Construction Productivity

The devil’s in the detail ........

Helen Anderson, Suzanne Wilkinson, John Tookey, Jeff Seadon, Brett Lineham, Ian Page, Wayne Sharman, Richard Capie, Ruth Berry, Andrew Reding, Adrian Bennett, Peter Cunningham, Chris Kane, Amanda Warren, Pam Bell, Kevin Golding, Derek Baxter, Brendan Mai

Productivity Hub Conference 2 July 2013
Productivity will improve when

we get the right people with the right tools doing the right stuff

we use a lot of low skill labour, don’t use our capital wisely and quality isn’t a key driver

Industry leader’s definition, 2011
One size does not fit all

<table>
<thead>
<tr>
<th>Residential</th>
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<td>SMEs</td>
<td>Group Builders</td>
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<td>Sole Traders, Sub-Contactors</td>
<td>Light Commercial and Non-Commercial &lt;NZD10m</td>
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<td>Franchise Arrangements</td>
<td>Commercial and Non-Commercial &gt;NZD10m</td>
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<tr>
<td>Public companies, Commercial J.V’s, PPP’s</td>
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TWENTY BY 2020
Construction productivity is lagging

Construction and total economy MFP

Data source: Statistics NZ, Ian Page, BRANZ
We’ve got a bit more volatility than other economies

Data: OECD, StatsNZ, Source: Ian Page, BRANZ
and other NZ sectors

Data: Statistics NZ, Source: Ian Page, BRANZ

Real GDP

- Manufacturing
- Electricity, Gas, Water and Waste Services
- Construction

GDP Base 100 at 1978

Data: Statistics NZ, Source: Ian Page, BRANZ
The wall of work is coming

Ian Page, BRANZ
Workload and productivity – the link

MFP index - Construction

Ian Page, BRANZ
Modelling the link

Demand growth in year 2 of an upswing causes MFP decline

MFP regression model

\[ \text{MFP} = c_1 + c_2 \text{RB} + c_3 \text{NR} + c_4 \text{OC} + c_5 \text{NR} - 1 + c_6 \text{RB} - 1 + c_7 \text{OC} - 1 \]

\( R^2 = 0.68 \)

RB = Residential bldgs, NR = Non-res bldgs, OC = Other construction workloads

Ian Page, BRANZ
Case study research suggests that the larger projects / larger companies are relatively productive. The reverse appears to be true for the smaller players and is probably where the greatest gains are to be made.
SMEs dominate residential

Firm sizes in construction - 2011

Source: Statistics NZ  Business Demographics Survey
Residential is high volume and value

Source: Ian Page, BRANZ

Fixed capital formation by sector

- PS = Private sector
- CG = Cent Govt
- LG = Local Govt

March year

Source: Ian Page, BRANZ
Productivity Partnership

Mud on the boots research

• Systems mapping
• Case studies
• Focus groups
• Detailed statistics
Systems mapping – a life cycle approach

Design → Manufacture → Construction → Use → Maintenance → Renovation → Deconstruction → Disposal → Extraction → Recycle → Reuse

Jeff Seadon, Scion
Nodal points

Financial
Risk
Build
Cost
Liability
Customer
Affordability

Design, Building & Trade Skills
Work Planning

Standardisation
Appropriate Building Design
Operational efficiency
Operational Adaptability

Life Cycle Quality
Human Factors

Financial

Jeff Seadon, Scion
Where’s the waste?

Using Value Stream Mapping with Small Builders to understand where waste in the building process is..

Andrew Reding, Ruth Berry
Where’s the waste?

Four most significant targets for reducing waste and increasing productivity

1: Client Skill Level (Knowledge and Communication)
Maximum potential saving through reduced iterations in finalising design – from 25 weeks down to 10 weeks.

2: Consenting and Tendering Process
Up to 20 working days could be saved from the up to 40 days elapsed time spent in consent submission. Although most consents are reported as being processed within the statutory 20 days, a high number are rejected at submission and/or placed on hold pending further information to be supplied by the applicant. Possible to further reduce the 20 working days as online consenting is implemented.

3: Project Management/Project Planning
Maximum potential saving in actual build time – from 15 weeks down to 9 weeks

4: Reduced Weather Delays (Technical Solutions)
The potential savings, while likely to be significant, will be a function of regional climatic conditions and the nature of the technical solutions.

Andrew Reding, Ruth Berry
What’s the potential savings?

Average time to build a house is 49 weeks from the idea to handover.

Focussing on 4 areas of greatest waste could reduce this to 28 weeks.

A savings of >$100m pa

Andrew Reding, Ruth Berry
What can we learn from the big guys?

10 firms build 18% of new housing
20 build 24%

96% of firms have 5 employees or fewer

60% of firms build <7 houses/year
Volume builders – a case study

“What gets measured gets done”

- 10 years construction cost data, all elemental costs recorded

- Productivity growth circa 3% year on year (taking out 2002)

- Hours to build
  - 2003: 976hrs
  - 2011: 743hrs

- Costs of Compliance
  - Blueprints / royalties: +1410%
  - Consents: +361%

- Time to build 200m² house:
  - Stonewood: 12-14 weeks
  - Industry norm: 18 weeks plus

Labour productivity constructed from real cost data

John Tookey, AUT
Opportunities for policy change

Stonewood Homes’ data on house inspections

• 16 separate inspections for 2 storey house

• Worst case is 3 weeks of lost production – work can’t occur with inspections taking place.

• Larger builders can ‘work around’ this inspection delay by redeploying workers to other productive activities on the same site. Smaller builders disproportionately negatively affected as a consequence.

• Council response time guarantee of 19 days becomes a target rather than a worst case – substantial additional time in processing queries

• Great variability in booking inspections – hard for scheduling

• Self inspection implications? Council liability vs contractor liability

John Tookey, AUT
Lifting Residential construction productivity is worth a lot: By taking 4 weeks out of a typical 18 week build period a large builder could save $7,000 - $9,000 per house:

Source: Ian Page, BRANZ
Non-residential

Residential
- SMEs
- Group Builders

Non-Residential
- Light Commercial and Non-Commercial <NZD10m
- Commercial and Non-Commercial >NZD10m
- Infrastructure Light and Large <$10m > $10m

- Sole Traders
- Sub-Contactors
- Franchise Arrangements
- Private companies
- Public companies
- Commercial J.V’s
- PPP’s

different challenges
Case studies of successful projects

Broad range of “Pathfinder” projects - from schools, bridges to a clock tower

12 Case studies covering:
- Construction processes
- Management, technical and employee capabilities
- Procurement influences
- Supply chain relationships
- Influence of Regulation
- Production techniques and lean construction
- Training and skills development

Suzanne Wilkinson (University of Auckland), Constructing Excellence
Case studies of successful projects

Framework for applying Project and Programme Productivity Drivers

1. PROCUREMENT
   Getting the team on board

2. DEFINING THE PROJECT for Success

3. CREATING THE CULTURE
   Collaboration and best for Project

4. MANAGING PERFORMANCE Tools & Technologies for Win-Win Outcomes

5. CLOSING OUT THE PROJECT Harvesting the learning & Continuous Improvement

Suzanne Wilkinson (University of Auckland), Constructing Excellence
We are not a cot case

12 Successful Projects – Benchmarked against UK

Many KPIs outperformed UK Projects

Suzanne Wilkinson (University of Auckland), Constructing Excellence
Firm-level Case Studies

What makes a good and productive construction company?

Four companies perceived to be successful in improving productivity were selected in consultation with Constructing Excellence

- Arrow International
- Mainzeal
- Naylor Love
- Fulton Hogan

Research consisted of interviews, supported where possible with company data drawn from performance indicators or other sources

Summaries of individual case results were provided to the companies for their comments
Firms did not use standard statistical measures of productivity and had limited trend data for their operations as a whole, but had measures of increasing productivity in some areas:

- Time, quality, cost, and safety measures were identified
- Emphasis on cutting waste in time & materials, reducing rework
- Greatest emphasis placed on better management including:
  - Effective and early planning
  - Project management
  - Relationships with supply chain partners, clients
  - Use of information technologies to coordinate the supply chain
- Less emphasis on staff skills, regulatory issues
Measuring matters

CCG Construction Industry KPIs
Performance 2006 v 2011

- S1 Client Satisfaction - Consultant % Scoring 8/10 or better
- S2 Client Satisfaction - Contractor % Scoring 8/10 or better
- S3 Client Satisfaction Delivery Team % Scoring 8/10 or better
- S8 Client Satisfaction Value for Money % Scoring 8/10 or better
- Q1 Client Satisfaction Product % Scoring 8/10 or better
- Q2 Defects on Handover % Scoring 8/10 or better
- Q3 Defects Clearance Period % where defects are cleared within 30 days
- C1 Predictability Design Cost % on target or better
- C2 Predictability Construction Cost % on target or better
- C3 Predictability Project Cost % on target or better
- T1 Predictability Design Time % on target or better
- T2 Predictability Construction Time % on target or better
- T3 Predictability Project Time % on target or better
- HSE1 Safety LTIs % Projects with zero LTIs (Lost Time Incidents)

NZ Ind Ave 2006 Data  CCG 2011

CONSTRUCTING EXCELLENCE IN NEW ZEALAND
The culture change paradox

Profits are growing

Data: Statistics NZ, Source: Ian Page, BRANZ
working longer, not smarter

Profits per paid hours (index 1990 = 1000)

- Forestry/logging
- Manufacturing
- Construction
- All industries

Data: Statistics NZ, Source: Ian Page, BRANZ
Christchurch – a special case

PrefabNZ HIVE

Stuff.co.nz
Construction Resourcing and Productivity

Organisations currently trying:
• Improving brand and reputation
• Developing productive workforce
• Enhancing efficiency and staff morale
• Improving skill levels (In-house training)
• Investment in overseas recruitment
• Salary rises

Intensified resource competition is likely to add further uncertainties to the time and cost of the rebuild.

http://www.resorgs.org.nz

Suzanne Wilkinson, Alice Chang, Resilient Organisations and University of Auckland
The collection, use and analysis of KPI data varies between organisations.

Non-conformity makes it difficult to analyse data across the construction sector.

In order to achieve 20% improvement by 2020, an industry baseline is required

Companies need to develop improvement strategies to tackle under performance

Suzanne Wilkinson, Trevor Kempton, Aly Gleeson
Construction Productivity and the Christchurch Rebuild

Fundamental changes needed

Potential areas to concentrate on:

• More Prefabrication
• Better Training (Management and skilled labour)
• Improved Collaboration
• More Standardisation
• Improved Innovation and Technology.
Summary

There is no silver bullet.
## Some summary observations

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<th>Christchurch</th>
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<tr>
<td>There’s lots of opportunity to reduce time and cost waste in SMEs</td>
<td>Predictability of forward workload for major projects allows for better cross industry planning and more efficient investment</td>
<td>The rebuild process is following a pattern similar to other post-disaster rebuilds overseas</td>
</tr>
<tr>
<td>Client skills levels need to be improved to enable them to contribute more effectively to the design and production planning of their properties</td>
<td>Current tendering processes are very costly</td>
<td>There is some innovation in terms of procurement and relationship management</td>
</tr>
<tr>
<td>Consenting and tendering processes have risen considerably since 2004 and add time and labour costs to construction projects</td>
<td>More sophisticated “partnership” procurement processes, especially by government, can produce long term benefits</td>
<td>There’s an opportunity to fast track some innovative design, planning and construction techniques</td>
</tr>
<tr>
<td>Project management and other planning skills need improving in SMEs</td>
<td>Better and more timely skills training is needed for project and HR management</td>
<td>The contribution of management and project skills training needs to be emphasised as the rebuild</td>
</tr>
<tr>
<td>Offsite manufacturing can improve quality, health and safety outcomes and can significantly reduce build time</td>
<td>KPI monitoring is sporadic and there’s an opportunity to provide better benchmarking</td>
<td>Auckland is much easier – it’s more predictable and insurance issues aren’t of anything like the same magnitude</td>
</tr>
<tr>
<td>Boom/bust is a disincentive to investing in new technology</td>
<td>More companies are using offsite manufacturing but it is capital intensive</td>
<td></td>
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<tr>
<td>Opportunities for peer-peer learning of, and on the job training in new technology and processes, are limited</td>
<td>The use of BIM is growing but there is opportunity for better skills and use</td>
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## What could be done next?

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<td>Develop innovative projects in Auckland and Christchurch to demonstrate</td>
<td>Work with government agencies to ensure that government projects demonstrate</td>
<td>Support a series of demonstration residential projects that will create a</td>
</tr>
<tr>
<td>quality higher density housing using modern construction methods</td>
<td>best practice procurement.</td>
<td>learning environment for innovative and effective design and construction</td>
</tr>
<tr>
<td>Develop business cases (and if feasible demonstration facilities) for trial</td>
<td>Develop business cases (and, if feasible, demonstration facilities) for trialling</td>
<td>Develop a pilot project aimed at supporting and demonstrating the benefits</td>
</tr>
<tr>
<td>ling in Auckland and Christchurch the productivity benefits and construction</td>
<td>off site manufacturing in Auckland and Christchurch focusing particularly on the</td>
<td>of off site manufacturing and innovative construction processes</td>
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<tr>
<td>advantages of off site manufacturing</td>
<td>standardisation of materials and processes</td>
<td></td>
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<tr>
<td>Publish housing market assessments and plans to show how BCAs will develop</td>
<td>Support publication and collection of KPIs at firm and major project level and</td>
<td>Encourage rebuild organisations to monitor industry KPIs and resource</td>
</tr>
<tr>
<td>their capacity and their processes to match these</td>
<td>develop training packages to assist companies use KPIs to aid productivity</td>
<td>scarcity and to plan appropriate interventions should these be necessary</td>
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<tr>
<td>Explore with BCAs how the time and cost of consenting and inspection can</td>
<td>Develop national BIM strategy, including public sector leadership on BIM (eg: required use on significant capital projects), and develop a programme to accelerate take up across NZ.</td>
<td>Publicise display home innovations and actively provide consumer purchasing advice including accounting for whole of life costs when making purchasing decisions</td>
</tr>
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<td>be lowered and set, and publish, targets for achieving significant</td>
<td>Support the tertiary sector to encourage short targeted courses for construction</td>
<td>Improve skills and training modules for rebuild specific issues such as new regulations and legislation</td>
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<td>efficiencies in BCA processes</td>
<td>management skills</td>
<td></td>
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<td>Target and communicate consumer advice and advocacy through appropriate</td>
<td>Support the Auckland and Christchurch procurement fora to provide forward</td>
<td>Develop mechanisms and appropriate protocols that would support SMEs to</td>
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<td>media – using real life case studies</td>
<td>pipeline information</td>
<td>share back office, admin and other facilities</td>
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<tr>
<td>Work with builder training bodies to improve project management tools and</td>
<td>Continue support for the Auckland and Christchurch procurement fora to provide</td>
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<td>training specifically for SMEs (including KPIs to improve understanding of</td>
<td>forward pipeline information</td>
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<td>firm level productivity)</td>
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The wall of work or the productivity crash?
More information

All research papers and relevant summaries are available at:

www.buildingvalue.co.nz