industry were loss-making house construction businesses (the red box in the top left corner). Very small sub-sector by profit margin groupings in the bottom right corner have not been labelled for neatness sake.

As many as 33% of construction industry businesses (the red boxes) that recorded either a profit or a loss (as opposed to no activity) recorded a tax loss in the March 2011 year.

6.1.3 Return on assets / investment

Return on assets (also called return on investment) is arguably the key measure underpinning the rationale for running a business. It measures profits divided by net assets invested in the business.

If the return on assets is poorer than could be achieved by putting the capital investment in the bank, for instance, then there is no rational business reason for running the business at the current level of performance. Without dramatic improvements in the performance of the business, the business will continue to be a bad investment that does not maximise the return on investment for shareholders.

Figure 45 shows the average pre-tax return on assets for four sub-sectors of the construction industry, which acts as a benchmark for individual firms to compare against.

Figure 45 Pre-tax return on shareholder's equity (net assets) has remained strong

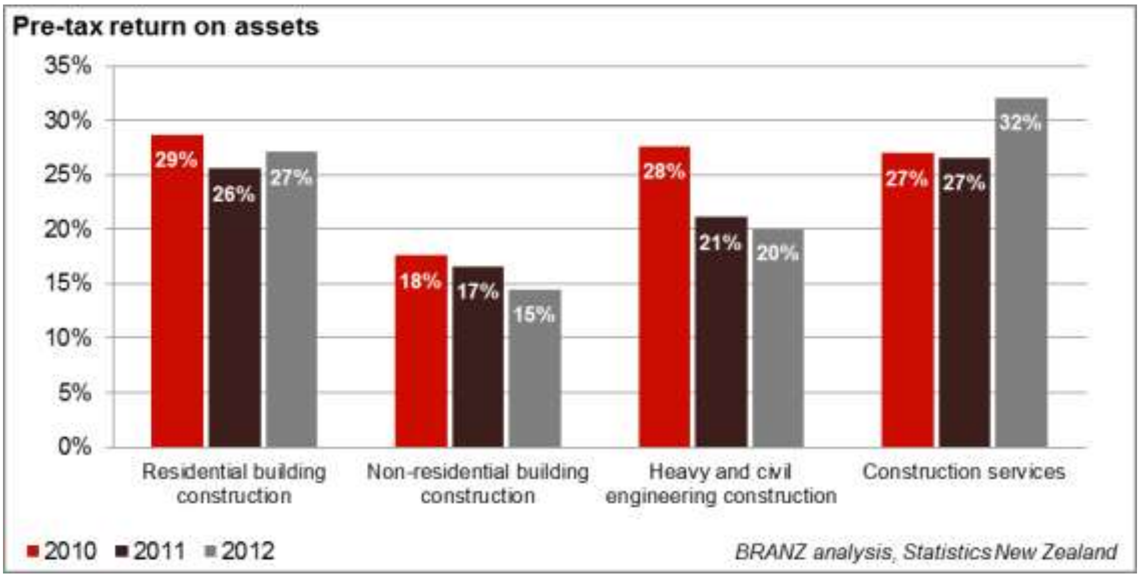
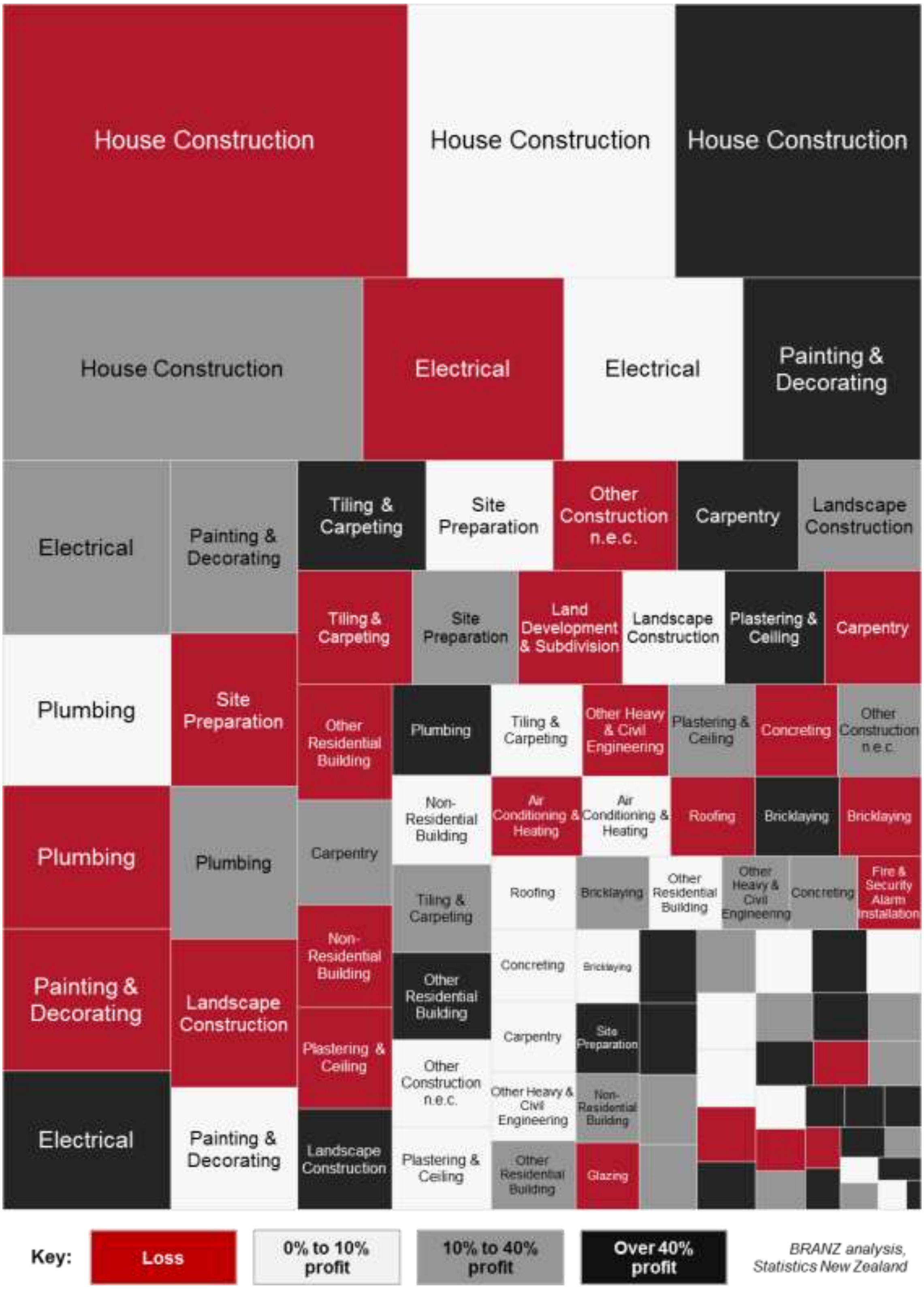


Figure 46 Large proportions of businesses across sub-sectors are losing money



The highest returns on assets have traditionally been in the residential and construction services sub-sectors. One of the key reasons for this is the low level of capital employed by these sub-sectors relative to the capital equipment needed for non-residential and civil engineering businesses.

6.1.4 An aside: Sourcing business advice

Anecdotal evidence suggests that many construction firms do not have a structured approach to monitoring their financial viability or many of their management processes. This is likely to be in part because of where and how most construction businesses source their business advice.

Figure 47 shows BRANZ survey results for sources of business advice for small (five or fewer workers) and larger firms. Note that the percentage totals add to more than 100% because some firms source business advice from more than one place.

Figure 47 Builders' sources of business advice

We would expect accountant and trade association advice to be relatively reliable (particularly financial advice), but the other sources of advice in the chart are less likely to have the focus on financial fundamentals required to monitor the health of a firm, nor the rigorous evaluation of management processes required to run a business well.

Around half of the advice received in small firms could be uninformed as to what genuinely makes a successful construction business.

Medium and large enterprises are more likely than small firms to use accountants. This is not surprising as managing cashflow and tax returns becomes more onerous for bigger firms compared to small firms.

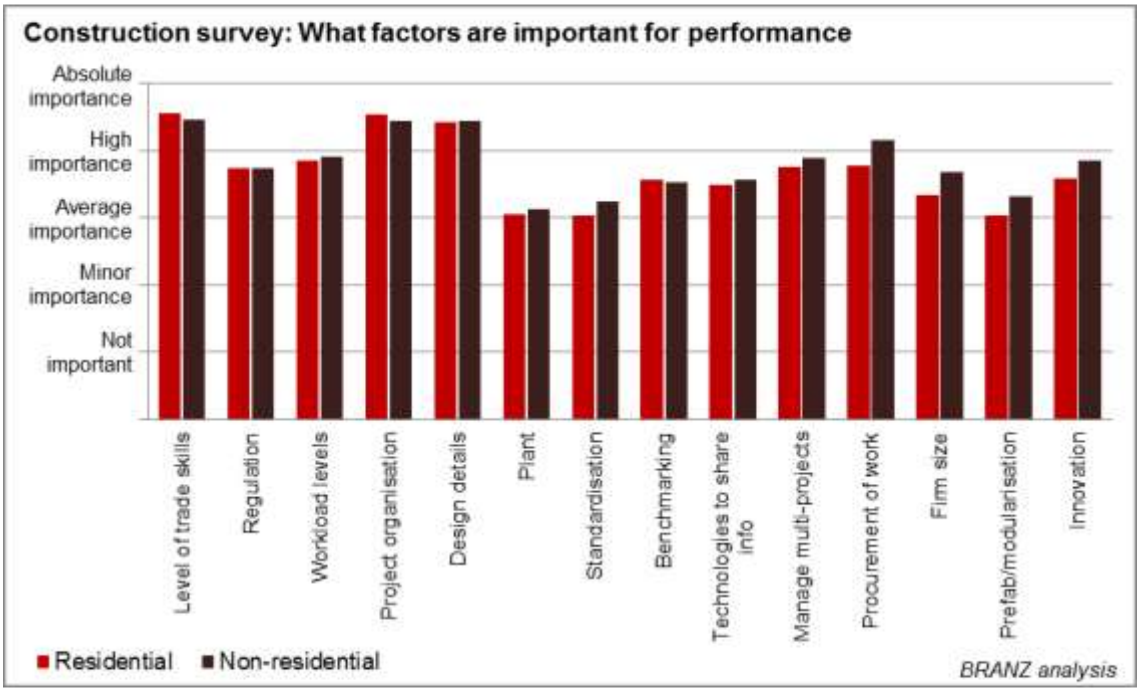
6.2 Supporting viability: other performance measures

In addition to monitoring these basic financial viability performance measures, there are numerous other factors that construction businesses need to monitor to ensure viable businesses. These are examined in the following sections, after briefly looking at what builders believe affects performance most, and what builders already monitor.

6.2.1 Builders' views on what affects performance

As Figure 41 points out, while the viability of the firm is at the centre of running a business, there are a large number of factors that support the effective achievement of this goal. In 2009, a small pilot survey was carried out with builders on the factors they believed affected their performance, or productivity (in the non-technical sense). The results are presented in Figure 48.

Figure 48 Construction firms believe skills, planning and design hold back performance



The results for the two sub-sectors were remarkably similar, with both residential and non-residential builders believing a lack of adequate skills, poor project organisation, and design details are the biggest hindrances to improved performance.

Interestingly, insufficient standardisation or prefabrication are not seen as big restraints on performance improvement although these two categories nevertheless scored around "average importance", not dramatically lower than the highest-scoring factors. Why these factors scored lower is not known, but it could be the respondents had little knowledge of how these factors could improve profitability, or that they thought prefabrication had gone as far as possible, given the current methods for assembling houses on-site and the current structure of the building sector. The literature identifies these as important measures to improve productivity throughout construction.

Both residential and non-residential builders believe a lack of adequate skills, poor project organisation, and design details are the biggest hindrances to improved performance.

The overall level of work and the ability to procure new work were also important factors in productivity. Benchmarking rated about average among all factors and is probably an indication that most firms do not do it, nor are aware of how benchmarking can help improve performance.

This survey and the earlier discussion of the firm's focus on performance rather than productivity in a technical sense point to a large basket of potential performance measures that can be used to monitor how the firm is doing and to identify areas to improve upon.

As emphasised previously, improving the performance of the firm results in greater profitability, which in turn achieves the goal of improving productivity as defined by official measures.

6.2.2 What firms currently monitor

BRANZ has already undertaken work to understand how often firms monitor KPIs (see Page and Curtis 2013).[16] Other work has indicated that improvements in business and management skills, particularly needed in small firms, could have a significant effect on industry productivity, as well as improving individual business performance (Dozzi, AbouRizk, 1993).[17]

Improving the performance of the firm results in greater profitability, improving productivity as defined by official measures.

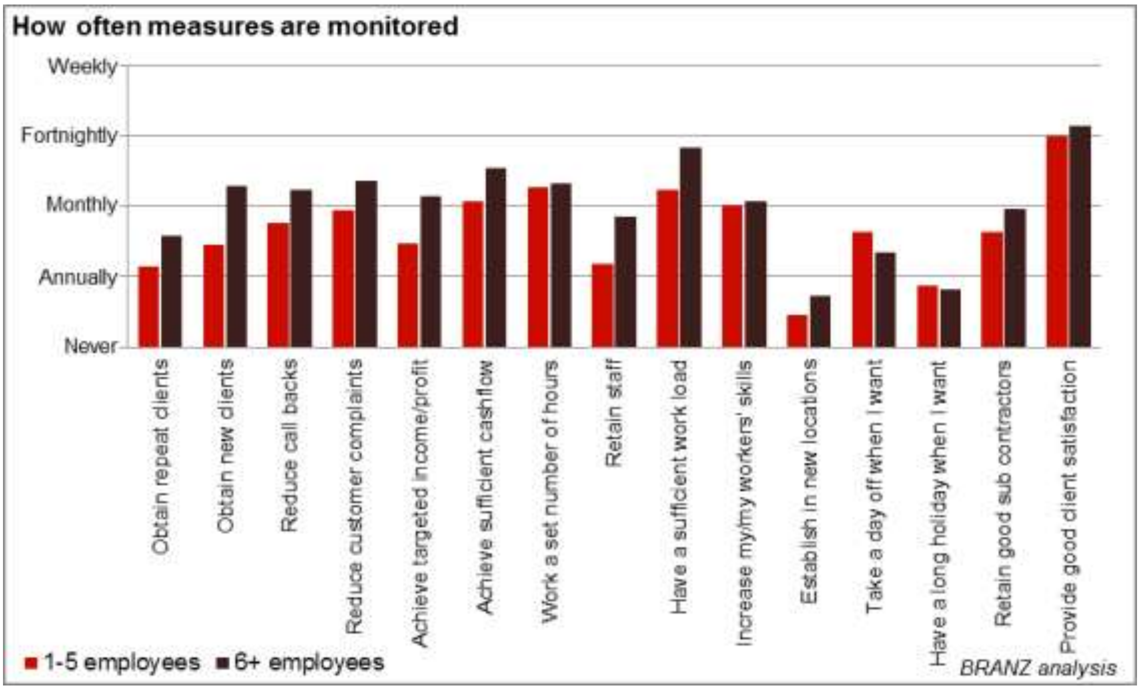
Figure 49 shows various KPIs that firms in New Zealand are using. The BRANZ survey asked how often firms used the various measures although it did not ask them to rate the relative importance of each measure.

Customer satisfaction, workloads and cashflow rated the highest among measures regularly monitored by construction firms. In the survey of more than 450 firms, smaller firms were more likely to monitor the opportunities to take a longer holiday or take a day off, probably reflecting the owners' hands-on and less formal approach to running the business than the more structured approach used in larger firms.

[16] Page, I; and Curtis, M. (2013). *Small firms' work types and resources*.

[17] Dozzi, S; and AbouRizk, S. (1993). *Productivity in construction*. National Research Council Canada.

Figure 49 Firms evaluate performance measures with varying frequency



Comparing Figure 49 with Figure 48 shows that although many firms identify a lack of lack of trade skills as a major impediment to performance, few firms monitor staff retention on a regular basis. Providing good customer satisfaction (the key to repeat business and word of mouth attraction of new clients) is ranked as the most regularly monitored factor, yet small businesses in particular irregularly monitor how they obtain new clients or repeat business.

There is a mismatch between industry concern over lack of skilled workers, and monitoring staff retention. Similarly, regular monitoring of client satisfaction is not matched by monitoring how repeat and new clients are obtained.

We now examine several of these factors in more detail, linking them to specific performance measures. We begin with customer satisfaction (and its flow-on impacts on new and repeat business).

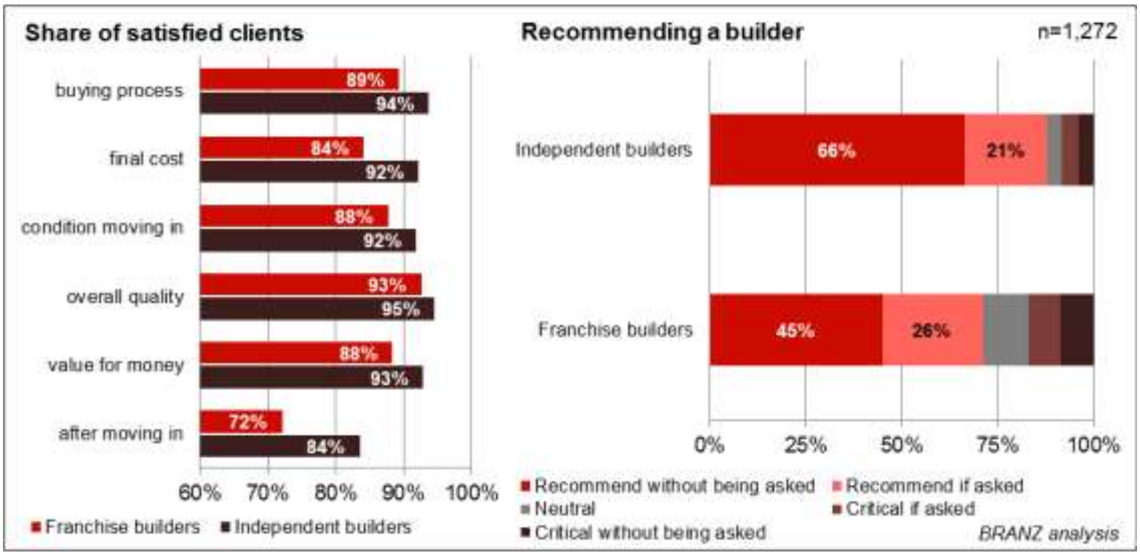
6.2.3 Customer satisfaction

The New Home Owners' Survey (Curtis 2013) asked questions on client satisfaction, likelihood of recommending a builder, and call-backs.[18] Figure 50 illustrates client satisfaction at different stages of the building process, as well as the likelihood that new home owners would recommend their builder.

The analysis started with the buying process and final cost, the condition of the house on moving in day, the overall quality of the build and resultant value for money, and finished with the level of service received after moving in.

[18] Curtis, M. (2013). *New house owners' satisfaction survey 2012*.

Figure 50 Levels of client satisfaction are generally high



Overall scores were high. Independent builders scored at least 84% across all six satisfaction questions, and over 90% on five of the six questions. Franchise builders did not do as well on any of the six questions, but again scores other than "satisfaction after moving in" were good.

The likelihood of new home owners recommending a builder was high for independent builders, at 87%. For franchise builders it was a less impressive 71%. One in six people who used a franchise builder to construct their home were critical of the job done, compared to one in 12 using an independent builder.

Figure 51 considers a wider basket of overarching satisfaction measures including those introduced in Figure 50.

Figure 51 Service after occupancy is consistently the weakest link in client satisfaction

The best scores are in overall quality, followed by buying process. This means that most clients were satisfied with the end result, and that new home owners believe builders helped them along the process to contract sign-up.

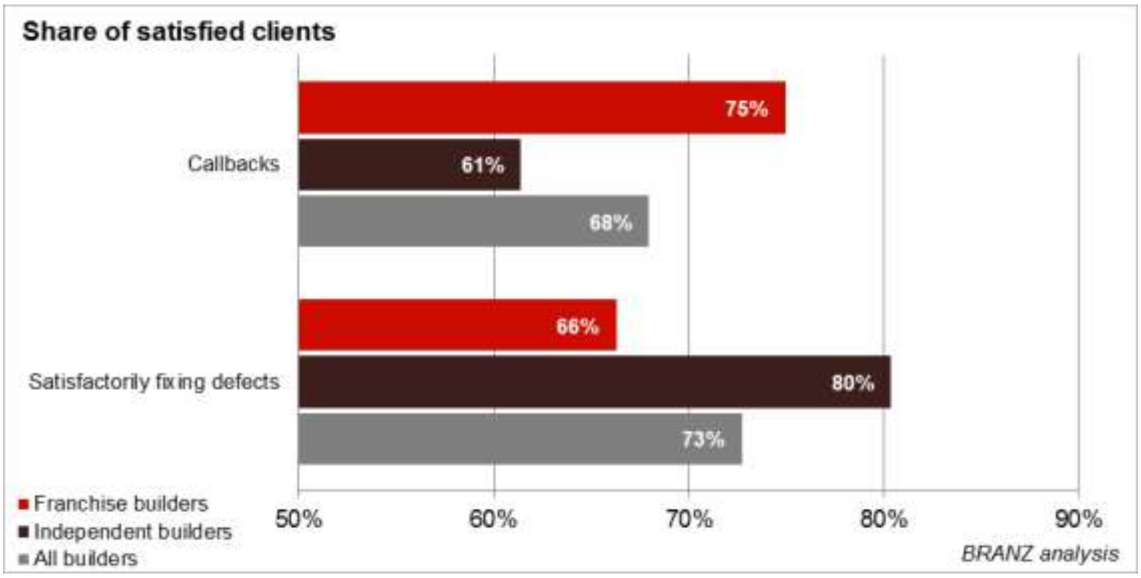
At the other end of the spectrum, performance was poorest on post-occupation service including fixing of defects and other service after occupancy. As a result, the proportion of people who would recommend their builder was lower than the buying process, standard of finish, and quality would suggest. This likely means the lack of post-completion service left a bad taste in the mouth of some new home owners.

Poor post-occupancy service such as fixing of defects and/or unreliable sub-contractors has a strong negative impact on owners' views of builders.

The comments on the survey forms for many of the lower scores pointed in particular to major problems with sub-contractors not fixing defects in a timely manner. This suggests a disconnection between the builder and the needs of the house buyer, in that the builder is perhaps not sufficiently aware of the effect poor service by a sub-contractor has on likely recommendation of a builder.

It is worth considering the issue of call-backs and how well defects are fixed in greater detail given the poor performance on these factors relative to the other measures of client satisfaction. Figure 52 highlights the extent of new home defect call-backs, and the level of client satisfaction with how builders deal with fixing defects.

Figure 52 Call backs and dealing with defects are not strengths of the industry



Three quarters of homes built by franchise builders require call-backs by the new home owner, along with three fifths of houses built by independent builders.

Among those who needed defects fixed, 66% were satisfied with how defects were handled by their franchise builders, while 80% of home owners using independent builders were satisfied. Overall this implies that around 19% of new home owners (27% of the 68% requiring call-backs) were **dissatisfied** with the quality of service in fixing defects. In other words, one in five clients is dissatisfied with how their builder handles defects.

6.2.4 Retaining skills: Job destruction and worker turnover

One of the major barriers to improved performance at the firm level, as identified by construction firms, is the ability to attract and keep an appropriate level of trade skills. Two measures of an industry's ability to provide job security and to retain workers are the job destruction rate and worker turnover rate.

Job destruction refers to the destruction of jobs (disestablishing jobs) as businesses downsize or fail. It provides a measure of job security for workers in the industry.

Worker turnover refers to the number of workers joining or leaving jobs within the industry. This indicates the ability of an industry (and individual businesses) to retain workers (and skills) rather than having them leave the industry for another industry or to stop working altogether. This is sometimes called "external churn".

We explore the headline results for these two measures of skills development and maintenance.

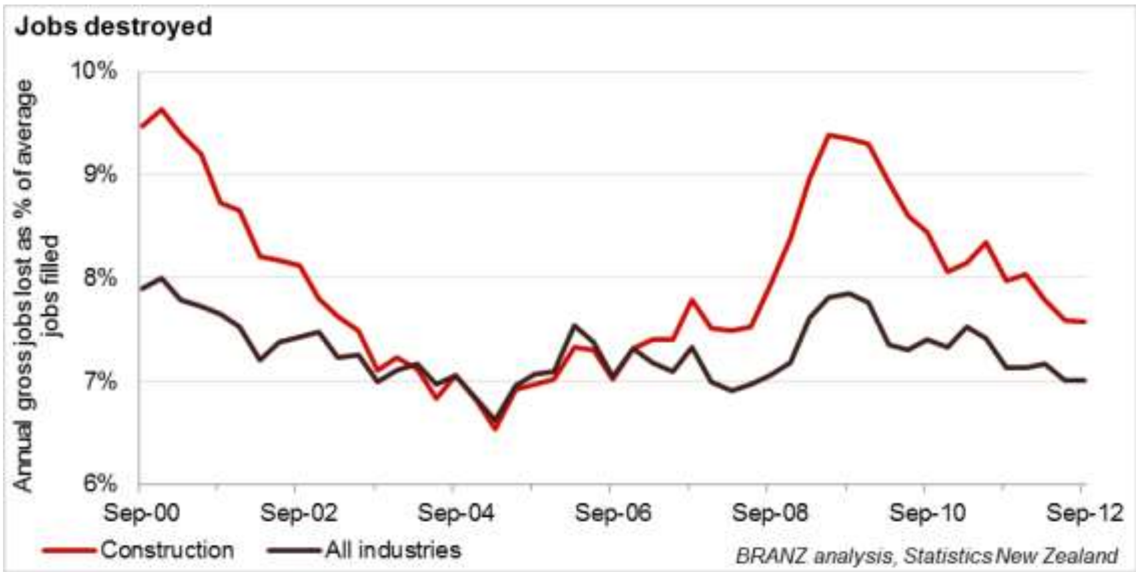
Job destruction rate

Figure 53 shows the rate of job destructions for the construction industry compared to the national average. Technically, this is measured as follows:

$$Job\ destruction\ rate = \frac{4quarter\ jobs\ destroyed}{4quarter\ average\ jobs\ filled}$$

In other words, it divides the number of jobs destroyed in the last four quarters by the average number of jobs in existence at the end of each of those four quarters.

Figure 53 Job destruction tends to be higher in construction during downturns



It is important to bear in mind that this figure does not show the **number** of workers joining or leaving employment in construction, but the **proportion** of **gross jobs** that cease to exist in a 12-month period.

So for instance, in the year to June 2009, 9.4% of the average number of jobs in existence across that year were destroyed. In other words, almost one in 10 jobs was destroyed in that year as businesses downsized or closed.

Jobs tend to be destroyed in the construction industry at a higher rate than in the New Zealand economy overall, particularly during downturns. During years of strong overall economic growth, job destruction rates in construction tend to closely mirror the national job destruction rate. This is somewhat surprising; with higher than national job destruction rates in years of poor demand, we could expect that the opposite would be true in boom years, yet it seems the national job destruction rate acts as a lower bound for job destruction rates.

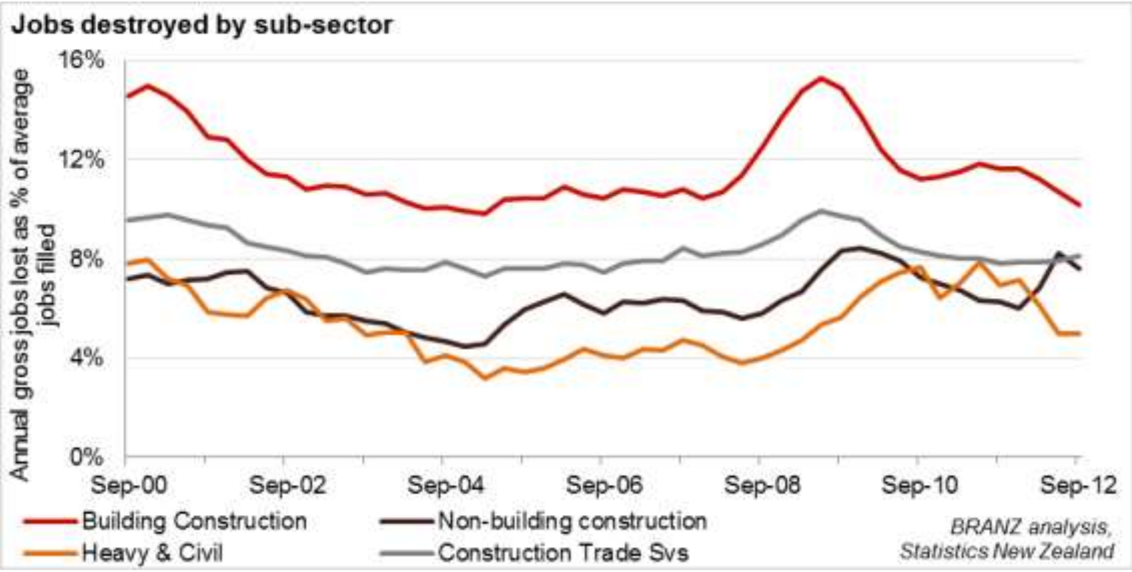
High rates of job destruction as businesses fail or downsize reduces job security and possibly affects business attitudes toward training and staff retention.

The implication is that there is **less job security in the construction industry** because jobs are destroyed more rapidly during downturns.

This discussion must be seen in the context of the earlier discussion on worker hoarding in the construction industry. We showed earlier that the construction industry as a whole appears to hold onto workers for as long as they can even when workloads fall. Nevertheless, as this current analysis shows, jobs are destroyed at a higher rate than in the rest of the economy overall. This may mean that businesses fail more regularly, but workers perhaps manage to stay in the industry (thus not affecting the total number of workers in the industry) but in new jobs.

Figure 54 shows that the job destruction rates for four sub-sectors.

Figure 54 Within construction, the highest job churn rates are in building construction



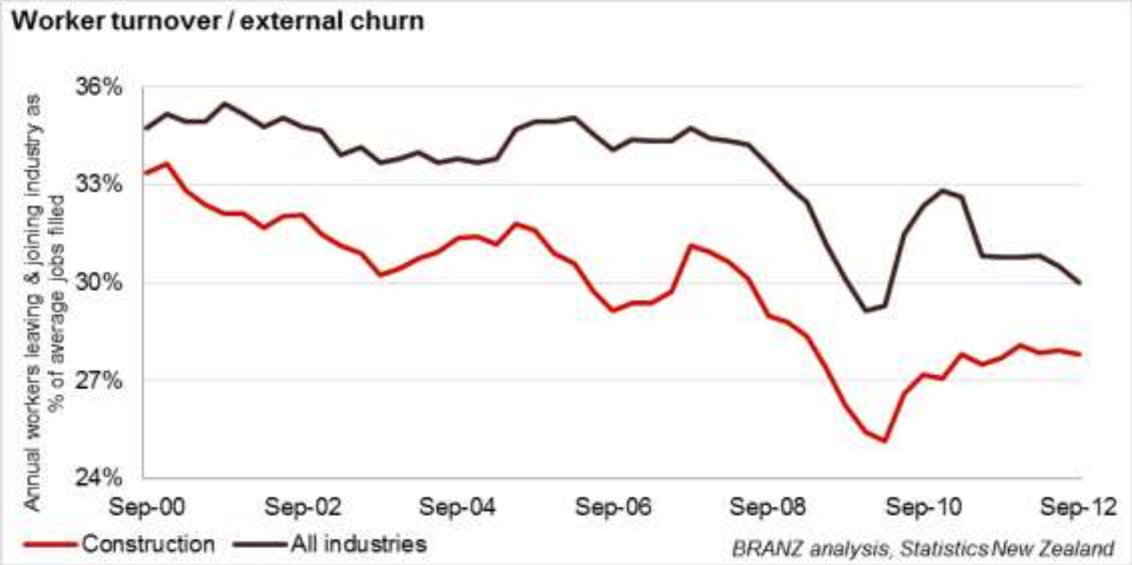
The building construction sub-sector, dominated by the residential construction market, shows the greatest variation in job destruction rates, with nearly one in six jobs being destroyed in the year to June 2009, for instance. Job destruction rates tend to be far lower and far flatter across the economic cycle in the other sub-sectors.

Worker turnover rates

Figure 55 shows the rate of workers entering and leaving jobs in the construction industry compared to the national average. Technically, this is measured as follows:

$$Worker\ turnover\ rate = \frac{4quarter\ worker\ accessions + 4quarter\ worker\ separations}{4quarter\ average\ jobs\ filled}$$

Figure 55 Keeping workers in the industry is something construction does relatively well



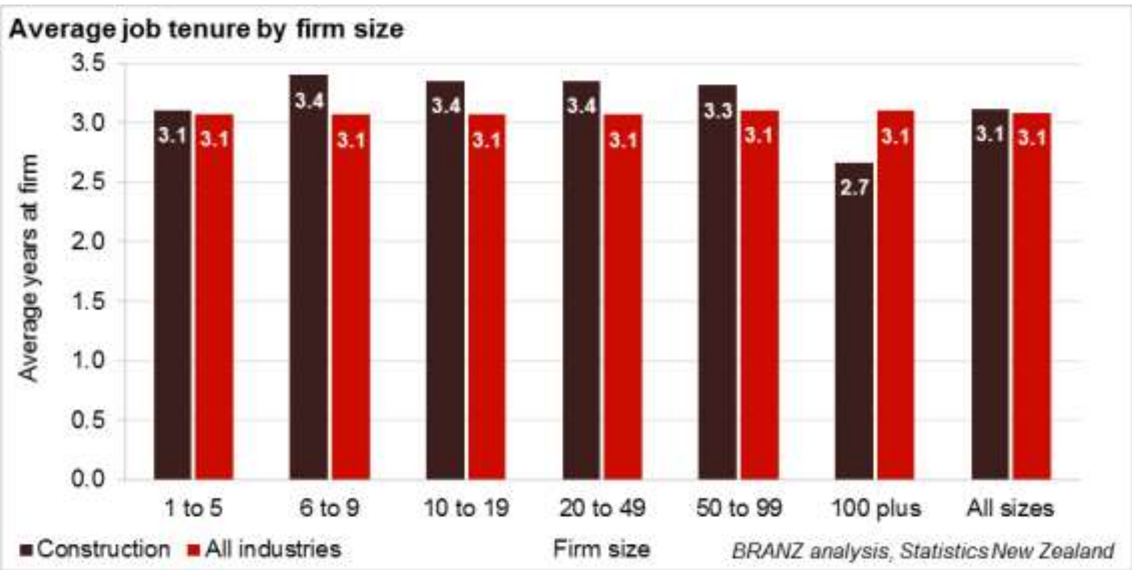
Churn in and out of the construction industry is better than for the economy overall. This means that, despite the large proportion of jobs destroyed in the industry each year, workers tend to stay within the industry more than workers in other industries.

Despite the large proportion of jobs destroyed in the industry each year, workers tend to stay within the industry more than workers in other industries.

Again, we must see this in the context of earlier discussions on worker hoarding and job destruction rates which at first observation may appear to contradict worker turnover data. The relatively good performance of worker turnover is naturally only measured across businesses that continue to exist, and therefore the high turnover of jobs (job destruction) in the industry is a very different measure from worker turnover, which measures tenure at existing jobs. It is perfectly plausible that jobs are created and destroyed at a higher rate, while the length of time workers stay in jobs that continue to exist is also higher than for other industries. Indeed, it may be that because of the insecurity created by the high rate of job destruction, workers tend to stay in a job when they find one that is relatively secure.

The tendency to stay longer in a particular job holds true for most firm sizes as well, as Figure 56 shows. Only in very large firms (of over 100 employees) do construction industry workers tend to remain in the job for less time than workers in other industries overall. This suggests that worker retention within the industry and even within specific existing jobs is not as big an issue as the disestablishment of jobs.

Figure 56 Workers in construction tend to stay in their jobs for longer



6.2.5 Innovating to add value

Other performance measures that can be monitored include the extent to which construction businesses innovate. Innovation can take various forms, including the adoption of new technologies; increased prefabrication or standardisation; or improved management, processes, services and marketing.

This section highlights some of the trends in the industry that point to more innovation, as a benchmark against which individual businesses can measure themselves.

Increasing the use of management and process tools, and further prefabrication and standardisation may boost performance.

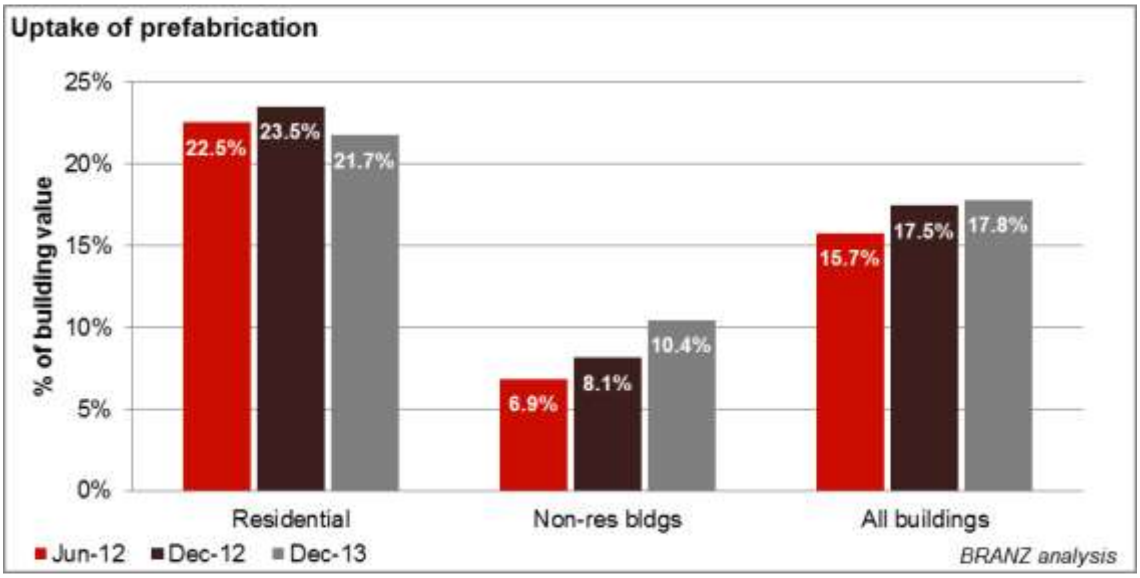
Prefabrication

One way to improve on-site productivity and quality is through prefabrication. BRANZ is monitoring the uptake of prefabrication through its survey programme. The results of our most recent surveys are shown in Figure 57, while Burgess et al (2013) offer further insights into the value of prefabrication.[19]

Initial indications are of a slow increase in overall uptake, but it will be several years before we have a reliable trend. At present, around 22% to 24% of the value of **residential** buildings put in place consists of prefabricated components. In non-residential buildings, there is far less prefabrication, but the trend does appear to be upward, reaching around 10% in December 2013.

[19] Burgess, J; Buckett, N; and Page, I. (2013). *Prefabrication impacts in the New Zealand construction industry*.

Figure 57 Prefabrication uptake is highest for new residential buildings

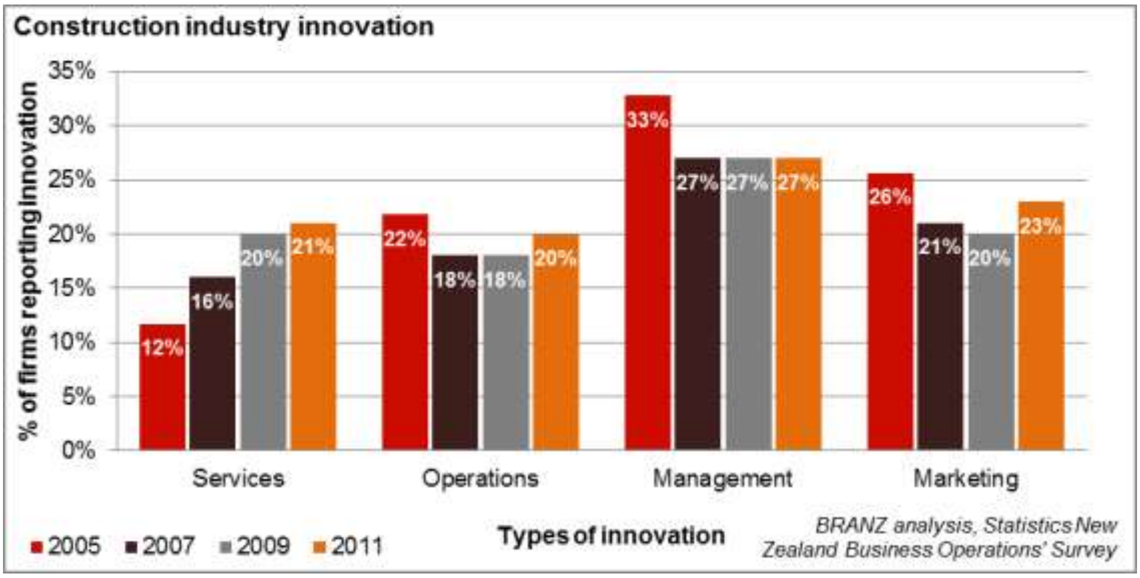


Improving soft skills

Another way to innovate and therefore increase efficiency of operations (and profits) is through adoption of better processes, management, interaction with the market, or an improved range of services.

SNZ conducts the Business Operations Survey annually and every second year it asks about innovation, with Figure 58 illustrating trends in innovation activity within the industry. "Services" refers to the type of goods and services provided by the firm and is a measure of movement into new areas of work. "Operations" refers to the processes used to deliver services and may include new technology. "Management" includes people and may involve firm reorganisation. "Marketing" refers to the methods used to advertise services.

Figure 58 One fifth of firms are innovating

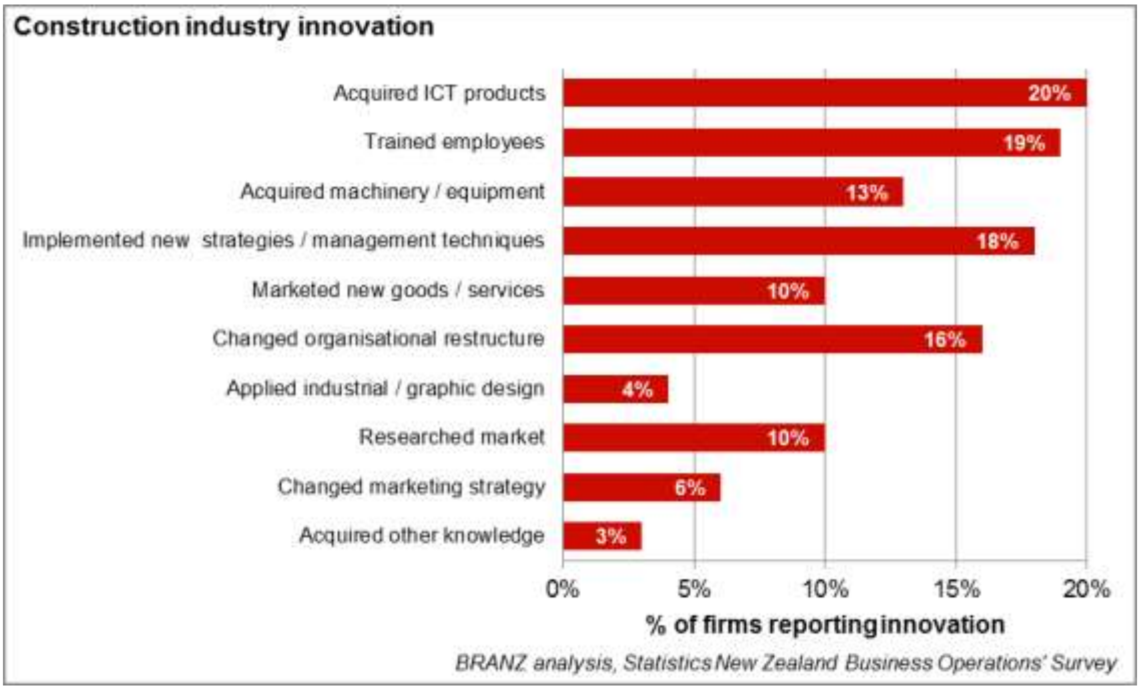


The most significant increase has been in the types of services undertaken and suggests firms are diversifying in order to survive and expand. Whereas only one in eight businesses innovated by providing new services in 2005, that grew to one in five businesses by 2011.

Trends are more mixed in terms of innovation across operations, management and marketing, with no clear spike in innovation. Overall, however, more than one in four businesses report that they innovated within the management of the business each year since 2005.

Figure 59 provides further detail on some of the actions construction firms are taking to innovate.

Figure 59 Most innovation includes ICT improvements, training and strategy



The most common innovation is in the uptake of more ICT solutions, followed by staff training and new strategies / management techniques. Few firms markedly changed their marketing strategies, researched their markets, applied industrial or graphic design techniques, or marketed new goods and services.

Unfortunately the questions in the Business Operations Survey are relatively generic because of the wide range of industries covered, suggesting that further work may be required to understand exactly what types of innovation construction firms are undertaking.

7. RECOMMENDATIONS

This analysis of the various factors that firms believe can improve performance, customer satisfaction, staff retention, and innovation suggests a number of relatively straight-forward measures that even small firms can employ to gauge how well they are doing, and where areas for improvement lie. But further monitoring and development work needs to be done.

7.1 Expand the basket of meaningful firm-level measures

A basket of potential measures is set out in Figure 60, which also highlights whether or not benchmarking is already available for each measure.

Figure 60 There are several easily-monitored performance measures at the firm level

Measure name	How to measure this	Industry benchmarking available?
Financial measures		
Solvency	Current assets / current liabilities; greater than 1.0 needed	
Profitability	Gross, taxable or net profit / turnover	Yes
Return on Assets	Taxable or net profit / net assets	Yes
Customer satisfaction		
Formal written feedback from client	Qualitative, basic survey questionnaire may help	Yes
Call back rate	% of jobs requiring a call-back	Yes
Fixing of defects	hours required, $ of labour costs	
Repeat clients	% of annual work value or jobs that is repeat business	
Staff retention		
Worker turnover rate or average tenure	Average years in job per worker, (joiners + leavers) / average staff level	Yes
Job turnover rate	Jobs disestablished / jobs filled at start of year	Yes
Innovation		
Innovation spend	% of turnover	
New management tools / processes	Qualitative assessment of changes	
Prefabrication	% of value of work put in place	Yes

BRANZ

Many of these measures already have benchmarking available at the sub-sector level, and often even the firm-size level, to allow individual firms to consider their outcomes relative to their peers, as well as to established rules of thumb around profitability and the like.

7.2 Investigate the use of management tools

One area in which the current data falls short is in understanding what sort of management tools and processes firms are adopting, and to what extent they attribute improved performance to these systems. This is an area that would benefit from further work.

7.3 Continue to facilitate benchmarking

The BRANZ New House Owners' Satisfaction Survey and the Firm Performance Survey provide information on client satisfaction in the industry, and the extent to which small and larger construction industry firms monitor and respond to things like worker turnover and reduced productivity, respectively.

We recommend that we continue to monitor trends in performance across different business sizes, regions, and sub-trades, so that we can provide benchmarking for the industry, against which individual firms can compare results.

8. APPENDIX A: HOW SNZ ESTIMATES CHANGES IN CONSTRUCTION PRICE INDICES

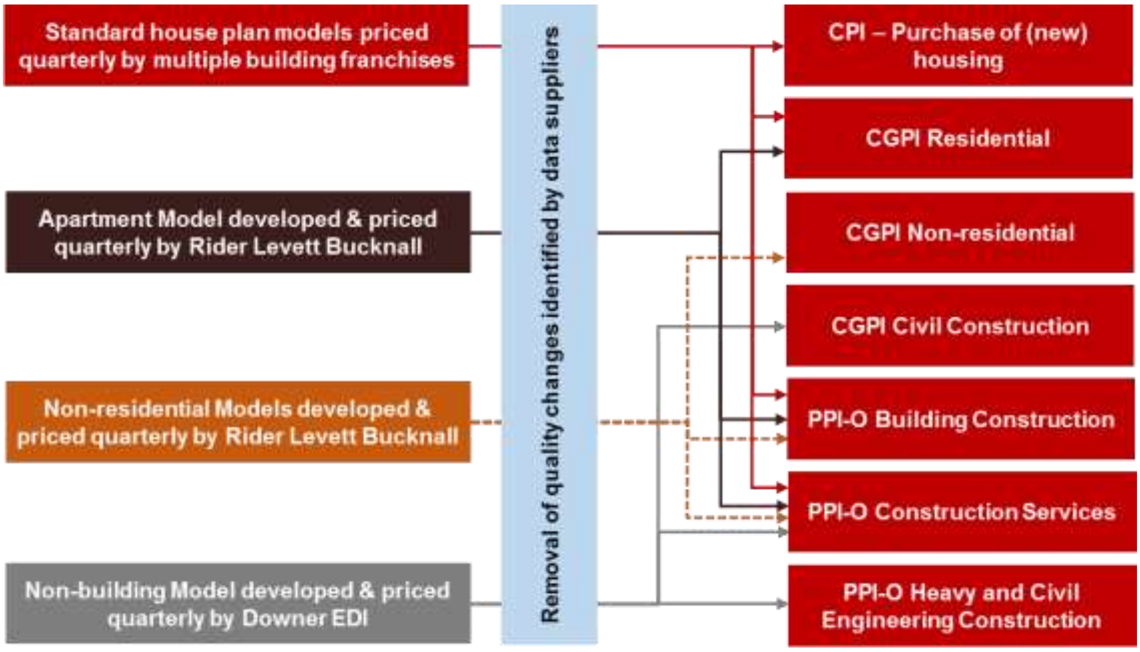
Construction price indices are included in three closely-related SNZ price indices. This chapter explains how these indices are estimated, and how they are related.

8.1 Introducing the price indices

- **Consumers Price Index** (CPI) most notably the "Purchase of (new) housing" index currently worth 4.66% of the total CPI weighting.
- **Capital Goods Price Index** (CGPI) – Residential Building, Non-residential Building, and Civil Construction indices.
- **Producers' Price Index Outputs** (PPI-O) – Building Construction, Heavy and Civil Engineering Construction, and Construction Services.

Figure 61 summarises how the SNZ models and price indices are related.

Figure 61 The relationship between SNZ models and indices



8.2 CPI: Purchase of (new) housing

Much of this section is sourced directly from SNZ.[20] It explains how the CPI Purchase of (new) housing index is estimated.

8.2.1 Selecting a sample

Members of the Master Builders Federation are selected using building guarantees data for inclusion in the CPI purchase of new dwellings survey. The data is stratified into the

[20] See http://www.stats.govt.nz/browse_for_stats/economic_indicators/cpi_inflation/home-ownership-in-the-cpi.aspx, retrieved on 19 December 2013.

five broad CPI regions: Auckland, Wellington, Christchurch, Rest of North Island and Rest of South Island.

Builders with four or more guarantees per year in any one of the five broad regions are included for initial selection in the survey. The final sample is selected by identifying builders within the initial selection that are able to provide prices for a **standard house plan**. The sample was last reselected in 2004 and consists of about 140 builders providing prices for about 215 house plans. These builders are located throughout the country.

8.2.2 Price collection

Price change is based on the price for constructing a new dwelling, from a survey of builders that construct standard-plan houses. Respondents are asked to **provide a quote for a house plan that they build fairly regularly**. Larger building enterprises (based on the number of buildings constructed) are asked for two such plans, while smaller building enterprises are asked to provide one plan.

The following relevant survey information is requested from respondents:

- floor area of the house in square metres
- number of bedrooms
- important features of the house (for example, double garage, en-suite bathroom, study)
- price (at the mid-point of each quarter) to build the house on a level, fully-serviced section owned by the client
- any changes to construction components or fittings.

Further, **when the price for the provided quote changes**, respondents are asked to indicate reasons for the change. The following options are given on the questionnaire (in the order that they appear on the questionnaire):

- price of construction components
- price of fittings
- labour costs (this includes staff recruitment and changes to existing salaries and wages)
- sub-contractor charges
- consent fees and other local authority charges
- other administration costs
- reaction to competitors' prices.

Respondents are also asked to provide:

- any comments that may help Statistics NZ understand any of the quote change reasons ticked above
- any other reasons for the quote change
- how any construction components or fittings have changed.

8.2.3 Quality adjustment

As with all price index collections, efforts are made to ensure that changes in prices quoted reflect constant quality. Respondents are asked to provide a quote for the same standard plan each quarter. Further, it is assumed that the house will be built on a level, fully-serviced section and that the section is not part of the price.

When any of the information about a standard plan changes, or the plan itself changes, quality assessments are made. This usually occurs after consultation with the builder in question, to remove any change in the quote that can be attributed to quality change.

The introduction of the Building Act (2004) resulted in improvements to practices and materials used in constructing new house plans (such as the introduction of double glazing in 2007), including those tracked in the CPI survey. The value of any improvement in materials that could be identified, and the value of any additional labour identified as required because of the improved building practices were removed from any quote increases, as these were regarded as improvements in quality. In addition, as increased consent fees and other local authority charges were often reported as a reason for increases in prices, a proportion of this was removed. This proportion was removed as it was deemed to be attributable to an increase in the overall quality of the dwelling, through better monitoring of building practices.

8.3 From CPI to CGPI

The Purchase of (new) housing index is used to form the bulk of the Residential Building index of the CGPI. However, a second model, for apartments, is also introduced although it has a relatively small weighting in the index.

This model considers materials, labour and quantity (volume) price changes, and is based on a standard model monitored by Rider Levett Bucknall (RLB).

A number of similarly structured models are used for non-residential building types such as educational facilities, warehouses and the like, and weighted to compose a Non-residential Building index.

The Civil Construction index is estimated using a similar model approach undertaken by Downer EDI.

8.4 From CPI and CGPI to PPI

The inputs into the CPI and CGPI just described are also used to develop the PPI-O, which is arranged by industry rather than unit of output. Thus the Building Construction PPI-O, for instance, will use the same CPI standard house model, and RLB Apartment and Non-residential models, appropriately weighted, to estimate an overall index.

Similarly the PPI-O for Heavy and Civil Engineering Construction will use the Downer EDI model, while the PPI-O for Construction Services is a weighted combination of the inputs into both the Building Construction and Heavy and Civil Engineering Construction PPI-O.

8.5 Limitations of indices

There are a number of challenges presented by these indices. None of these are meant as a criticism of SNZ; they simply highlight the challenge of accurately developing price indices.

- **Quality v price**: Clearly SNZ is trying to accurately measure quality v price changes and to remove the impacts of quality changes from its indices. In reality, however, they are unlikely to pick up all changes as they are reliant on the builder or the QS to distinguish between pure changes in the price of inputs (passed on as price increases) and input price increases that are the result of improvements in quality (such as double glazing).
- **Quality creep through technology or slow-moving improvements**: Discussions with SNZ highlighted the fact that other movements, such as the adoption of new technology which may happen quite slowly, may be even more difficult to detect in the calculation of price v quality changes, as the builder may not specifically identify these changes because they are incremental, and are small in any given quarter.
- **Short-term disequilibrium**: Over the long-term, price indices, assuming they are able to accurately isolate and exclude quality improvements, will tend to accurately reflect the long-term trends in price. However, in the short-term, anomalies such as those seen when a new regulation (such as double glazing) is introduced may lead to a spike in the reported prices that is simply a result of a supply chain that is not yet up to the task of providing huge amounts of a new specification or product. While it is correct to capture these price spikes as such, without annual smoothing it makes the choice of start and end point of a time-series evaluation particularly tricky.
- **Independence of estimates**: Some might suggest that in the case of a single (or small number) of firms providing estimates of the cost to undertake projects there may be incentive to inflate prices. One reason this incentive exists is that some of these indices are used for contract price adjustments on, for instance, roading projects. The higher the price increase, the more the contractor gets paid. This may lead to an over-inflation of prices (and therefore the CGPI and PPI) and a resultant smaller estimate of construction industry GDP.

9. APPENDIX B: GLOSSARY

- **Acid Test Ratio**: A test of whether a firm has enough short-term assets to cover its short-term liabilities. Cash plus accounts receivable plus short term investments all divided by current liabilities.
- **Capital productivity**: Total production (GDP) divided by capital units.
- **Capital stock**: See Net capital stock.
- **Capital units**: An estimate of the standardised number of units of capital (or more technically, the flow of capital services) used by an industry which are generated by using capital assets over a specified period of time (typically a year). It is the amount of 'service' each asset provides during a period. For each asset, the services provided in a period are directly proportional to the asset's productive capital value in that time. As an asset ages and its efficiency declines so does the productive capital value and the service the asset provides. Capital services is the appropriate measure of capital input in production analysis. For more information, see Statistics New Zealand. (2012*). Productivity statistics: Sources and methods*, Eighth Edition.
- **Current liabilities**: A firm’s debts that are due soon (usually within one year). Current liabilities include short term loans, accounts payable, and accrued liabilities.
- **Current ratio**: A measure of whether a firm has enough short-term assets to cover its short-term liabilities. Current assets including stock divided by current liabilities
- **GDP** (gross domestic product): The value of all the final goods and service produced in an industry or country within a given period (usually a year).
- **GFCF** (gross fixed capital formation): The value of new capital (buildings, plant, equipment and the like) put in place within a geographic area within a certain time (usually a year).
- **Gross profit**: Turnover less cost of sales
- **Gross profit margin**: Expressed in percentage terms, this measures gross profits (before tax, overheads, payroll or interest payments) divided by turnover (or sales).
- **Job destruction:** The destruction of jobs (disestablishing jobs) as businesses downsize or fail. It provides a measure of stability in job security for workers in the industry.
- **Labour units**: The number of hours worked in generating the GDP produced in an industry or economy.
- **MFP** (multi-factor or total productivity): Total production (GDP) divided by capital units and labour units.
- **Net capital stock**: The sum of the written-down (depreciated) values of all the fixed assets still in use.
- **Net profit**: A measure of the profitability of a venture after accounting for all costs including cost of sales and direct costs, taxes, interest, overheads and one-off costs.
- **Net profit margin**: Expressed in percentage terms, this measures profits after tax, overheads, payroll and interest payments, divided by turnover.
- **Performance**: The effectiveness of a firm or industry in achieving its primary objectives.

- **Productivity**: The ratio of outputs (usually GDP in technical estimates) divided by inputs (usually capital and labour).
- **Taxable profit**: Turnover less cost of sales, overheads and payroll
- **Taxable profit margin**: Expressed in percentage terms, this measures profits after overheads and payroll, but before tax and interest, divided by turnover.
- **Worker turnover**: The number of workers joining or leaving jobs within the industry. This indicates the ability of an industry to retain workers rather than having them leave the industry for another industry or to stop working altogether.