Asia Pacific Journal of Advanced Business and Social Studies
ISBN (eBook): 978 0 9943656 7 5 | ISSN : 2205-6033
Year: 2016 , Volume: 2, Issue: 1

HOW WILL NZ'S CONSTRUCTION INDUSTRY ESCALATE PRODUCTIVITY TO MEET THE LARGEST PREDICTED CONSTRUCTION DEMAND IN DECADES – AND IS A LEAN APPROACH ONE OF THE MAGIC BULLETS?

Anthony Bosnich[a], Linda Kestle[b]
[ab]Faculty of Technology and Built Environment,
Unitec Institute of Technology, Auckland, New Zealand
Corresponding email: abosnich@unitec.ac.nz

ABSTRACT

Low productivity levels for at least twenty years in New Zealand's construction industry have only realised any improvement by increasing hourly inputs, such as a 0.2% per annum rise since the 1990's. NZ's Productivity Commission in 2010 and the NZ Sector Report by Minister Joyce in 2013 considers increased productivity in the construction industry as essential for the benefit of all New Zealanders, as it affects the Gross Domestic Product, employment rates and living conditions. The construction industry employs around 170 000 people and predictions are that there will be unprecedented building and construction growth over the next 5-10 yearsdue to Auckland's predicted 25% population growth by 2025 and Christchurch's rebuilding following the major earthquakes four years ago. Auckland will see a 68% increase in new building, according to Minister Joyce (2013), outstripping Christchurch's rebuilding demands over the same period. The paper investigated how to potentially and realistically increase productivity and business performance across design and construction management in the New Zealand Construction Industry over the next decade or so. An in-depth and critical analysis of relevant international journals, conference papers and New Zealand's government agency and non-agency publications was undertaken. The key findings included a very strong recommendation that senior management personnel in the construction industry need to fully implement a lean management approach in the NZ productivity context which is then driven by full consultant and on-site employee involvement and ownership.

Keywords: Productivity, construction industry, lean, New Zealand.

1. INTRODUCTION

The New Zealand construction industry has been in a state of negative productivity for several years (NZPC, 2010) and whilst the work load has been handled somehow in the past, there are currently signs that indicate a period of substantial growth is

imminent (BRANZ, 2013). This growth might be of a scale that could be beyond current productivity capacity. Previously, industry personnel met the required output by increasing input and working extended hours. Analysis of the highs and lows of our *cyclical* industry suggests that coping with those highs has not actually improved productivity and this was reflected in the downward trend of unemployment rates at the same time (Joyce, 2013).

Lifting productivity takes time and requires deliberate choices, patience and perseverance, underpinned by ongoing analysis of data, and associated evidence. Even small increases in productivity growth, if sustained, can have a big impact on industry personnel's income and wellbeing. Lifting productivity is ultimately the result of individual and organisational decisions, concerning generation of value for the organisation and for the end user.

Lessons regarding productivity and performance improvement can be drawn from published research by Liker and Lamb (2000) that focused on overseas projects that have demonstrated long-term productivity gains.

2. LITERATURE REVIEW

This research investigation was undertaken to establish how or whether the adoption of a lean approach on projects might improve productivity across design and construction management in New Zealand's construction industry. The document analysis approach was deemed appropriate. However, documentary sources first had to be evaluated in relation to their authenticity, credibility, representativeness and meaning before they could be considered to be valid sources. Official statistics provided an objective picture, and publications such as those by Joyce (2013), Branz (2010) and NZPC (2010) have been cited and utilised in this research as being primarily 'objective facts'. The reality was though, that there may well be vested interests in the statistics produced by government and governmental organisations. However, the productivity and forecasted growth in demand statistics cited and included here served as sufficiently credible guidelines and benchmarks when trying to establish how to lift productivity in New Zealand's Construction Industry.

Documents for the analysis were selected on the basis of three main foci:

1. NZ Productivity Reports over the last 5 years or so to give a longitudinal picture and possible trends.

2. NZ Construction Sector reports on recent employment and GDP outcomes for the last few years and Reports on Forecasted Demand and therefore; potential sector growth with the associated demands for trained resources over the next 5-10 years.
3. Lean manufacturing, design and construction principles, lean strategies and in-case studies demonstrating their applicability and/or influence in terms of lifting productivity, whether in design or construction management projects in the UK for example.

2. 1 What is the current NZ construction industry productivity status?

The New Zealand Sector Report by Joyce (2013) confirmed that the NZ construction industry has a significant influence on the overall well-being of the whole country and the GDP. It produces over $30 billion in revenue annually and plays a fundamental role in the economy.

The construction industry employs approximately 170, 000 people in a wide variety of occupations including many trades and professions. Construction is the fifth largest sector in the NZ economy and employs 7.6% of the total work force, producing a nominal 6.3% of the GDP. When construction is booming, the impact flows through the whole economy and this is reflected in the country's unemployment statistics. History has also demonstrated that a decline in construction activity sees a relative increase in unemployment rates.

Improving productivity is about creating more from available resources such as raw materials, labour, skills, capital equipment, land, intellectual property, managerial capability, and financial capital. There are a number of ways to describe productivity ranging from the level of technical output per worker to the colloquial 'working smarter, not harder'. In other words, lifting productivity is about how smart people combine different resources to produce goods and services others wish to purchase. With the right choices, higher production, higher value and higher incomes can be achieved for every hour worked (Joyce, 2013.)

The main reason for productivity being of nationwide concern is that productivity is the mechanism by which societies progress. Generally speaking, the higher the country's productivity levels, the overall public well-being improves and expand in scope. Well-being may include quality healthcare and education; excellent roads and infrastructure; safer communities; support for people that need it and sustainability of the environment; reduced taxation rates and a level of government service that meets or even exceeds public expectations.

Societies with high productivity are those that make smart choices in areas such as savings and investment versus current consumption. They are typically characterised by dynamic and competitive markets; openness to trade and to international connectedness; high awareness of external influences; rapid uptake and smart application of new technologies, products and processes; and increasing demand for highly skilled and creative people. These are the successful societies that attract and retain people, ideas and capital (NZPC, 2010).So how can the New Zealand construction industry make realistic improvements in productivity performance? Productivity improvement has to be related to a need and commitment to significant changes in current practice.

2.2 What is the current forecasted construction activity demand for the next 5 years in NZ and why is it happening?

Pacifecon (NZ) Ltd, with the support of BRANZ was commissioned by the Building and Construction Productivity Partnership to forecast national construction demand for the next six years ending March 2019.The resultant document is the National Construction Pipeline Report (Pacifecon (NZ) Ltd 2013).The forecast for the next 6 years till 2020 showed a 23% growth potentially in the construction sector but that the industry will not have the capacity to accommodate this additional work load given current productivity levels and work practices.

"The forecasts show unprecedented levels of demand for building and construction, as the previous highest level of building and construction was in 2007, when over $26 billion worth of building projects were constructed. The forecasted peak in 2016 is $32 billion that represents an increase of 23%. Activity is forecast to remain at these elevated levels for the rest of the period (Pacifecon (NZ) Ltd 2013).

The figures confirm that to maintain productivity levels as they are now will not satisfy the forecasted demand. The ability to increase productivity is key to our future developments. The challenge for the NZ construction industry will be how to sustain four or more years of 10%+ growth when our current rate is in the minus figures (Pacifecon (NZ) Ltd 2013).

This poses a serious question for the industry. Is it beyond our current capacity to realistically turn around productivity levels in such a short timeframe? This must also place the productivity commission's target of increasing by 20% by 2020 in doubt.

"The forecast also showed high rates of growth over a longer period than at any time in the past 40 years. This forecasted level of sustained, increased growth is comparable with the mid-1990's boom and indicates that building and construction growth would be greater than 10% for longer than previous booms (Pacifecon(NZ) Ltd 2013) with Auckland's dominating demand.

"Auckland dominates the national demand for building and construction, even taking into account the Canterbury rebuild. Auckland accounts for about a third of all building and construction work and is expected to grow by 68% over the forecast period. All regions are forecasted to experience growth through to 2016." (Pacifecon (NZ) Ltd 2013). This place a constraint on the industry, therefore, not only is there a likely requirement to increase productivity, but the rate of demand will proportionally increase every year as well.

The NZ Productivity Commission stated that "for most countries, productivity improvements are gained by increasing output with the same input". To produce the same outputs with the same inputs is not increasing productivity; however, it is only maintaining the status quo, that is, normal production. Improvements in productivity are not just limited to the physical aspect of human output or achievement. Increased productivity is only really possible where the same input results in creating more from the available resources, such as raw materials, labor, skills, capital equipment, land, intellectual property, managerial capability and financial capital (NZPC, 2010).

This increase may be realized in *value* and *efficiency,* which are quite different from cost and being effective. In summary, lifting productivity is concerned with how smart people combine different resources to produce goods and services that others wish to purchase (NZPC, 2010).

As with any management tool, productivity must be measurable, and needs to be compared with Key Performances Areas (KPA), and Key Performance Indicators (KPI).These need to be applied to each project, closely monitored and reported on as production versus anticipated progress.

2.3 What is a Lean Approach?

Within the context of the building construction sector a Lean approach, one of the key definitions utilized for example by the Construction Industry Institute (CII) USA, began by defining lean construction as:

"The continuous process of eliminating waste, meeting or exceeding all customer requirements, focusing on the entire value stream, and pursuing perfection in the execution of a constructed project."

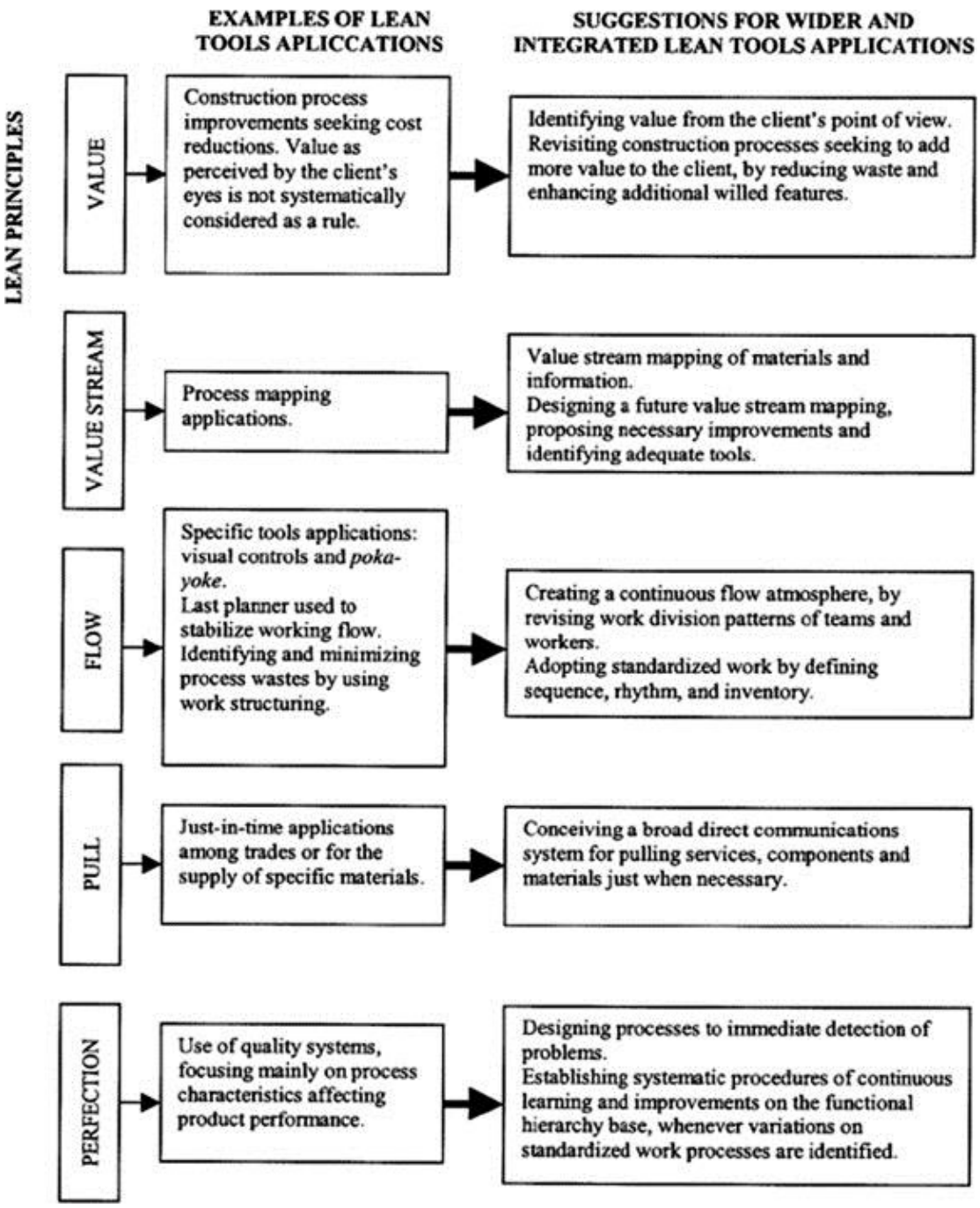
As noted by Aziz and Hafez (2013), there are basically five lean construction principles:

- *'Value'*- what does the customer actually define as 'value' to them in terms of the proposed project outcomes,
- *Value Stream'*- eliminating everything that does not generate value to the end-product including wasted materials, wasted personnel and wasted time,
- '*Pull*'- producing exactly what the customer wants at the time it is needed and to always be prepared for when customer might need to change,
- *'Flow'*- Ensuring constant flow in the process and value chain by focusing on the entire supply chain not just the end-product,
- '*Perfection*' - continuous improvements sought in terms of time, cost and quality.

Howell (1999) affirmed that managing construction under Lean is different from typical contemporary practice because it:

- has a clear set of objectives for the delivery process,
- is aimed at maximizing performance for the customer at the project level,
- designs concurrently product and process, and
- applies production control throughout the life of the project.

By contrast, the current form of production management in construction is derived from the same activity centered approach found in mass production and project management. It aims to optimize the project activity by activity; assuming customer value has been identified in design. Production is managed throughout a project by first breaking the project into pieces i.e. design and construction, then putting those pieces in a logical sequence, estimating the time and resources required to complete each activity and therefore; the project. Each piece or activity is further decomposed until it is contracted out or assigned to a task leader, foreman or squad boss. Control is conceived as monitoring each contract or activity against its schedule and budget projections (Howell, 1999).



Sourced from Aziz and Hafez (2013)

To benefit from the lean approach, the following should be implemented on projects:

(1) Select suppliers who are willing to adopt lean project delivery;
(2) Structure the project organization to allow money to move in pursuit of the best project-level returns;
(3) Define and align project scope, budget, and schedule;
(4) Explore adaptation and development of methods;
(5) Make design decisions, with explicit alternatives against stated criteria;
(6) Practice production control in accordance with lean principles;

(7) Build quality and safety into projects;
(8) Implement JIT and multi-organizational processes after site demand;
(9) Use evaluations and planning on process that transform materials;
(10) Use computer modeling to integrate product and process design;
(11) Use 5S workshops: a tool for workplace organization and promoting teamwork.

2.4 DISCUSSION OF THE DOCUMENT ANALYSIS

What are the suggested actions for performance improvement from the local findings?

The resultant findings from the document analysis of reports by the Productivity Commission, BRANZ, the Sector Productivity taskforce and the NZ Sectors ministerial report, for example on the NZ Construction Industry Sector and its Productivity, suggested that the industry does indeed have a challenge on its hands if methods and habits do not change to meet the increased demand and wherever possible exceed stakeholder and end-user expectations. After analysing the data regarding productivity in the NZ construction industry over the last twenty years, it is clear that that the industry has suffered from negative rates for many years. "The industry has managed to survive the peak times. The previous highest level of building and construction was in 2007 when over $26 billion was constructed." (Pacifecon NZ Ltd, 2013). It can only be assumed that the coping mechanism for added production was to apply more resources which would have affected the final costs. Although the industry survived this peak in demand, it appears to have added only minor value to the industry as a whole, as productivity levels still languish seven years later, and costs continue to escalate. (Pacifecon NZ Ltd, 2013).
BRANZ (2009) and NZPC (2010) both reported that improving current practice was still required, and maybe the actions for performance improvement include the following:

- Skilled training, particularly for on-site management and management of multi- projects at the firm level (BRANZ, 2009).
- Improvements in human capability through well directed public and private investment in quality education (NZPC, 2010).
- More modularization of housing and less one-off designs (BRANZ, 2009).
- More benchmarking at the firm level to encourage improvements (BRANZ, 2009).
- Increase the average firm size to achieve efficiencies (BRANZ, 2009).
- Effective governance and management of organizations (NZPC, 2010).
- Streamline regulation and compliance costs of central and local government (BRANZ, 2009).
- A high quality low cost regulatory environment (NZPC, 2010).
- Respect for the law and property rights, as well as the enforceability of contracts and low levels of corruption (NZPC, 2010).
- Open competitive markets for trade of goods and services (NZPC, 2010).
- Investigate what lessons can be learnt from innovative and efficient firms in the industry (BRANZ, 2009).
-

To address all these items individually would, in some cases provide enough detail and research to form the basis of further research.

What are the suggested ways to improve productivity the NZ construction industry from overseas experiences that included the lean approach?

Perhaps the answer to being able to manage the forecasted increase in demand, growth and subsequent requirements over the next 6-7 years may also reside in experiences outside the NZ industry. To gain insight into successful operational methods might perhaps assist with the path to increased productivity and the resultant increase in our wellbeing. Building commercial or residential projects, which are frequently highly customised, the basic principles still remain of aiming to give the customer what they want and shortened lead times by trying to eliminate or at least mitigating waste. Such an approach, the 'lean approach' essentially applies to high or low volume, customised or standardized processes and projects.

With the NZ Construction industry heading toward increased demands for buildings (commercial and residential) with increasing levels of modular prefabrication, and off-site production, a few design and construction organisations are already effectively embracing a few, if not several of the 'lean manufacturing'/'lean design', 'lean construction' principles in practice. However, the industry is not necessarily referring to these approaches as 'lean' nor going the extra distance to fully embrace lean practice, by involving all employees in the continuous improvement effort, not just management and some technical employees, as suggested by Liker and Lamb (2000).

Published research by Morrey et al. (2013), shed significant light on " how a set of (lean) tools adapted from the concept of standardized work were developed in a bid to engage people from across the business in the performance improvement process." This was a case study in the UK involving a design management, construction and refurbishment of buildings business, started back in 1890 originally, grew in the 70's and that was now delivering major construction projects with an annual turnover in excess of NZ $500 million. The business was producing inconsistent results in terms of time cost and quality with some projects performing well and others were not. The reasons for this were found to be the varying ways in which different project teams were trained whether project managers, site managers et al, and these personnel were often found to be developing their own ways of working, sometimes even setting up their own new processes and templates for each project. The business chose to develop standard internal work practices, including standardisation of management training and on-site practices, as a means to improve project and personnel performance. A number of standardised tools were created, agreed upon and subsequently implemented across the business by working groups of employees that came from a range of different disciplines. Senior managers at all levels of the business were involved and middle managers (construction directors) acted as 'process leaders' of the working groups (Morrey et al., 2013). Interestingly, despite all of this staff engagement, not all of the participants owned/implemented the new lean strategy and tools immediately.

Lean has been accepted as a philosophy by the business and it has developed its own adapted-to-local factors, fit-for-purpose lean approach, using the lean principles of *identifying the value (the customer needs), the value stream (consequences of process mapping), the (streamlined) flow of processes, the pull of production adjustments, and seek perfection,* as a guide and focus.

The resultant was an increased level of standardisation of practice and training without people feeling like they had to become robots.

Koskenvesa et al. (2010), found that labor productivity and waste in production planning and control in the Finnish construction industry does not increase because initial production plan information includes waste as an accepted phenomenon.

Consequently, there is palpable potential for productivity improvement by supporting initiatives that reduce wasteful activities by also managing production not just the project on and off-site. In New Zealand's construction industry, this could be sensible approaches for larger companies, but how do the hundreds of small to middle sized design/construction companies prepare for this forecasted swell in demand beyond anything New Zealand has ever seen before and in such a tight timeline. Several construction companies in NZ have used the 'Last Planner' system created by Ballard (2000), to ensure ownership of 'The Plan' from all employees with reasonable success that enables participants to maintain contact with the ongoing on-site situation and assist and influence in any changes required.

Thus, one of the questions might be: should the smaller and medium companies consider merging, to combine their skills, knowledge and capacity and standardise operations that would then limit wasted resources, improve performance and increase competitiveness, thereby creating a fit-for-purpose lean approach to their business?

CONCLUSIONS

The objective of this research was to try and establish the current productivity status of the construction industry, particularly given that a boom is not only forecast but currently underway. In addition, the lean approach was explored to establish whether it might aid productivity improvement across the design and construction management sector of the NZ construction industry, particularly given the forecasted significant increase in demand for building projects over the next 6-7 years nationally and a history of low productivity performance.

Published research documents demonstrated how productivity was or could be improved using lean manufacturing, lean design and lean construction principles. These have provided useful insights and opportunities that could be applied to the NZ construction industry and improve productivity. Tools and techniques such as modularisation, off-site prefabrication, and meticulous attention to detail at the design and construction stages could and probably should be implemented by the NZ construction industry whether small or large operators. In addition, the case study of how to develop a strategy to enact lean provided significant insights into how to improve, not only productivity, but also secure management and employee engagement in a longstanding design and construction company in the UK, that needed to review inconsistent efficiency and quality outcomes for stakeholders. The context and findings of that work resonates closely with the NZ Construction industry situation around building practices, staff training and resultant productivity levels, mainly because most construction companies in NZ are small to medium scale operators, all with different ideas on how best to run their businesses on and off site. Standardisation, whether that is design details or management training practices iss pivotal to providing a consistent framework for project teams and resultant productivity performance improvements. Due to the dominance of Small and Medium Enterprises (SMEs), a total commitment across the industry to improve and escalate productivity will likely only be achievable under some form of Government initiative or incentive. In addition, design and construction companies need to actually make strategic decisions at the senior management level, around the need for and commitment to the full implementation of a lean management approachfor change to occur.

REFERENCES

i. Aziz, R.F. and Hafez, S.M. 2013. *"Applying lean thinking in construction and performance improvement"*. Alexandria Engineering Journal, 52 (4) 679-695.

ii. Ballard, G.H. 2000. *"The Last Planner". PhD thesis,* University of Birmingham, UK.

iii. BRANZ 2009.*"Building Construction Sector Productivity Workforce Report."* Building Research Association of New Zealand, Wellington, NZ.

iv. BRANZ 2010.*"Construction Industry Productivity."* Building Research Association of New Zealand, Wellington, NZ.

v. BRANZ 2013. *"Pacifecon National Construction Pipeline 2013-19."* NZ Building and Construction Partnership, Wellington, NZ.

vi. Howell, G.A. 1999. *"What is Lean Construction?*".In 7th Annual Conference of the IGLC, 28-29 July 1999,Berkeley California. USA .

vii. Joyce, H.S. 2013. *"The NZ Sectors Report 2013: Main Report."* NZ Government, Wellington. Government Printer, NZ.

viii. Koskenvesa, A., Koskela, L.J.,Tolonen, T and Sahlsted, S. 2010. *"Waste and Labor productivity in production planning: case Finnish Construction Industry"*. In 18th Annual Conference of the IGLC, 14-16 July 2010, Haifa, Israel.

ix. Liker, J.K. and Lamb, T. 2000. *"Lean manufacturing principles guide: a guide to lean shipbuilding."* University of Michigan, USA.

x. Morrey, N, Pasquire and Dainty, A. 2013. *"Developing a strategy to enact lean". Engineering, Project and Production Management,* 3(1) 35-45.

xi. Mossman, A. 2005. *"Last Planner Overview: collaborative production planning, collaborative programme coordination"*. Lean Construction Institute.

xii. NZPC 2010. *"NZ Productivity Commission: Productivity Levels."* Statistics new Zealand, Wellington, NZ.

xiii. Womack, J. P. and Jones, D. T. 1996. *"Lean Thinking: banish waste and create wealth in your corporation."* Simon and Schuster, New York. USA.

xiv. Wright, G. 2000. *"Lean Construction boosts productivity'. Building Design and Construction,* 41(12) 29-32.