STUDY REPORT

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Building Industry Performance Measures

Part One

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Preface

This is the first of a series of reports on the measurement of performance in the construction industry. The Building and Construction Sector Productivity Partnership is concerned at the low growth of productivity in the industry and is examining ways to improve its performance. Some research has been done into the drivers of productivity and this project is about what performance indicators and outcomes should be measured in order to monitor progress in improving productivity in the industry.

Acknowledgments

Building Industry Performance Measures Part One

Abstract

The Construction Productivity Partnership is developing a number of programmes to improve productivity in the building and construction industries. The goal is to raise productivity 20% by the year 2020. The metric for this is the official productivity statistics produced by Statistics New Zealand (SNZ). Previous work has shown the programme needs to address many aspects of the industry including firm behaviour, skills, procurement and client knowledge. The stakeholders are many and all need to be involved in understanding what steps need to be taken to improve performance. This project looks at how we can measure progress toward the goal. It looks at the drivers and outcomes of productivity, as set out in the Draft Research Action Plan. Ways to measure progress in each outcome are identified and some baseline data is provided.

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1.   INTRODUCTION

There are a variety of measures available to monitor the performance of the building industry. Different measures are used for projects, at the firm level, and at the national level. This report is mainly uses firm level performance measures which can be aggregated up to provide an industry level measure.

The main official measure of performance at the industry level is productivity. This is calculated from national accounts data and employment and capital stock data. The same method is used for all industries enabling consistent comparisons to be made between industries and over time. The main problem with this measure is it is incomplete as it does not cover the views of end-users nor the issue of the quality of the output.

This research looks at current measures of productivity and other official data which is related to performance such as business operations behaviour and firm profit margins. The Productivity Partnership identified several drivers of productivity and methods for monitoring these drivers are identified.

The results of two BRANZ surveys of owners and firms are reported; first, a measure of quality using end-user satisfaction levels; second, firms' use of performance indicators as a measure of commitment to improvement.

2.   SUMMARY

The main findings are:

- The official productivity indexes of labour, capital and multi-factor productivity should be the main measure of progress toward the goal of improving productivity by 20% by 2020.

- To help achieve the goal industry needs to concentrate on a number of measures identified in the Research Action Plan[1]. These include; at the project scoping/design stage, a consideration of whole life costs, innovation, prefabrication, standardisation, and BIM; at the procurement stage, more use of KPIs, counter-cyclical orders and design-build. The industry needs to develop methods for monitoring uptake of these measures and Table 1 has listed ways to do this.

- Official productivity data has a delay of at least 18 months. A more timely measure is needed and the use of capital formation per industry worker (three-month lag) is suggested. The latter approximately tracks the official measures and provides an early indication of trends.

- Labour productivity is available for the 24 sub-industries in construction, though it has a 24-month lag. This should be monitored from year to year to indicate the relative performance of the various sectors and which sectors need improvement.

- A new home owners satisfaction survey was undertaken by BRANZ and provides various measures of quality including overall satisfaction levels, call-backs and builder recommendation responses. Individual firms can apply to BRANZ on a confidential basis for data on their firm's results compared to industry averages. A similar survey could be developed for non-residential building owners.

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[1] http://buildingvalue.co.nz/publications – see the Draft Research Action Plan from the Productivity Partnership.

- Another survey, of home builders on time waste and use of performance indicators, was undertaken by BRANZ. The abovementioned two surveys provide benchmarks of industry performance and it is suggested they be repeated at two-year intervals.

- The next report due in 2013 will provide baseline data for all the relevant criteria, against which progress in industry performance can be measured.

3. LITERATURE SEARCH

Official productivity measures are published by SNZ. The building and construction industry performs poorly in labour productivity and multi-factor productivity, compared to other industries. Various reasons have been advanced for this and include the boom-bust nature of construction, inadequate skills, small firm size, lack of standardisation and prefabrication, compliance costs and low innovation, see Davis (2008). Remedies are not part of this study but these issues suggest a variety of measures may be needed to monitor progress in improving performance.

Most literature on measuring industry performance is at the firm level and applies to all industries. Eccles (1991) noted that for firms in general the use of financial indicators is limiting in terms of understanding how to improve performance and other factors such as innovation, market share and customer satisfaction needed to be included. Kaplan and Norton (1992) introduced the Balanced Scorecard concept which has four aspects; financial, customer, internal business processes, and learning and growth (see Appendix for more details). Following the Egan report (1998) the UK Department of the Environment, Transport and the Regions which has a role in housing, developed a set of key performance indicators (KPIs) for industry firms consisting of time, cost, quality client satisfaction, orders, business performance and safety (DETR 2000).

These KPIs have been further developed in the UK and other countries including New Zealand. Locally Constructing Excellence NZ (www.constructing.co.nz) uses approximately ten KPIs and firms are able to benchmark themselves against industry averages.

To measure the quality of the end product, post-occupancy evaluation (POE) methods were used in the UK in the 1960s and 1970s. British architects (RIBA 1963) introduced "Stage M – Feedback" in their conditions of work where they reviewed the building performance after first occupancy and reported back to the client. Subsequently Stage M was dropped by architects because clients were not prepared to pay for feedback and architects did not want to give the impression that this service would be provided for free (i.e. as part of normal architectural work).

Renewed efforts to encourage evaluation and feedback have continued. Bordass and Leaman (2005) in the UK surveyed construction clients on feedback and found many barriers to its adoption. These included uncertainty about the techniques available, POE is too academic, clients did not want to pay for feedback as tenants and future owners benefit more than them, and the disconnect between procurement and operations in building owner organisations. These barriers are being gradually overcome by a "portfolio of techniques" approach where clients can visit a website (www.usablebuildings.co.uk) and chose a simple or more complex method according to their needs. There are overlaps with the green rating of buildings (e.g. BRE environmental assessment method, www.breeam.org). Major building owners would use it for design feedback on subsequent projects and the one-off owners would use it to assess whether their energy and water use (for example) could be better optimised.

POE has been defined as the "systematic evaluation of opinion about buildings in use, from the perspective of the people who use them" (www.postoccupancyevaluation.com). In the new

house sector, this is the homeowner and it is believed this is not often done locally. A search was made of the larger builder websites for mention of satisfaction. We found GJ Gardner Homes' service promise states its vision is to "have every customer recommend us to their closest friend" (www.gjgardner.co.nz). Both the David Reid Homes (www.davidreidhomes.co.nz) and Landmark Homes (www.landmarkhomes.co.nz) websites state they thrive on the satisfaction of their homeowners. Golden Homes wants the experience "to be a pleasure from your very first showhome visit to opening the door of your completed Golden Home for the very first time". Many other firms also mention satisfaction or experience as being an important aspect to them. However, it was not apparent if any post-occupancy evaluation was done by the builders nor how they monitored these objectives or satisfaction of their clients.

Independent home owner satisfaction surveys have been carried out overseas. Three customer satisfaction surveys were conducted by Ipsos MORI for the Housing Forum and Constructing Excellence UK between 2000 and 2003. The structure of some of these questions was used in the local survey undertaken by BRANZ, reported later. Some other questions were based upon a survey by the Home Builders' Federation (HBF) in the UK.

JD Power and Associates carries out similar surveys in the US. Such surveys have been ongoing for 14 years now in that country. It states that "Nine factors drive overall customer satisfaction with new home builders: workmanship/materials; builder's warranty/customer service staff; price/value; builder's sales staff; construction manager; home readiness; recreational facilities provided by the builder; builder's design centre; and location" (www.jdpower.com/homes). It uses the survey responses from 17 markets to rank new home builders and determine overall customer satisfaction.

Other sources of data related to firm performance are obtained from SNZ, mainly its Business Operations Survey and tax data from the Inland Revenue Department. The former is an annual survey of business with six or more employees. Data is gathered on a variety of indicators related to productivity including research and development, innovation, delivery performance, benchmarking skills and quality processes etc. The tax data collect by SNZ from the Inland Revenue Department enables value added per employee and percentage profit margins to be calculated for firms and aggregated into bands for each sub-industry. Trends in these indicators are potentially a measure of productivity change and indicate which sub-industries are performing less well than other sectors.

4. MAIN RESULTS

4.1 Official Productivity Measures

Productivity is defined as outputs divided by inputs. The official measure uses value added as the output. The inputs are labour volumes, capital stock or a combination of labour and capital. These inputs give, respectively, labour productivity, capital productivity and multi-factor productivity. The latter is a measure of technological, managerial and regulatory impacts, i.e. after accounting for labour and capital inputs it measures the effect of other factors that can influence performance of the economy or an industry. Figure 1 and Figure 2 show the official indexes for the whole economy and for construction. The charts indicate the construction industry has performed poorly compared to the all industry index.
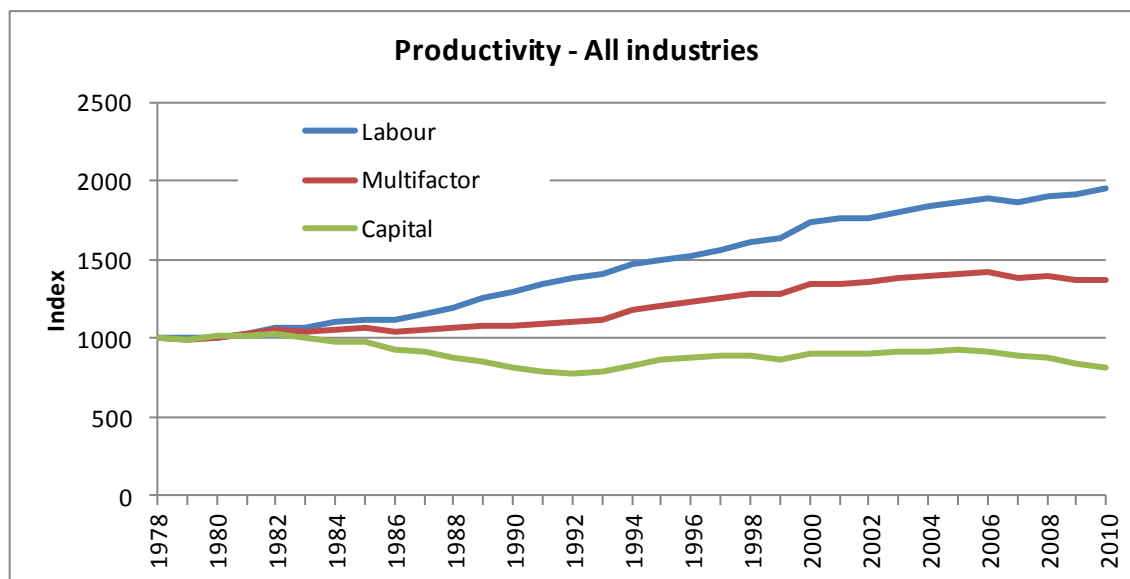
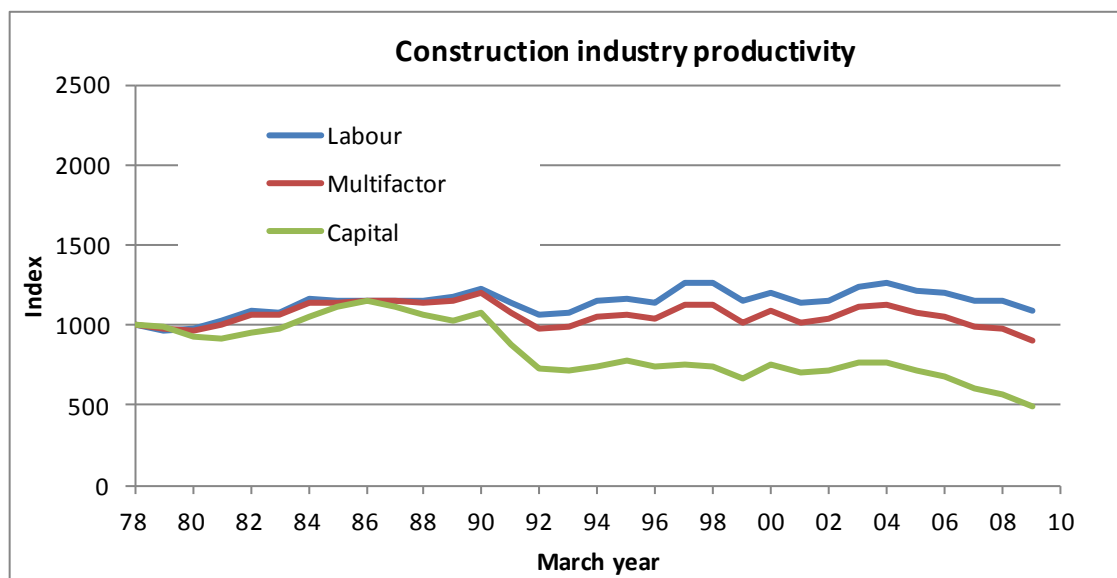**Figure 1 Productivity Indexes – All Industries**

Figure 2 Productivity Indexes – Construction

Much of the all industry improvements come from the agricultural sector, see Figure 3. So in Figure 3 we have selected similar industries to construction for comparison and the chart indicates construction has performed poorly compared to like sectors.

The target of the Construction Productivity Partnership (2010) is to improve the multi-factor index, namely a 20% improvement in productivity by 2020. The improvement is to be measured as a trend rather than using any particular year as the base point. So, for example, one approach is to have the five-year multi-factor index average to 2009 as the base and target a 20% improvement for the five years centred on 2020.
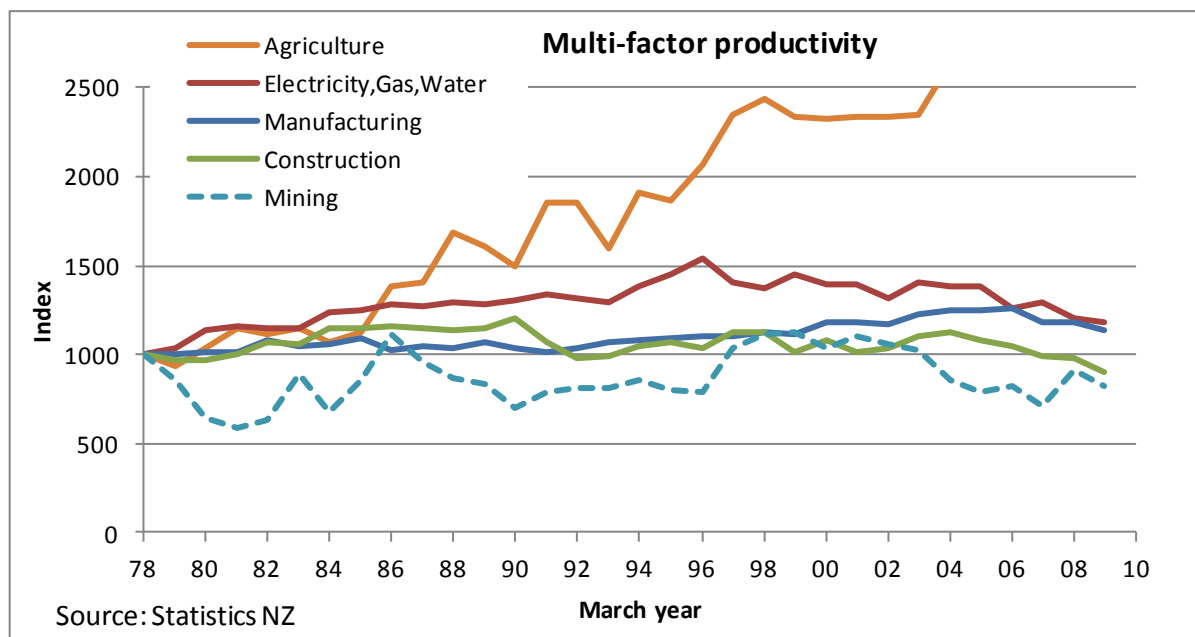
Figure 3 Multi-Factor Productivity for Selected Industries

4.1.1 Capital Formation Per Worker

An alternative measure of productivity is fixed capital formation (FCF) per worker in the construction industry. This is shown in Figure 4 where capital formation includes all buildings and other construction (i.e. civil engineering). The worker numbers are from the household labour force survey and are adjusted for average hours worked.

The chart indicates this alternative measure approximately lines up with the official labour and multi-factor (MFP) indexes. Its use is suggested as a more timely indicator because capital formation and labour data is available within a three-month lag whereas the official productivity data has an 18 to 24-month lag.
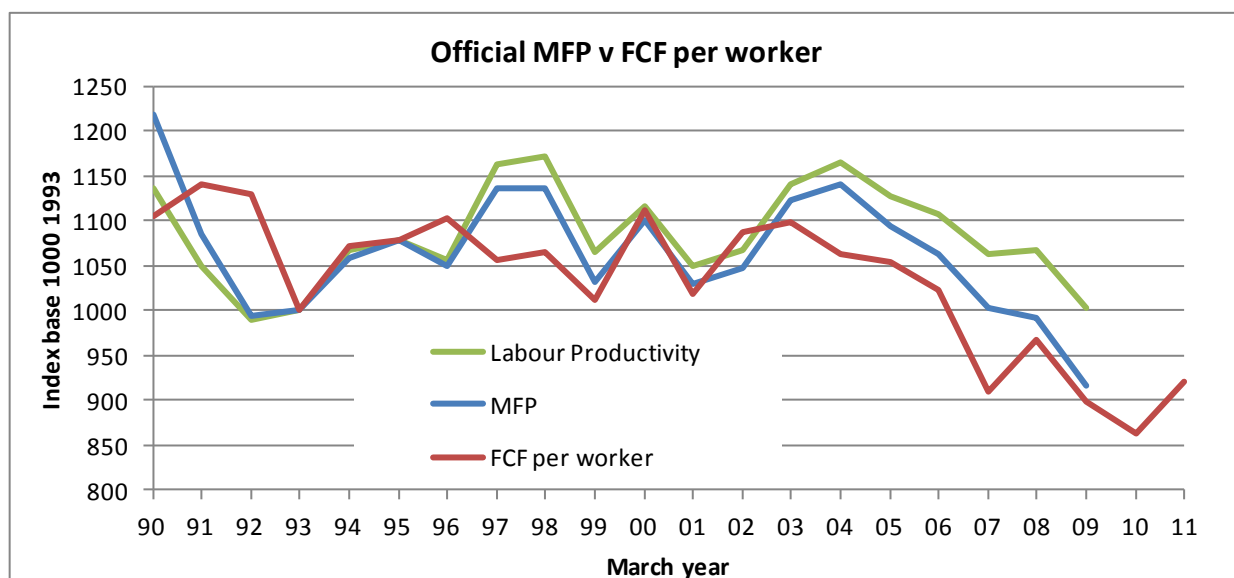

Figure 4 Alternative Productivity Measure Using Capital Formation Per Worker

4.2   Sub-Industry Productivity

To supplement the official productivity data at industry level tax data has been used to calculate individual firm labour productivity. This data is aggregated by SNZ to preserve confidentially. However, data for 24 sub-industries in the construction group are available and Figure 5 shows this data for labour productivity. This type of data is suggested as being useful for monitoring performance year to year of the various sub-industries and may help identify which sectors need to improve the most. We would not expect sub-industries to have the same productivity because some are more plant-intensive than others and they will have higher productivity as a result. For example, the chart indicates the finishing trades, which use mainly unskilled labour and have minor use of plant, have comparatively low productivity, namely the plastering, tiling, carpentry and painting sectors. A reduced requirement for these trades by, for example, a change in materials or more pre-fabrication, would help improve overall productivity in the industry.
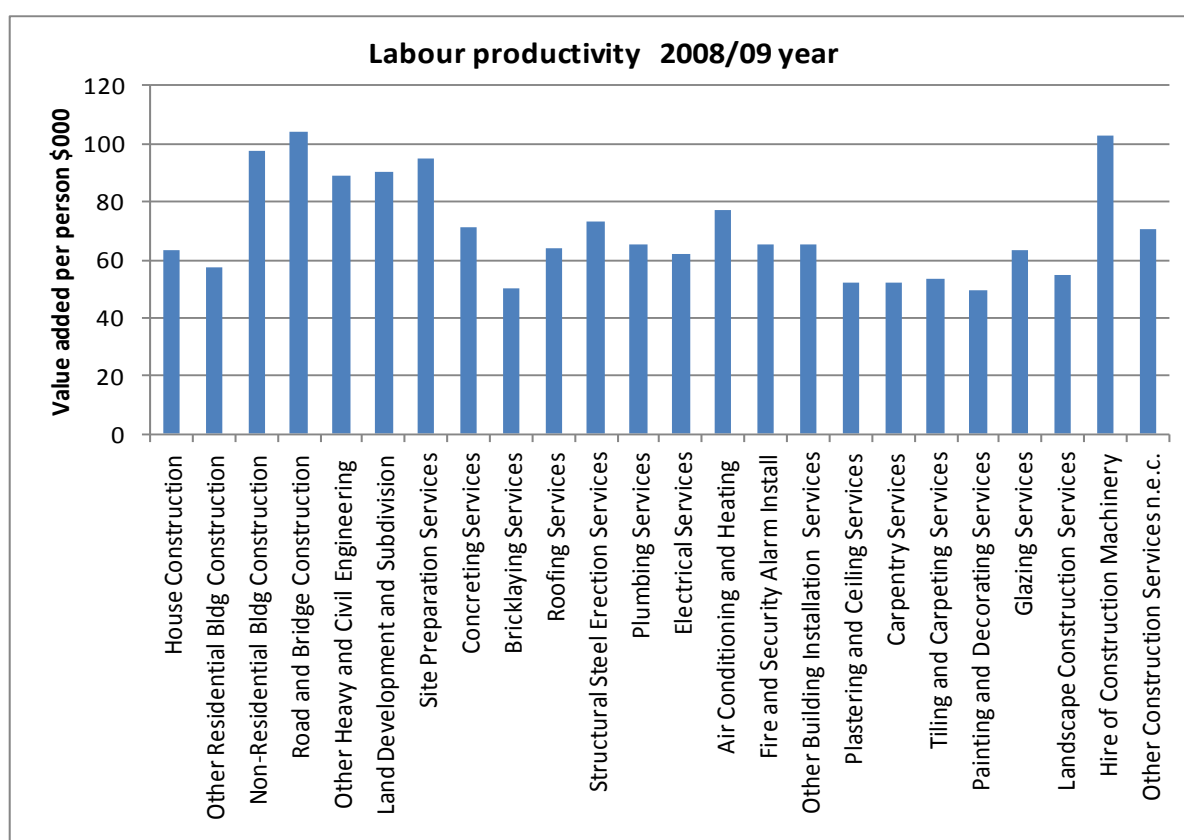
Figure 5 Sub-Industries Productivity

Figure 6 shows profits by sub-industry. This data is more useful to firms than the previous chart because they can compare their profit levels with the average in their sub-industry which may be an incentive to improve their own performance. Further breakdowns by profit segments are available for each sub-industry (see Page, Curtis 2011) and these show the proportion of firms within each profit group.
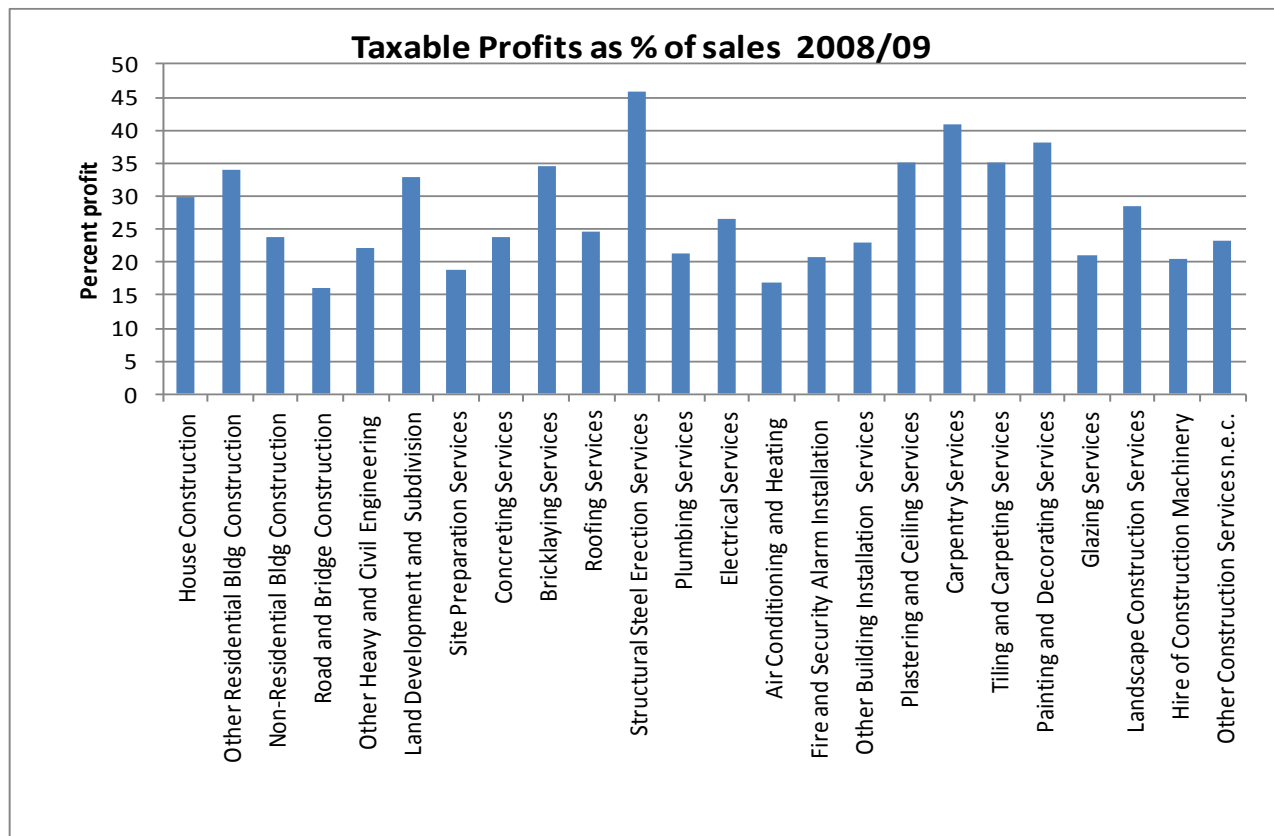
Figure 6 Sub-Industries Profit Levels

4.3 Research Action Plan Indicators

The Construction Productivity Partnership (2011) research action plan has 14 primary drivers and 11 firm level outcomes, see Table 1. It is suggested these outcomes be monitored for progress in improving productivity. Data sources for tracking progress are shown in the table. For some items data sources already exist and the following can be monitored:

- Owners' satisfaction levels, builders' performance, call-backs and quality for new housing is available from the BRANZ New House Owners Satisfaction Survey 2011. It also asks how owners find builders and what they are looking for in a builder. This gives some idea of owners' levels of knowledge about procurement.

- Data on time wastage by type and what indicators firms use to monitor performance is available from the BRANZ Construction Firms Characteristics Survey 2011.

- The Business Operations Survey (BOS) by SNZ has data on innovation, IT use, skills, use of technology and benchmarking in the construction industry.

- Boom-bust cycle data and Government expenditure data is available from official statistics.

- Employment numbers by trade and profession is available from the census.

- Numbers in training at the tertiary level and Continuing Professional Development numbers are available from the various education organisations.

- The BRANZ quarterly New Dwellings and Non-residential Buildings Surveys have questions on pre-fabrication (by component).

- The Whats-On data provides counts of new housing by builder name which covers standardisation.

Table 1 Industry Drivers of Productivity

Drivers of improved productivity		
More standardisation of Govt procurement.	Reduction in waste and re-work.	More customisable standard designs.
Less impact of boom-bust cycle	Increased recognition of construction as a career.	Improved perception/ uptake of pre-fab.
More efficient communication between	More investment in training and education.	Integrated supply chain.
client, designer, builder and regulator.	More use of whole life cost trade-offs.	More design-build.
Increased use of BIM and IT.	More uptake of innovation.	More use of KPIs to select tenders.

Outcomes at sector /firm level	Measurement of progress toward achievement	How	Progress?
Greater client awareness	Improved owners procurement, supply chain,whole life cost knowledge. Knowledge of quality vs cost trade-offs.	Survey owners	yes (1)
Higher quality buildings	Satisfaction surveys. Surveys of post-occupancy evaluation (POE) and whole life costing. Hand-over/ commissioning processes. Re-work levels.	Survey owners	yes (1)
Streamlined regulations	More use of IT, easier access to info, more pre-approved solutions, better skills in BCAs, reduced consent rejections, more product certification.	Survey designers and contractors.	
Uptake of lean construction	Reduced waste, rework. Integrate client and suppliers into projects. More adoption of 5S and similar. Use of project management tools and benchmarking.	Survey owners. Survey contractors. BOS	yes (1), (2)
Improved public perception of sector.	More publicity about what the industry does. Incidence of good and bad stories about the industry. Survey owners of recently complete buildings.	Survey owners, Clippings Service.	
Increased professionalism	All sectors committed to progress. Less complaints. Membership increasing. Effective partnering between firms. Less turnover in personnel.	Survey owners Survey contractors and designers.	
Right type and level of skills	LBP numbers. CPD requirements. Delays in filling types of jobs. Apprenticeship/ trainee numbers. Safety data.	ITOs and professional assocns. BOS.	(3)
Greater use of technology & innovation.	More use of IT consenting. More pre-fab. More use of BIM. More on-site info via internet and smart phones.	Survey contractors and designers. BOS.	
Design fit for purpose over lifetime.	Client knowledge/ use of whole life costing. Early contractor involvement in design. More building of adaptable/ flexible buildings.	Survey owners Survey designers.	
Increased standardisation.	More prefab, more multiunit. Housing/ schools/ health/ industrial bldgs are more standardised. More design/ build. More learnings to next project.	Whats-On data. Review Education and Health Dept procurement.	(3)
More efficient procurement.	More standardised Govt procurement. Govt uses KPIs for procurement. Govt countercyclical to boom-bust. Clients more aware of procurement effects.	Review Govt Dept procurement. Survey owners. BOS.	(3)
BOS = Statistics NZ Business Operations Survey.	ITOs = Industry Training Organisations.		
(1) BRANZ New Home Owners Satisfaction Survey 2011			
(2) BRANZ Firms Characteristics Survey 2011			
(3) Some baseline data has been gathered.			

For other indicators, surveys tailored to owners, designers and contractors will be required to obtain data, as indicated in Table 1, particularly for the non-residential building and civil engineering segments.

The remainder of this report has a quite narrow focus and looks at the two surveys BRANZ developed to specifically obtain data for monitoring performance of the building industry. The two surveys are:

- New House Owners Satisfaction Survey 2011.
- Construction Firms Characteristics Survey 2011.

4.4 New House Owners Satisfaction Survey

The new home owner's survey asked questions on satisfaction, builder recommendation and call-backs. There were also questions on how the builder was chosen and the owner's input into the design. The latter two provide an indication of the owner's knowledge of how to obtain a new house. Table 2 illustrates satisfaction within the new housing sector. Different stages in the process were measured. The "All measures" score (the last column in the table) could be monitored as a measure of trends in satisfaction, as well as the proportions of respondents who are fairly dissatisfied and very dissatisfied. The satisfaction levels are highest for the service provided by the builder during the buying process and the condition of the home on the day of occupancy. The satisfaction levels being high during the buying process are not surprising as if a potential owner is dissatisfied with a particular builder during the process the owner is unlikely to use them. More results are in the Appendix.

Table 2 Summary Satisfaction Scores for New House Owners

New House Owner Satisfaction Scores							
Buying process	House condition at move-in	Service after move-in	Overall quality	Complete on time	Standard of finish	Fixing of defects	All measures (unweighted)
1.57	1.66	1.98	1.41	1.77	1.52	2.01	1.70
Score 1= very satisfied, 2= fairly satisfied, 3=neither, 4= fairly dissatisfied, 5 = very dissatisfied.							

Figure 7 illustrates how owners talk about their builders. The average score for the above question is 1.41 (same scoring as before – 1 = recommend without being asked, 5 = critical without being asked) and this is another set of statistics which could be monitored for an indication of trends in owner satisfaction. Overall the average is quite good but the responses at the bottom end must be very damaging to the builders concerned. This question could be used to monitor the public perception outcome in Table 1.
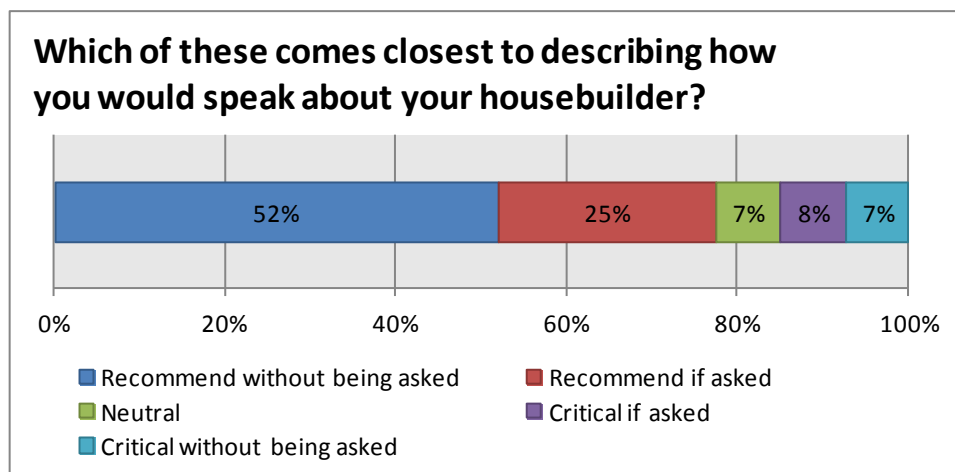
Which of these comes closest to describing how you would speak about your housebuilder?

| 52% | 25% | 7% | 8% | 7% |

■ Recommend without being asked ■ Recommend if asked
■ Neutral ■ Critical if asked
■ Critical without being asked

Figure 7 New House Owners Recommendation of the Builder

The incidence of defects was measured by the number of call-backs. The "yes" responses in Table 3 shows a large percentage of owners needed to call-back the builder. This percentage is a measure of quality and is another indictor which should be monitored over time.

Table 3 New House Call-Back Rate

Call-Back Rate NHS 2011		
	Number	%
Yes	355	72%
No	136	28%
Total	491	100%

4.5 Construction Firm Characteristics Survey

A survey of house builders asked questions on firm characteristics (size, type of work), wasted time, performance indictors used by the firm and types of contract used. The self-reported amount of time wasted was quite low with over 40% of firms saying they had no wasted time.

Overall the amount of time waste was only 3.3% on average, see Figure 8. The processes where time was wasted were recorded and are in the Appendix. In brief, the main areas of waste were waiting for council approvals, waiting for trades and delays due to inadequate details or changed specifications.

Firms were also asked about indicators used to monitor their general performance, see Figure 9. The five most important indicators to them were good communications with owners, owners' levels of satisfaction, communications with the main contractor, retaining good sub-contractors and reducing call-backs.
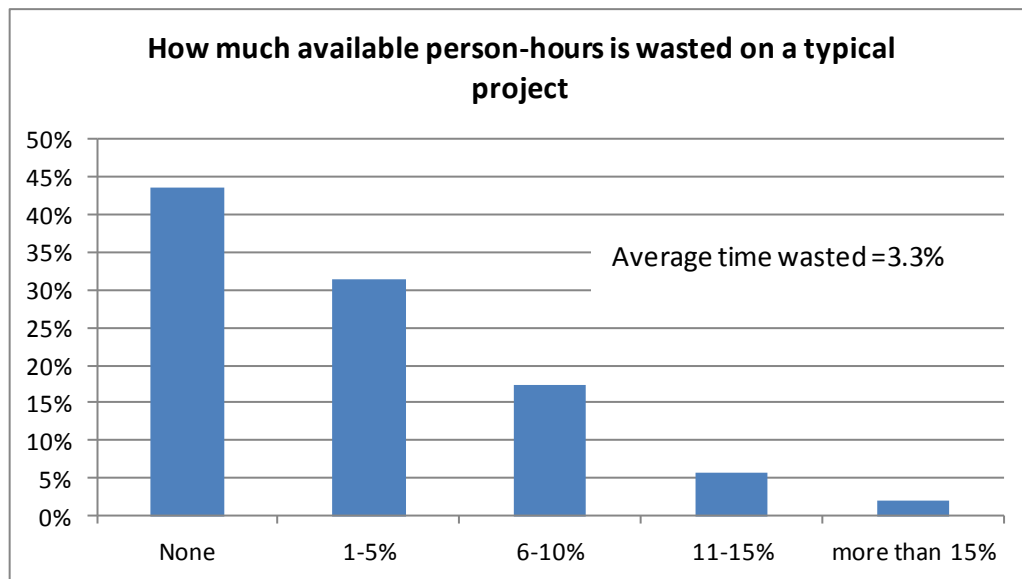
How much available person-hours is wasted on a typical project

Average time wasted =3.3%

	None	1-5%	6-10%	11-15%	more than 15%

Figure 8 BRANZ Survey of Firm Wasted Time

Performance indicators used by building firms

N =347

Obtaining repeat clients
Obtaining new clients
Cash flow
Reducing the number of call backs
Achieving a targeted level of income...
Making as much income and profit as...
Working a set number of hours per week
Retaining staff
The amount of forward work load
Increasing the skills of my workers
An expanding business with the same ...
Moving into new work types
Moving into new locations
Ability to take a day off when I want
Ability to take a long holiday when I want
Able to find & retain good subbies
Maintaining good comm with council...
Maintain good comms with designers
Maintain good comms with owners
Maintain good comms with main contr
New owners level of satisfaction
Regular monitoring of costs
Regular monitoring of debtors
The number of customer complaints

1 =Not important, 2= Minor importance, 3= Important, 4= very important

Figure 9 BRANZ Survey of Firm Performance Indicators

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5. DISCUSSION

It is logical to use the official productivity measure for monitoring performance in the industry. Both the labour and multi-factor indexes are relevant because they are well understood. The capital index is less useful because it varies according to the proportion of other construction with its large plant component.

The sub-industry labour productivity measures could also be useful for identifying under-performing sectors. The metric (value added per worker) will differ between sub-industries and we are looking for improvements in each sub-industry from year to year.

The productivity drivers in Table 1 were developed by a group of experts and are believed to be the relevant lever points for improving productivity. The relative importance of each driver is not known and no single driver will be enough in itself to effect a significant change. Instead it is likely a range of measures will be needed to improve productivity, as advanced by the different streams of the Productivity Partnership. Hence a range of indicators will need to be developed to monitor progress. Table 1 indicates what needs to be measured and suggests how this should be done. The next report in this project will further outline how this can be done and show a baseline of numbers for all outcomes.

Quality of industry output is very important both in terms of customer satisfaction and whole life costs. There are well developed satisfaction survey methodologies in utilisation overseas and these have been adapted for local use. It is suggested the BRANZ New House Owners Satisfaction Survey be repeated within two years to monitor progress. A similar survey needs to be developed for non-residential buildings.

The BRANZ survey of firm characteristics is thought to be less useful than the owners survey because the builders' responses appear to be aspirational, rather than reflecting the reality of how they are behaving now. The average response of only 3.3% time wasted appears to be an under-estimate according to industry experts. However, the question on time wasted, and where it occurs, are likely to prove useful to monitor over time.

6. CONCLUSIONS AND RECOMMENDATIONS

It is recommended that measures be developed to monitor the expected outcomes in Table 1. Some of the measures and data are already in place. The two BRANZ surveys of new house owners and on construction firm characteristics should be continued.

The main gap is in non-residential building, and surveys to owners, designers and contractors are needed to fill those gaps.

BRANZ is separately advising medium and large house builders that it has extensive data on owner satisfaction and that firms are able to apply to BRANZ for their confidential report which compares their firm's performance with industry averages. It is hoped this service will encourage firms to undertake measures to improve their service and product. With each report BRANZ has provided a checklist of how firms can improve and what indicators they need to watch.

The next report due in 2013 will provide baseline data for all criteria in Table 1, where possible, against which progress in industry performance can be measured.

7. REFERENCES

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8. APPENDIX

This Appendix contains details of:
- Annual Business Operations Survey, carried out by SNZ.
- Survey forms for the New House Owners Satisfaction Survey and the Construction Firm Characteristics Survey.
- Additional results from the two BRANZ surveys.
- Balanced Scorecard performance method.
- Constructing Excellence KPIs in New Zealand.
- Boom-bust cycles and counter-cyclical Government investment.

8.1 Business Operations Survey (BOS)

The business operations survey is undertaken annually by SNZ. Every survey asks about research and development spending, delivery performance (on-time and in-spec), new practices (services, methods and processes), new technology and current technology (how up-to-date is it?). In addition, occasional questions are included on innovation, training, benchmarking, skills, IT use and other factors relevant to productivity. Some of the responses to these questions are in Figure 10 to Figure 13 and are possible indicators to be monitored over time.
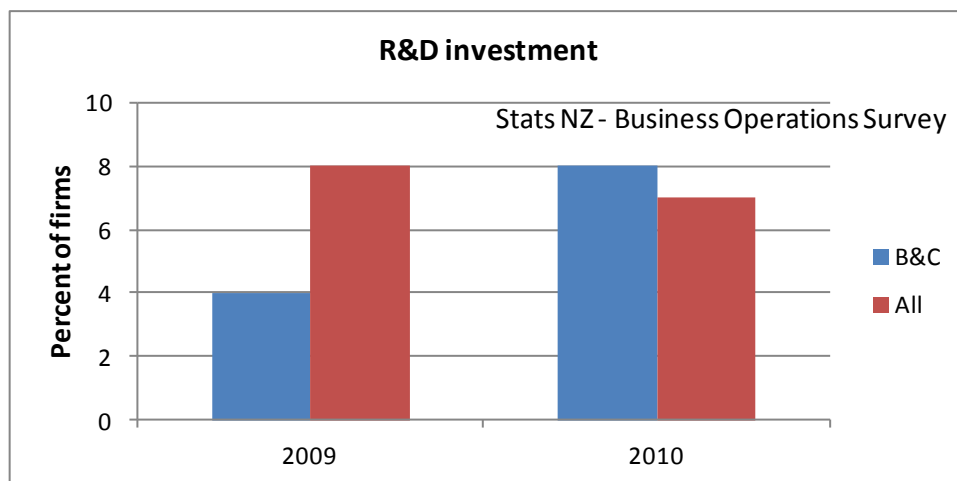
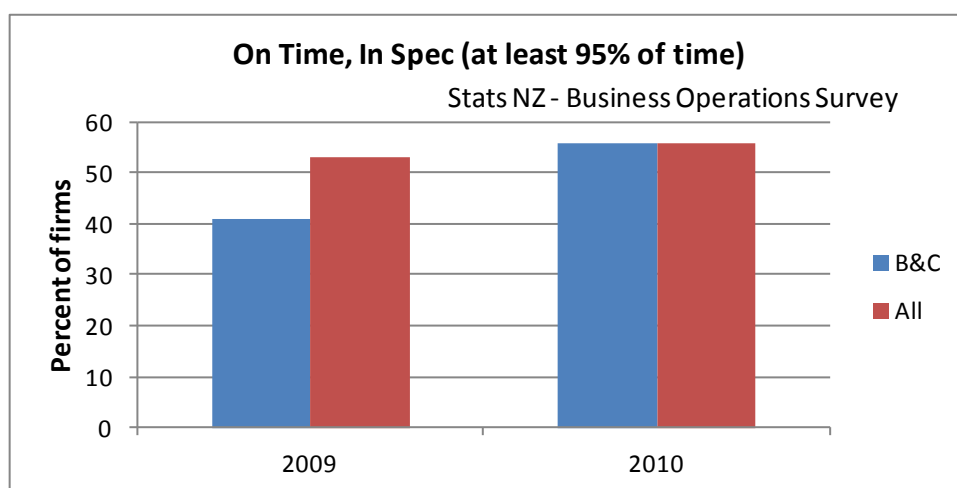**Figure 10 BOS – Research and Development Investment**

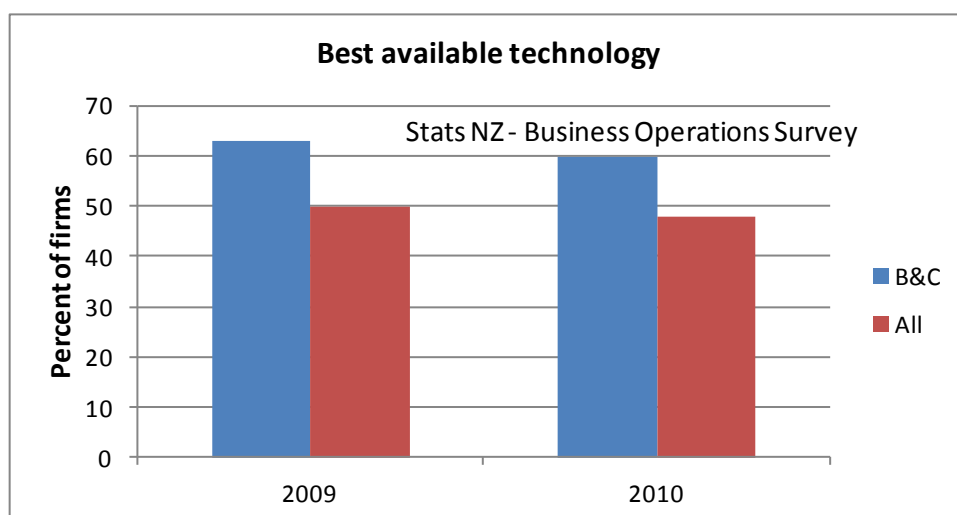**Figure 11 BOS – On Time, In-Spec Performance**

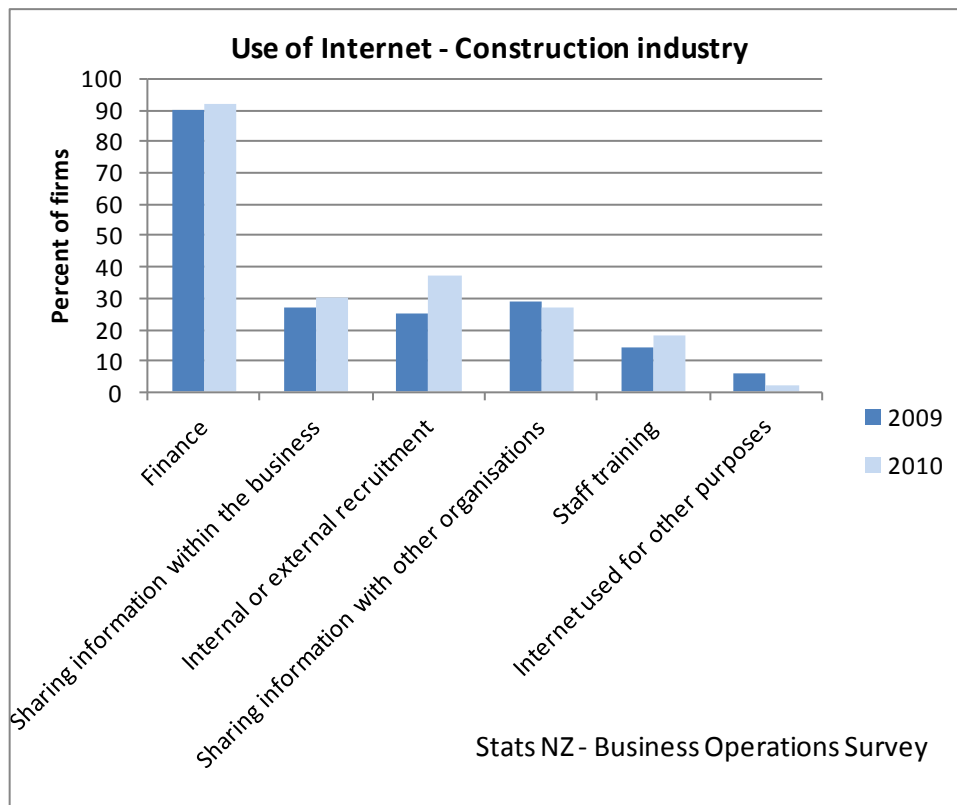**Figure 12 BOS – Use of Best Technology**
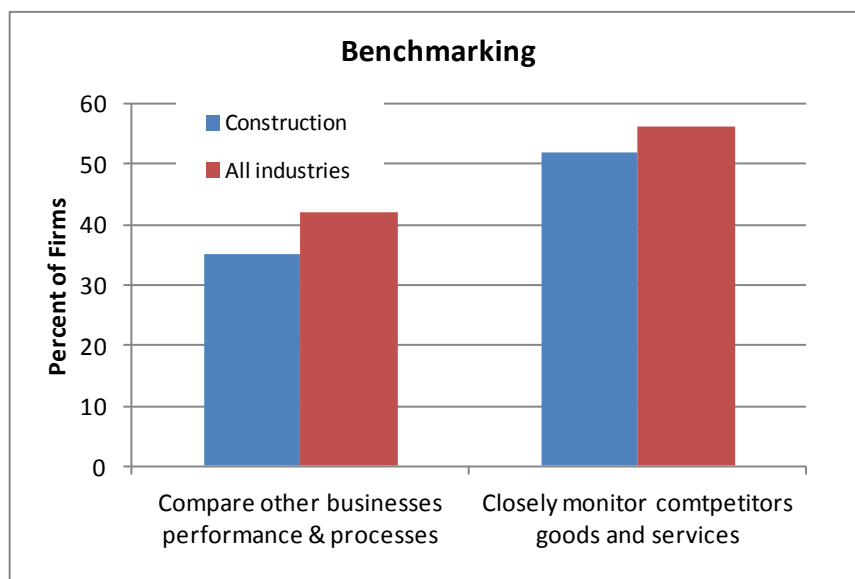
Figure 13 BOS – Use of IT

Figure 14 BOS – Benchmarking

These questions are not repeated every year but they will give an indication of progress in lean methods, professionalism, skills, technology, innovation and procurement.

9. BRANZ SURVEYS

Two surveys were developed:
- New home owners satisfaction survey.
- Construction firms' characteristics survey.

9.1 New House Owners Survey

A total of 1735 surveys were sent out to new home owners from 31 territorial authorities in New Zealand for new houses with consents applied for between August 2010 and March 2011.

Some results of the owners satisfaction survey were reported earlier. This section looks at some of the analyses done on the responses. A total of 501 responses from new home owners were received. The postal survey was to new home owners whom had moved in within the last six months. The survey form is below in Table 5 and most questions were answered by the respondents but for some questions the response was around the 450 mark.

The types of analyses included:
- Average score for each question.
- Types of disputes over cost.
- Types of features to be improved.
- Types of call-back.
- General comments on overall performance of the builder.
- Regressions relating builder recommendation to satisfaction scores.

In addition the builder name is known and BRANZ is able to calculate average results for individual builders for comparison against overall industry performance.

An example of the regression analysis is in Table 4 below. It analyses how the builder recommendation response is influenced by the first seven satisfaction questions and the incidence of cost disputes and call-backs.

Table 4 Regression Analysis – Builder Recommendation Versus Various Performance Factors

Likelihood recommend builder (1=high, 5=low) = c1 + c2*Buying process + c3*House condition + c4*Service after moved in + c5*Quality + etc								
Regression Statistics								
Multiple R	0.85315528							
R Square	0.72787394							
Adjusted R Square	0.72225666							
Standard Error	0.64765195							
Observations	446							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	9	489.165558	54.3517287	129.577624	2.718E-117			
Residual	436	182.881527	0.41945304					
Total	445	672.047085						
	Coefficients	*tandard Erro*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-0.1045	0.0838	-1.2464	0.2133	-0.2692	0.0603	-0.2692	0.0603
Buying Process	0.3729	0.0452	8.2514	0.0000	0.2841	0.4618	0.2841	0.4618	1=very good, 5= very poor
House Condition	0.1340	0.0519	2.5811	0.0102	0.0320	0.2360	0.0320	0.2360	1=very good, 5= very poor
After moved in	0.2209	0.0550	4.0123	0.0001	0.1127	0.3291	0.1127	0.3291	1=very good, 5= very poor
Overall Quality	0.2041	0.0727	2.8076	0.0052	0.0612	0.3469	0.0612	0.3469	1=very good, 5= very poor
Completion on time	0.1178	0.0361	3.2611	0.0012	0.0468	0.1888	0.0468	0.1888	1=very good, 5= very poor
Standard of finish	0.1197	0.0653	1.8337	0.0674	-0.0086	0.2480	-0.0086	0.2480	1=very good, 5= very poor
Fixing of defects	**-0.0035**	**0.0488**	**-0.0726**	**0.9421**	**-0.0994**	**0.0923**	**-0.0994**	**0.0923**	1=very good, 5= very poor
Cost Disputes	0.5444	0.1001	5.4380	0.0000	0.3476	0.7411	0.3476	0.7411	no=0,yes =1
callbacks	**0.0262**	**0.0724**	**0.3621**	**0.7175**	**-0.1161**	**0.1685**	**-0.1161**	**0.1685**	no=0,yes =1

The regression results indicate the most important parameters affecting builder recommendation are cost disputes, the buying process, service after move-in, and overall quality. Some other variables also have significance (a t-statistic over 2.0 means the variable is statistically significant), but these four have the main influence.
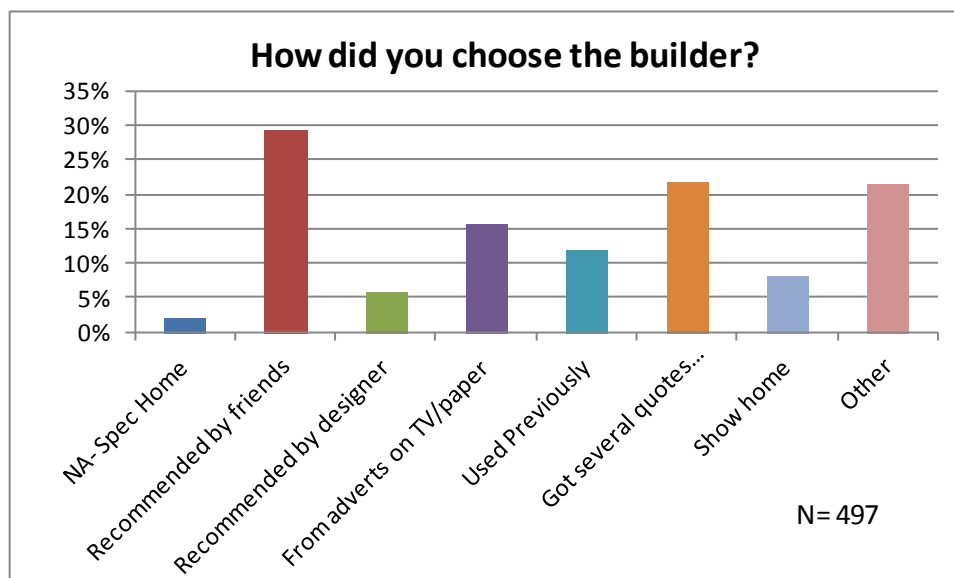

Figure 15 New Home Owners Knowledge

The survey asked how the builder was chosen, see Figure 15. The "Other" category includes many responses such as the builder is a friend, the sales reps were good, found on internet/liked their website, the section sold it, and the owner wanted a particular type (e.g. Lockwood).

It is suggested that "Recommended by friends" and "Got several quotes" be used as a measure of clients knowledge and be monitored on an ongoing basis. These two categories total 51% of all responses and we would want this percentage to rise over time as an indication of client knowledge.

 Figure 16 illustrates how satisfied the new house owners were with the service provided by the builder during the buying process, condition of the home on the day they moved in, the service provided by the builder after they moved in and the overall quality of their home. It is suggested that the last category on "overall quality" be used as the quality measure for new housing.
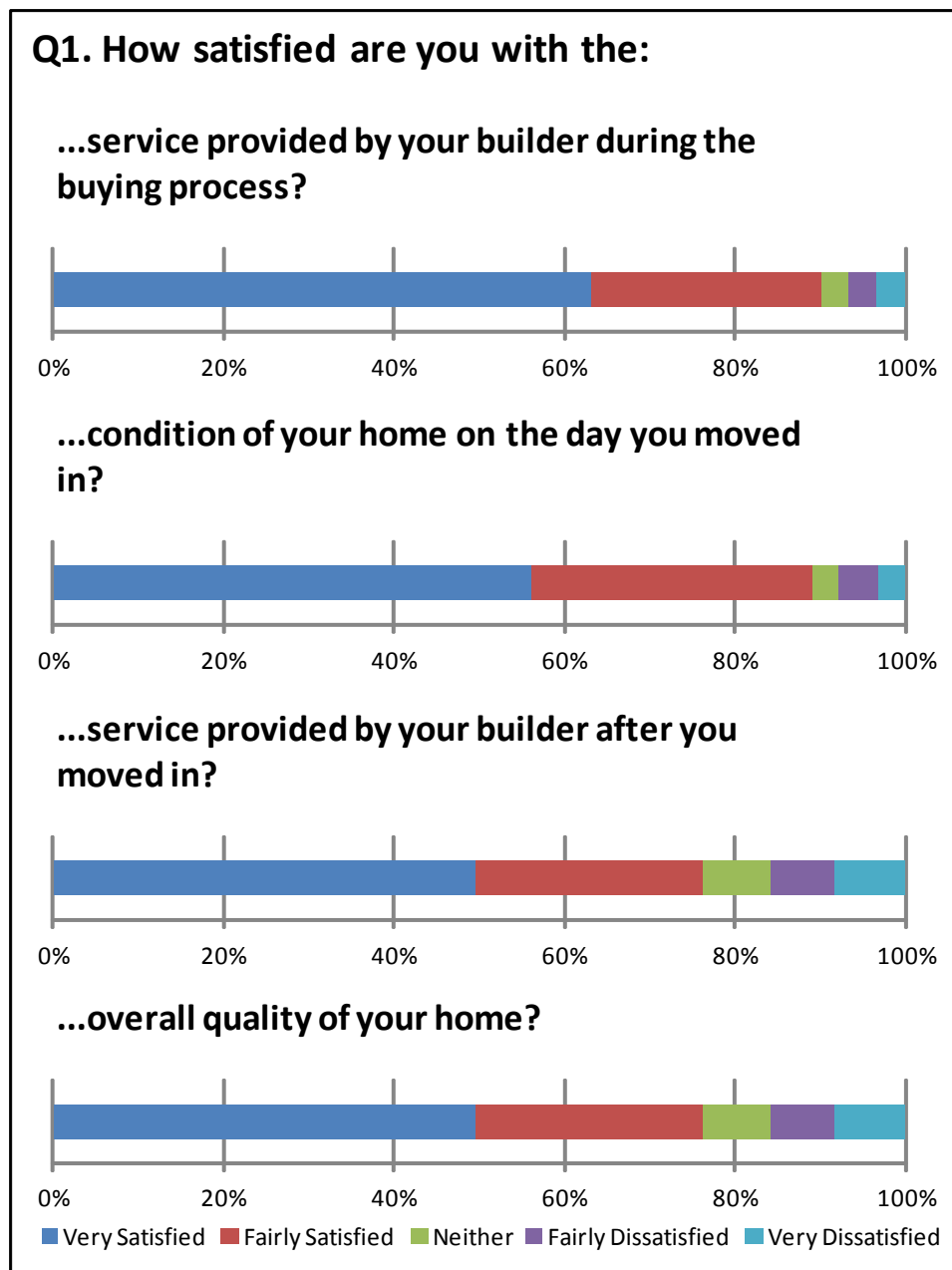
Figure 16 New Home Owner Satisfaction Responses

Table 5 New Home Owners Satisfaction Survey

NEW HOUSE OWNERS SATISFACTION SURVEY
All responses are added together and no individual is identified in reports produced by BRANZ.

1. Satisfaction: How satisfied are you with the:

	Very Satisfied	Fairly satisfied	Neither	Fairly dissatisfied	Very dissatisfied
Service provided by your builder during the buying process?	☐	☐	☐	☐	☐
Condtion of your home on the day you moved in?	☐	☐	☐	☐	☐
Service provided by your builder after you moved in?	☐	☐	☐	☐	☐
Overall quality of your home?	☐	☐	☐	☐	☐

2. Rating: How would you rate:

	Very good	Fairly good	Neither	Fairly poor	Very poor
Your builder in relation to completing your home in time?	☐	☐	☐	☐	☐
The standard of finish of your new home?	☐	☐	☐	☐	☐
The fixing of defects after first occupancy	☐	☐	☐	☐	☐

3. Did you have input into the house design before it was built?   Yes / No   (circle one)

If Yes, what type of input from the options below (**tick one**)

Select design from the builder's standard plans with **NO CHANGES**	☐
Select design from the builder's standard plans with **SOME CHANGES BY OWNER**	☐
One-off design by an architect/architectural designer with **MAJOR OWNER INPUT**	☐
One-off design by an architect/architectural designer with **MINOR OWNER INPUT**	☐

What type of input? Size, quality of finish, maximum budget, layout ideas, minimise maintenance, **OTHER** _____
(circle one or more)

4. How did you choose the builder?   (please tick all that apply)

Not applicable House already built	Recommended by friends	Recommended by designer	From adverts on TV/paper	Used previously	Got several quotes chose best	Other (state)
☐	☐	☐	☐	☐	☐	☐

5. What features were important in choosing a builder?   (please tick all that apply)

Not applicable House already built	Price	Quality/ Reputation	Builder availability	Limited builder choice	Looked at builders previous houses	Other (state)
☐	☐	☐	☐	☐	☐	☐

6. Were there any disputes with the builder over final costs?   Yes / No (circle one)
If yes, what was the dispute about? _____
_____
_____

7. Which of these comes closest to describing how you would speak about your housebuilder?

Recommend without being asked	Recommend if asked	Neutral	Critical if asked	Critical without being asked
☐	☐	☐	☐	☐

8. Bedrooms
How many persons are in your new house? _____   How many bedrooms are in your new house? _____
What use is made of these bedrooms? Family use, visitors, resale value, used as study, used for storage, games room, **OTHER** _____

9. What is the total floor area of your new house? _____ square metres
How many storeys does your new house have? _____ storeys

10. What features of your house do you think could be improved? Please list as many as you can
_____
_____
_____

11. Did you call back the builder to repair defects after first occupancy? Yes / No (Circle one)
If Yes what defects needed fixing? _____
_____
_____

12. Have you ever heard of lifetime design (or universal design)? Yes / No (Circle one)
Did you include any lifetime design features in your new home? (i.e. Wider passageways, wider doorways, lever handles, a bedroom and bathroom on entry level) **Yes / No** (Circle one)
If Yes what features did you include? _____
_____
_____

13. Do you have any general comments on the overall performance of your builder?
_____
_____
_____
_____

Thank you. Please fold this form and freepost it in the return envelope   Dec-11

9.1.1 Call-Backs

One of the causes of person-hours wasted on typical projects is call-backs for defective work. The proportion of call-backs from new homeowners increases with a higher number of consents taken out in our survey period as illustrated in Figure 17.
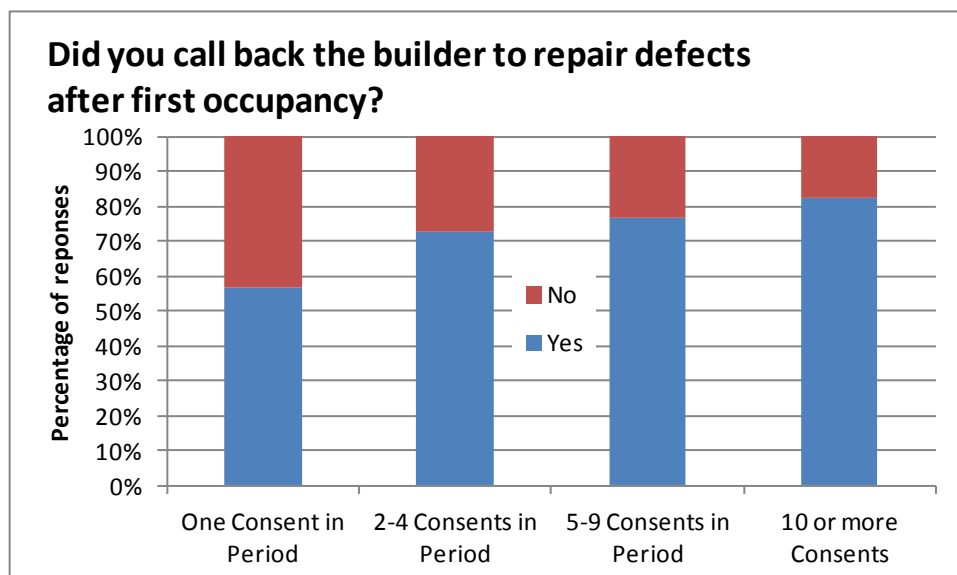

Figure 17 New Homeowners Call-Back Rate

9.2 Construction Firms Characteristics Survey

A total of 1200 survey forms were sent to contractors on the BRANZ mailing lists and responses were received from 350 firms. The survey form is in Table 7. As reported earlier the average wasted time reported was only 3.3%. Very few firms reported more than "sometimes" wasting time.
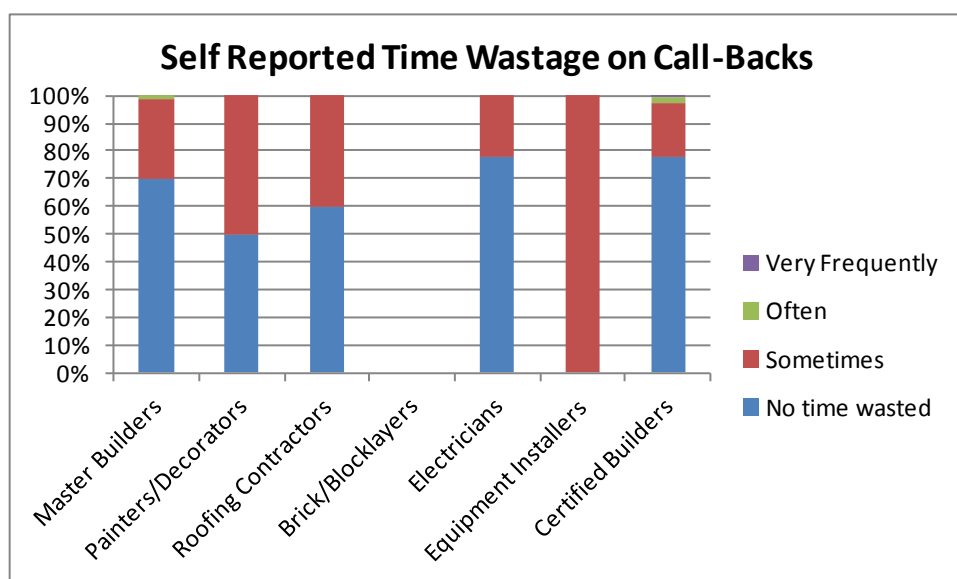
Figure 18 Firms Self-Reported Time Wastage on Call-Backs

The main reasons for wasted time are shown in Figure 19 and Table 6 below. They include waiting for council approvals, other trades delays, changed specifications and inadequate specifications. Table 6 indicates that all causes of time waste occur at least "sometimes" and the response numbers for "sometimes" are quite high.
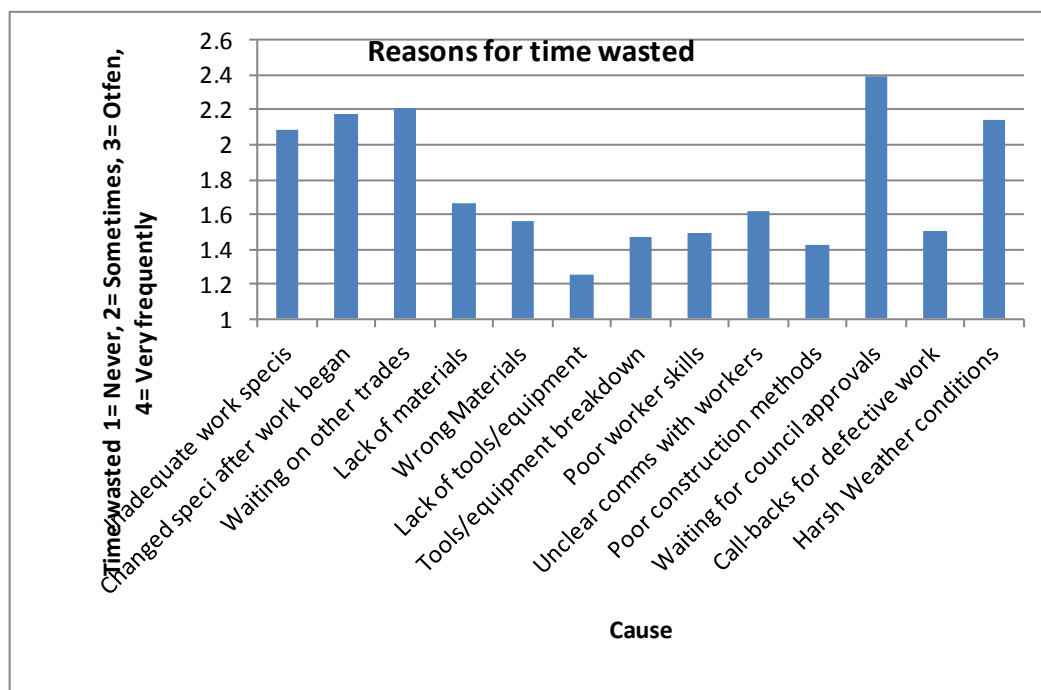
Figure 19 Reasons for Time Wasted

Table 6 Reasons and Frequency of Time Waste

Any time wasted on your jobs in the last 12 months?								Ave
If yes, what were the causes:				Response numbers				Ave
			Score=	1	2	3	4	score
Inadequate work specis				24	121	22	9	2.09
Changed speci after work began				14	128	32	7	2.18
Waiting on other trades				13	133	44	5	2.21
Lack of materials				65	92	7	1	1.66
Wrong Materials				78	78	5	1	1.56
Lack of tools/equipment				122	39	0	1	1.26
Tools/equipment breakdown				89	70	2	1	1.48
Poor worker skills				90	68	5	1	1.49
Unclear comms with workers				70	86	6	1	1.62
Poor construction methods				102	48	8	1	1.42
Waiting for council approvals				26	91	51	25	2.39
Call-backs for defective work				85	68	4	1	1.5
Harsh Weather conditions				10	156	26	6	2.14
Other				0	7	4	3	2.71
Score Key 1=never, 2=sometimes, 3= often, 4=very frequently								

Table 7 Construction Firm Characteristics Survey

FIRM CHARACTERISTICS SURVEY

What is your firm size?   (Tick one box)

Numbers on-site =	Single person	Two persons	3 to 5 persons	6 to 10 persons	11 to 20 persons	21 to 50 persons	Greater than 50 persons
	☐	☐	☐	☐	☐	☐	☐

What type of work does your firm do ?   (tick one box or more)

New housing housing	Housing A&A	Housing repairs maintenance	New other buildings	Other bldgs alters/ additns	Electrical	Plumbing
☐	☐	☐	☐	☐	☐	☐

Roofing	Painting/ decorating	Plastering	Installing equipment	Tiling/ carpet installation	Concreting	Bricklaying
☐	☐	☐	☐	☐	☐	☐

Any time wasted on your jobs in the last 12 months ? (i.e workers not able to be employed elsewhere)   Yes/ No (Circle one)

	1-5%	6-10%	11-15%	more than 15%
If yes how much available person-hours was wasted on a typical project (tick one box).	☐	☐	☐	☐

Please tick one box in each row.

If Yes what were the causes:	Never	Sometimes	Often	Very frequently
Inadequate work specification or details	☐	☐	☐	☐
Changed specification after work began	☐	☐	☐	☐
Waiting on other trades	☐	☐	☐	☐
Lack of materials	☐	☐	☐	☐
Wrong materials	☐	☐	☐	☐
Lack of tools/ equipment	☐	☐	☐	☐
Tools/ equipment breakdown	☐	☐	☐	☐
Poor worker skills	☐	☐	☐	☐
Unclear communications between supervisors and workers	☐	☐	☐	☐
Poor construction methods	☐	☐	☐	☐
Waiting for council/ EQC inspections/ approvals	☐	☐	☐	☐
Call-backs for defective work	☐	☐	☐	☐
Harsh weather conditions	☐	☐	☐	☐
Other (write_____)	☐	☐	☐	☐

What indicators are important to you for monitoring how your firm is generally performing?

Please tick one box in each row.

	Not important	Minor importance	Important	Very important
Obtaining repeat clients	☐	☐	☐	☐
Obtaining new clients	☐	☐	☐	☐
Cash flow	☐	☐	☐	☐
Reducing the number of call-backs	☐	☐	☐	☐
Achieving a targetted level of income and profit	☐	☐	☐	☐
Making as much income and profit as possible	☐	☐	☐	☐
Working a set number of hours per week	☐	☐	☐	☐
Retaining staff	☐	☐	☐	☐
The amount of forward work load	☐	☐	☐	☐
Increasing the skills of my workers	☐	☐	☐	☐
An expanding business with the same types of work	☐	☐	☐	☐
Moving into new work types	☐	☐	☐	☐
Moving into new locations	☐	☐	☐	☐
Ability to take a day off when I want	☐	☐	☐	☐
Ability to have a a long holiday when I want	☐	☐	☐	☐
Able to find and retain good sub-contractors	☐	☐	☐	☐
Maintaining good communications with council inspectors	☐	☐	☐	☐
Maintaining good communications with designers	☐	☐	☐	☐
Maintaining good communications with owners	☐	☐	☐	☐
Maintaining good communications with main contractors	☐	☐	☐	☐
New owners levels of satisfaction	☐	☐	☐	☐
Regular monitoring of costs	☐	☐	☐	☐
Regular monitoring of debtors	☐	☐	☐	☐
The number of customer complaints	☐	☐	☐	☐

Types of contract and payment   (please tick one box in each row)

	Never	Sometimes	Often	Always
Hourly Rate	☐	☐	☐	☐
Quoted Price	☐	☐	☐	☐
Spec Build	☐	☐	☐	☐
Turn Key	☐	☐	☐	☐
Progress Payment	☐	☐	☐	☐

Thank You. Please fold this form, and freepost it in the return envelope   Oct-11

9.3 Balanced Scorecard

This performance measure was developed in 1990s for firms in general (Kaplan et al, 1992). The main parameters are Financial, Customer, Internal Business Processes, and Learning and Growth. An application to construction industry firms is shown in Table 8 with the key performance indicators (KPIs) used to measure each parameter. The authors used a panel of 11 management experts to find the weights applied to each KPI, using the analytical hierarchy process (Saaty, 1982). In brief this carries out pair-wise comparisons between all KPIs which determine the relative weights of each KPI. A scale of 1 to 5 was used to assess each KPI.

Overseas the measure is used by individual firms to measure performance against industry averages. It would be possible to measure similar parameters for New Zealand firms. Changes in the industry average from year to year would be a local measure of how well the industry as a whole is trending.

The KPIs shown are not necessarily the right ones for NZ firms and further investigation is needed if the BSC method was to be applied to local construction firms. Similarly the weights will differ from country to country, though the same approach as described in the paper would be applicable here, namely a local panel of experts. Due to the large data requirement this method is not recommended for monitoring local firm performance.

Table 8 Balanced Scorecard Applied to Construction Firms

Balanced Score Card method				
Indicators		**KPIs**	**Data source**	**Weight %**
				(1)
Financial		Profits	O	17
		Sales Growth	O	8
		Stability (debt ratio)	O	9
Customer		External Customer satisfaction	BRANZ	6
		Internal Customer satisfaction	na	3
		Market share growth	na	9
Internal		R&D, as % sales	O	7
business processes		Technical capability (patents, etc).	BOS	6
		Business efficiency (OH as % sales).	O	8
Learning/ growth.		HR (% persons degree),	O	7
		Quality of knowledge management	BOS	11
		Information use, ease of use.	O	9
O = official sources				100
BOS = Business Operations Survey (from SNZ)				
(1) KPIs and weights from a paper by Yu et al (2007).				

9.4 Constructing Excellence New Zealand (CENZ) KPIs

CENZ has undertaken surveys on KPIs since 2008 and has recorded data on many individual projects. The data is obtained from owners on a specific project and includes:

- Type of project, procurement process and type of contract.
- Predicted versus actual design time.
- Predicted versus actual construction time.
- Predicted versus actual overall project time.
- Predicted versus actual design cost.
- Contracted versus actual construction cost.
- Anticipated versus actual overall project cost.
- Client satisfaction of the product and service (ten-point scale).
- Defects condition at handover (ten-point scale).
- Safety – number of incidents per man-hours.
- General data on the type of owner (central or local government, private sector) and value of projects commissioned per year.

The data enables a distribution of scores to be obtained for each performance criteria. Firms can benchmark themselves on the distributions (i.e. assess whether they are in the top 20% for example).

To use this data as an overall industry measure we monitor how each criterion changes from year to year. Say, for example, the average predicted to actual construction time ratio, for all projects collected in any one year, is 0.90. Then we would be looking for an improvement in that parameter to say 0.95 in a later year. Similar ratios could be formed for the other KPIs and we would expect an improvement in most ratios over time.

The main problem with using the CENZ data is that it almost certainly represents the better performing firms. Most of these firms have been in the programme on a voluntary basis for several years and will already have improved their performance compared to the overall industry.

The solution could be to undertake an industry-wide survey asking firms to fill in the KPI questionnaire for their latest project and ascertain industry averages from what is hopefully a representative sample. This survey would be repeated every two-three years and it would provide a valuable measure of firm performance.

9.5 Counter-Cyclical Construction

Productivity is known to be adversely affected by the boom-bust activity in the industry. How likely is it that Government could mitigate these fluctuations in workloads by commissioning work in a counter-cyclical fashion?
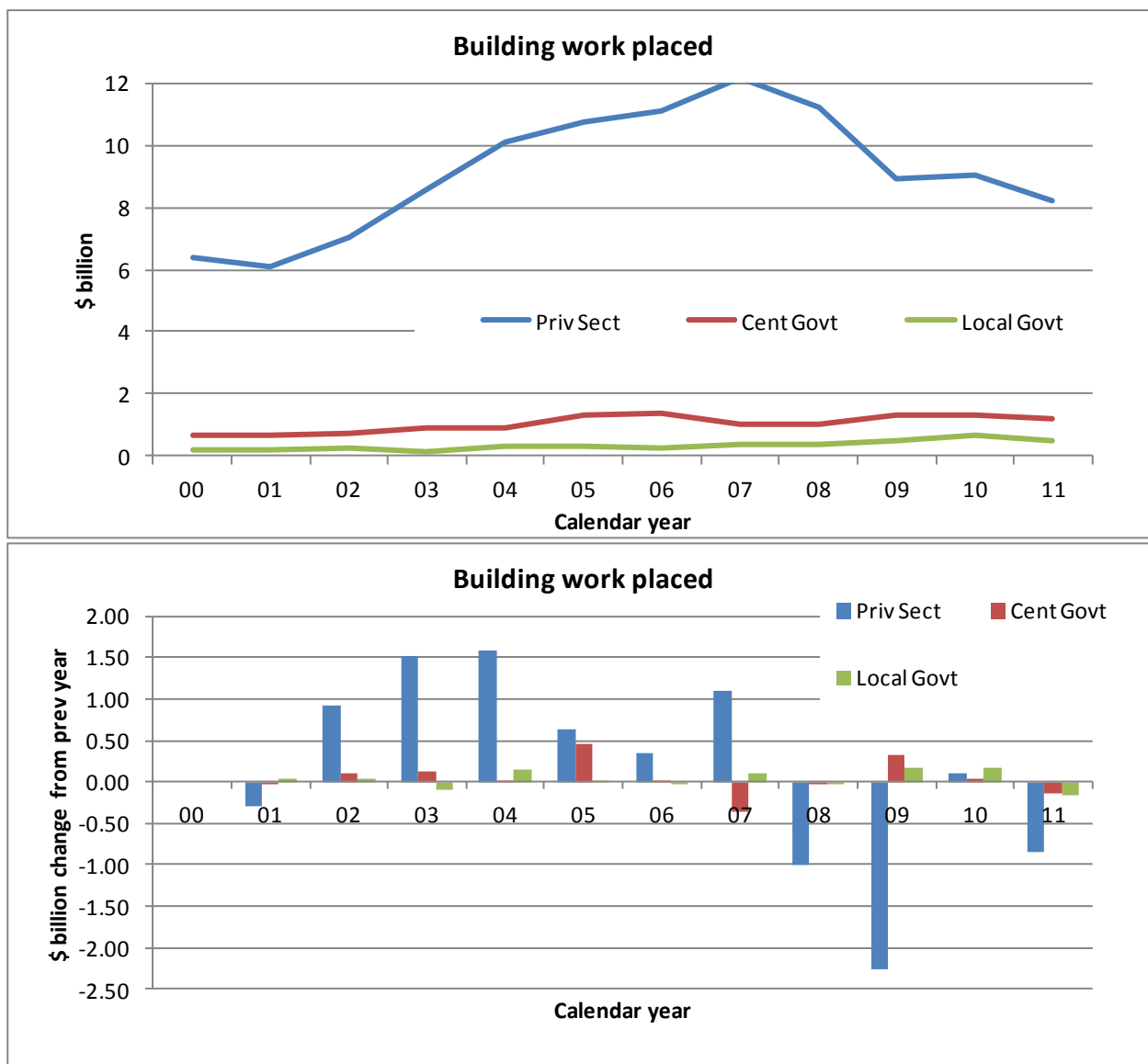
Figure 20 Building Work Placed by Sector of Ownership

Figure 20 shows building activity by sector of ownership over recent years. Most of the fluctuations occur in the private sector, mainly in new housing. These changes in work are quite large and it would be difficult for central or local government activity to completely offset the changes in private workloads. Figure 20 is for building work only. When civil engineering is added the picture does not change much, see Figure 21.

Most of the changes in workloads from year to year remain in the private sector when civil engineering is added. The scope for Government offsets is small, even if it is accepted that civil works can be substituted for building work in use of similar resources. However, any offsetting action is welcome and will help to reduce the fluctuations.
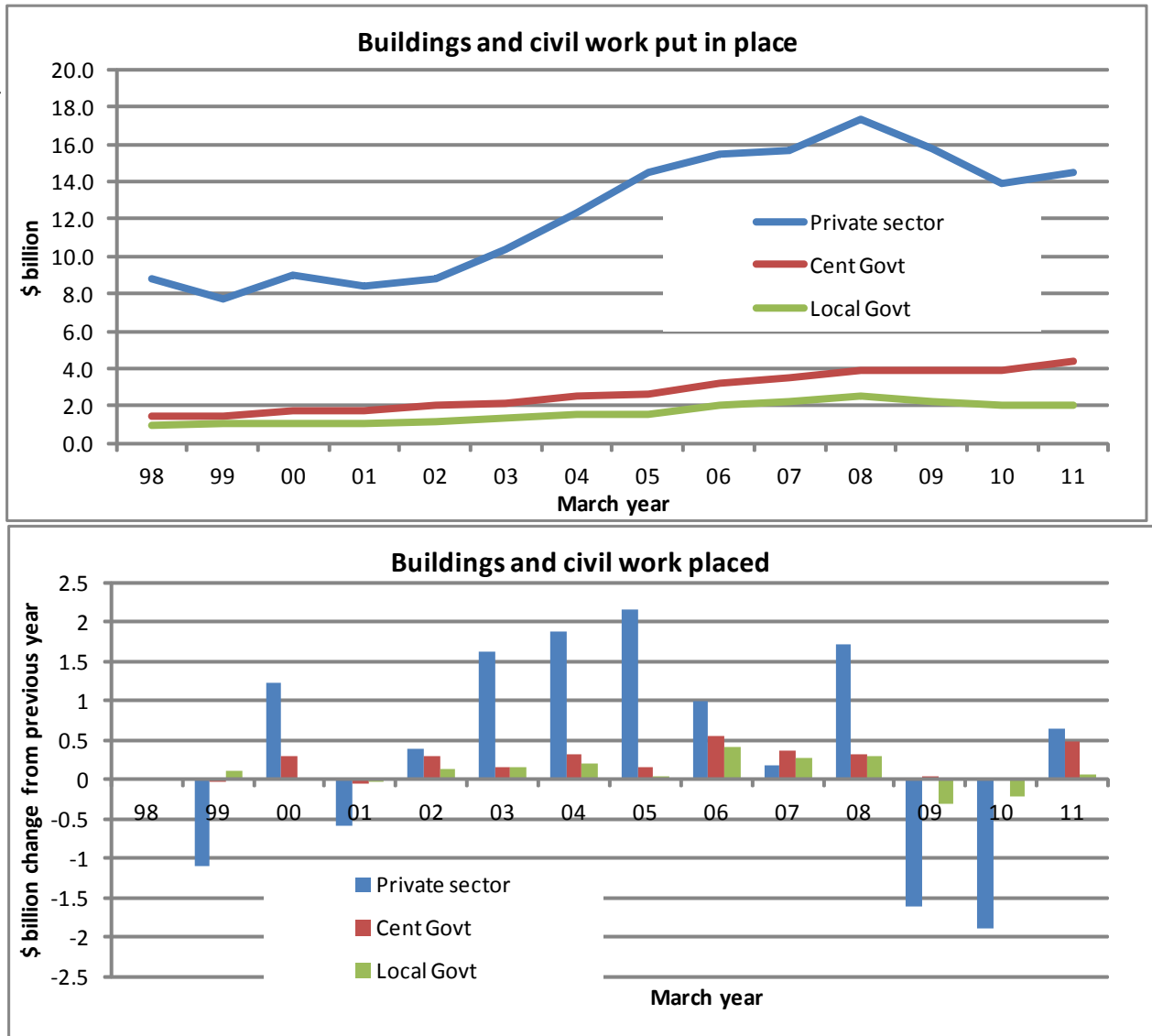
Figure 21 Buildings and Civil Works put in Place