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# **Sustaining Lean in New Zealand Manufacturing Organisations**

**A thesis presented in partial fulfilment of the requirements for the degree of Master of Technology in Engineering and Industrial Management at Massey University, Palmerston North, New Zealand**

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## **Abstract**

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This study has focused on the NZ manufacturing sector. The weak productivity rates of this sector over the last few years prompted the Government (through New Zealand Trade and Enterprise) to take steps to help manufacturers' boost productivity growth through a directed campaign to apply lean manufacturing. Several high-growth potential companies were selected to participate in NZTE's *Aichi* lean programme which ran from 2005 through to 2008. Several companies also joined NZTE's current *Direct* lean programme which kicked-off in 2007. Overseas experience shows that a majority of organisations attempting lean transformations fail to sustain improvements. This study looked at the experiences of a sample of organisations that participated in NZTE's Lean Programme in sustaining their lean transformations.

This study utilised case study research techniques to extract qualitative data from nine manufacturing companies. Eleven organisations were originally selected for study but two companies went into receivership prior to the commencement of data collection. The organisations were assessed for lean sustainability using a recognised sustainability model. In general, lean improvements were not sustained across NZ manufacturing organisations. NZTE's Lean Programmes were successful in promoting lean but proved poor in ensuring sustained improvements. Only one case study organisation looked likely to sustain improvements. There were several common problems experienced by the organisations. These problems were; erroneous understanding of lean, poor change strategy, poor SMT commitment, NZTE funding 'pushing' change, high staff turnover, high staff resistance and failure to develop the lean champion's capabilities.

The root-cause of these problems was lack of organisational leadership. The majority of the leaders chose to attempt lean simply as a tool for short-term gains. Many organisations experienced good initial gains from implementing lean but the majority failed to sustain these improvements. Overseas experience shows that to sustain improvements organisations need to focus on and invest into life-long learning. This study showed that there is a distinct lack of focus on learning within the sample. It is recommended that the 5P model be used as a guide to creating learning organisations within NZ. The 5P model has been developed from the 4P model (Liker 2004) which

is based on the philosophies and principles used by Toyota to become a learning organisation. The 5P's are Preparedness, Philosophy, Process, People and Partners and Problem Solving. Organisations first establish their strengths and weaknesses through a period of preparedness. The next step is to establish a long-term philosophy to enable the successful roll-out of the other P's. Process improvements provide the setting in which to challenge and develop people, which is necessary to achieve a true learning organisation focused on continuous improvement through problem solving.

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## **List of Abbreviations**

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<i>Abbreviation</i>	<i>Explanation</i>
BBD	Better-by-Design (an NZTE initiative)
BOD	Board of Directors
CEO	Chief Executive Officer
CI	Continuous Improvement
DOL	Department of Labour
EFQM	The European Foundation for Quality Management
EQA	European Qualifications Authority
GM	General Manager
ISO	International Organisation for Standardisation
KL	Key Leaders
KPI	Key Performance Indicator
LMS	Lean Management System
MBNA	Malcolm Baldrige National Award
MED	Ministry of Economic Development
MM	Manufacturing Manager
NZTE	New Zealand Trade and Enterprise
OECD	Organisation for Economic Co-operation and Development
OFI	Opportunities for Improvement
OM	Operations Manager
PIT	Process Improvement Team
PM	Production Manager
PS	Production Supervisor
SME	Small and Medium Enterprises
SMT	Senior Management Team
SOP	Standard Operating Procedure
TL	Team Leader
TPS	Toyota Production System
TQM	Total Quality Management
VSM	Value Stream Mapping



## **Project Overview**

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### **Introduction**

Economic productivity growth remains a key issue for the NZ Government (OECD 2005). The manufacturing sector is a key contributor to the NZ economy and productivity growth rates for the sector have been of concern to the Government in recent years. In 2004 the NZ Government piloted the *Aichi* lean manufacturing programme in selected manufacturing firms in a bid to boost productivity. The adoption of lean manufacturing (Womack and Jones 1996) in NZ is in line with what has been happening globally. As organisations have struggled to remain profitable during periods of economic slowdown, many have embraced lean to improve competitiveness (Worley and Doolen 2006). Like many improvement programmes, lean implementations have not succeeded universally in their application with many different variables impacting the failure or success of a lean transformation. Many overseas organisations have struggled and even failed with their lean transformations (Woods and Robert 2008).

### **Research problem**

Several NZ organisations have undertaken lean transformations in a bid to boost productivity. Overseas experience shows that many organisations have struggled and even failed with their lean transformations. This project seeks to study the lean journeys of NZ organisations to establish key inhibitors and enablers to sustaining lean manufacturing in NZ.

### **Research aim**

- To study the experiences of NZ manufacturers in sustaining lean transformations

### **Key questions guiding research**

The following questions were used as a guide to formulate the research objectives and the framework for study.

- What are the current lean practices within NZ organisations? – Phases, processes, technology and techniques?

- What lean tools and techniques have been used by NZ organisations? What short-term gains have been observed? Can they use these short-term gains for more ambitious long-term projects?
- How do we quantify improvement and its contribution to lean?
- What are the major concerns?
- What views do companies hold about ‘sustainable lean’?
- How will ‘sustainable lean’ be successful in a NZ manufacturer? What results should we expect?
- How do we customise the ‘sustainable lean’ stages to a typical NZ manufacturers’ business processes?

### **Research objectives**

- To review current literature on lean sustainability in NZ and globally.
- Identify a good representative sample and a robust methodology to extract data from this sample.
- Determine the commonalities and differences within the sample.
- Suggest recommendations to sustain lean.

## **Chapter 1: Literature Review**

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### **1.0 Introduction**

This chapter will review literature on the inhibitors and enablers of sustaining lean manufacturing and other business improvement methodologies. The role of New Zealand Trade and Enterprise (NZTE) in expanding and sustaining lean thinking within the NZ manufacturing sector is also evaluated. The lean culture is defined as a problem solving culture and is based on the concepts of continuous improvement (CI) and learning (Czabke *et al.* 2008). Many of the leading lean advocates and scholars (Emiliani 1998b; Hines *et al.* 2008; Liker 2004; Womack and Jones 1996) insist that the true measure of lean sustainability is when an organisation had embedded a culture of CI. For the purpose of this study, lean is defined as a CI methodology and lean is sustained when an organisation has embedded a culture of CI. Many overseas organisations have struggled and even failed with their CI transformations. In light of this, several leading researchers have developed theoretical models to assist companies in sustaining CI transformations. Many organisations have also used benchmarking models as alternatives to methodologies such as lean to embed CI cultures. Recognised CI implementation models, theoretical CI sustainability models and CI benchmarking models are also evaluated in this chapter to identify the most suitable model for developing the framework for this research.

### **1.1 What is a continuous improvement culture?**

The term CI means incremental improvement of products, processes, or services over time, with the goal of reducing waste to improve workplace functionality, customer service, or product performance (Emiliani 1998b). Processes subjected to analysis by this concept characteristically reveal significant opportunities for reductions in process time or expense, and improvements in quality or customer satisfaction. No matter how good the organisation becomes, a culture of CI and learning will create new opportunities for improvement (OFI). CI principles, as practised by the most devoted manufacturers, result in astonishing improvements in performance that competitors find nearly impossible to achieve (Czabke *et al.* 2008). Common methodologies for implementing CI include lean manufacturing, Total Quality Management (TQM), Six sigma, Toyota Production System (TPS), Theory of Constraints, Agile Manufacturing, etc. Key authors, including Dale (1997), Redman

and Grieves (1999), Sohal (1999), Emiliani and Stec (2005), Bhasin and Burcher (2006), all agree that successful CI transformations require management to have a long-term focus without losing sight of important short-term goals and that organisations need to create their own culture where CI through people is the norm.

## 1.2 The NZ manufacturing sector

The manufacturing sector has been and will continue to be an important contributor to NZ's economic productivity growth and is a major export earner and a major employer. The sector comprises of approximately 15,000 companies from the automotive, aviation, electronics, engineering, marine and plastics industries. Together they contribute more than 15% of gross domestic product (GDP) and over 44% of export receipts (MED 2009). Recent indicators suggest that current productivity growth rates are of concern to the NZ Government (OECD 2007, NZTE 2008).

Productivity is important because it underpins economic growth (O'Reilly 2006). Productivity is a useful measure of the relative value-generating ability of a company or industry when compared with others. Productivity (Figure 1) is a measurement of how well an organisation transforms available resources (inputs) into products and services (outputs) (BusinessNZ 2005). In other words:


$$\text{Total Productivity} = \frac{\text{Total Outputs}}{\text{Total Inputs (labour, materials, capital and intangibles such as managerial expertise and information etc)}}$$

Figure 1: Productivity definition (BusinessNZ 2005)

Productivity rates are globally used as a measure of economic performance and standard of living. The OECD has frequently stated that NZ has poor productivity performance compared to other developed nations. NZ's lack of investment in physical capital and over-reliance on boosting production through longer hours and the use of relatively cheap labour means that their capital productivity lags behind many of the OECD countries (BusinessNZ 2009). The OECD calculations for productivity indicates that NZ's productivity grew by just 1% between 2004 and 2005, compared to the OECD average of 1.9% (Edmond 2007). This was the 8th

lowest growth rate out of the 30 OECD countries, below that of many of NZ's key trading partners. The OECD state that boosting productivity growth is the only sure way to close the substantial income gap between NZ and other developed countries.

The manufacturing plus report (NZTE 2006a) recommends that NZ manufacturers need to focus on a long-term culture change of adding value based on customer needs to improve productivity growth. A second key theme from the report was the need for continuing education in the workforce and, in particular, in leadership, senior management and mentoring areas. BusinessNZ (2009) agrees that the importance of the internal culture of an organisation in raising productivity should not be underestimated. The Department of Labour (DOL 2009) strongly believes that long-term productivity growth can be achieved in NZ by investing in up-skilling of the labour force through education. BusinessNZ (2009) suggests that the onus is on the private sector to generate more wealth to improve NZ's productivity growth rates and the standard of living but NZ will only see the benefits of private sector activity if it is supported by Government and public sector initiatives. The NZ Government is currently trying to find models that are aimed at helping manufacturing organisations improve productivity growth rates. Lean is one of the models the Government is currently focusing on.

### **1.3 Lean – The NZTE strategy**

NZTE was established in 2003 as NZ's national economic development agency. NZTE provides the Government with a vehicle for intervening in the economy through the delivery of services and initiatives designed to promote and accelerate economic growth. One of NZTE's key strategic initiatives is '*global transformation of the manufacturing sector*' (NZTE 2006b). Their aim is to see manufacturing recognised as a high performing sector, and a major and growing contributor to the NZ economy. It is anticipated that the manufacturing sector will increase its contribution to NZ's per capita GDP growth, foreign exchange earnings and profitability. This strategic initiative forms the basis of how NZTE aims to work with the manufacturing sector to achieve this. This initiative concentrates on improving the way manufacturers do business – from idea generation through to commercialisation and international success. This includes a specific focus on improving productivity and connecting firms to large, defined opportunities overseas. One of the key

activities under this strategic initiative is the development and roll out of an integrated set of activities to improve the productivity of firms through training courses, support networks and a national body to oversee the expansion of 'lean thinking' or a 'competitive manufacturing' culture throughout New Zealand.

The major NZTE lean initiative has been the *Aichi* programme. NZTE piloted the *Aichi* lean manufacturing programme in 2004 to guide businesses through the lean manufacturing process. This programme was funded through the *Aichi* Leveraging Fund. The *Aichi* Leveraging Fund was a four-year Growth and Innovation Framework project, which began in 2004 and ended in March 2008. The ultimate aim of this project was to improve commercial, cultural and people-to-people links between Japan and NZ (Sutton 2005). Selected high-growth-potential firms were sponsored through a lean implementation programme for a period of 12 months. They were formed into cohorts or clusters to share experiences and learn from each other. NZTE initiated the *Aichi* lean programme in four companies in 2005/2006, three companies in 2006/2007 and eight companies in 2007/2008. In addition to the *Aichi* programme, NZTE has sponsored eight other firms in 2007/2008 on the lean journey through other programmes such as its Growth Services Fund and industry cluster initiatives. These firms have joined the lean programme on their own initiative or through more indirect routes. The non *Aichi* companies are referred to as *Direct* members throughout this project.

NZTE have used a three stage approach to encourage firms to adopt lean and to support them along the journey (Wilson *et al.* 2008) these are:

- 1. Engagement:* This stage was to introduce lean principles to the business owners and their senior management teams (SMT) and demonstrate the benefits it offers. Senior management commitment was a key requirement for participation in the NZTE programme. The original NZTE lean programme included a trip to Japan for companies to visit exemplar lean firms. The trips provided clear evidence of the need for full commitment and leadership by management.
- 2. Implementation:* Here NZTE, in conjunction with the firm, co-funded a consultant for a period of 12 months to work intensively with the firm on implementing a lean programme.

3. *Sustainability*: The final stage of the process was focused on how to maintain the momentum of lean change within firms. This was supported by NZTE sponsorship of industry forums and the establishment of clusters to facilitate networking and sharing of experiences at both the executive and shop floor levels.

#### **1.4 The principles of lean**

Lean manufacturing is a set of management principles and techniques geared towards eliminating waste in the manufacturing process and increasing the flow of activities that, from the customers' perspective, add value to the product (Womack and Jones 1996). Organisations become interested in adopting lean principles and practices because it claims to result in many benefits including: higher quality products and services, increased market share, margin expansion, revenue growth, higher productivity, better customer focus, faster response to changing market conditions, and higher asset efficiency, etc (Emiliani 2005). The essence of lean manufacturing is the elimination of waste wherever it exists within the firm and along the whole supply chain (Kippenberger 1997). The traditional batch-and-queue mentality of mass production is seen as carrying large amounts of waste along the length of the supply chain. Five principles define lean and are fundamental to the elimination of waste along the supply chain (Womack and Jones 1996).

These principles are:

- *Specifying value from the perspective of the customer* – specify what does and does not create value from the customer's perspective and not from the perspectives of individual firms, functions and departments.
- *Identifying the value stream* – identify all the steps necessary to design, order and produce the product across the whole value stream to highlight non-value-adding waste.
- *Making the value creating steps flow* – make those actions that create value flow without interruption, detours, backflows, waiting or scrap.
- *Creating pull* – only make what is pulled by the customer.
- *Striving for perfection* – strive for perfection by continually removing successive layers of waste as they are uncovered.

## 1.5 The beginnings of lean

The birth of the '*Toyota Production System (TPS)*' or '*Lean Manufacturing*' can be traced back to Toyota's desire to become a learning organisation. This desire to learn and the strong external pressure Toyota faced in surviving and growing as an organisation after the events of World War II led to the development of a disciplined process-focused production system now known as the TPS or Lean. Buckler (1996) and Coetzer and Perry (2006) agree with Toyota that for an organisation to be successful in its rapidly changing external environment, its capacity to learn must exceed the rate of change imposed on it. The views that learning is important to the survival of organisations and is a significant source of competitive advantage are also prevalent in the workplace learning, organisational learning, and knowledge management literature.

Toyota's culture is driven towards meeting and exceeding customer expectations by continually improving their processes through their people. Toyota built this culture over 70 years by focusing on the two pillars of '*continuous improvement*' and '*respect for people*' (Liker 2004). Toyota faced many difficulties with developing their culture and it has taken several decades of trial and error, observation, problem-solving, learning from mistakes, reflection, etc for Toyota get to their current state. It took Toyota decades to build their culture and they are open to sharing their philosophies, systems and tools. Toyota is aware that other companies cannot simply duplicate their culture and it will take them many years to get to where Toyota currently is. Toyota did not coin a term for their production system until the late 1980's. They did not have a term for it as it was just a natural way of doing things for Toyota. The term '*Lean Manufacturing*' was not created until Womack *et al.* (1990) decided to introduce the Western World to Toyota's systems and philosophies through their book '*The Machine that Changed the World*'.

It is important to note that Toyota's focus on learning gave birth to lean and it wasn't lean that made Toyota a learning organisation. Lean is not about imitating the tools used by Toyota in a particular manufacturing process. Lean is about developing principles that are right for an organisation and diligently practicing them to achieve high performance that continues to add value to customers and society. Liker (2004)



states that organisations should learn from Toyota and use the tools Toyota has developed to give them a head-start to a CI culture but unless these organisations create their own unique CI culture, sustained improvements will not eventuate.

Emiliani (1998) argues that lean, applied correctly, results in the ability of an organisation to learn. As in any organisation, mistakes will always be made but mistakes are not usually repeated because this is a form of waste that the lean philosophy and its methods seek to eliminate (Emiliani 1998b). He advocates that the ability for an organisation to learn does not require it to have a lean philosophy however, it must possess an ability to change how it thinks which requires a culture characterised by trust, shared responsibility, and openness to experimentation without fear of failure. Instead, the majority of companies have functional, results-oriented leaders who are highly skilled at maintaining the status-quo or perpetuating local optimisation strategies. Liker (2004) believes that all manufacturing organisations that want to be successful in the long-term must become learning enterprises. Toyota is one of the best models in the world though every company must find its own way and learn from itself.

### **1.5.1 Influence of the Japanese culture on Toyota**

Aspects of the Toyota Way are intertwined with the Japanese culture, which is relatively homogenous (Liker 2004). Toyota's desire to become a learning organisation was greatly boosted by Japanese cultural aspects such as *Hansei* (learning from self-reflection), *hoshin kanri* (policy deployment), *nemawashi* (prior consultation), *Kaizen* (continuous improvement), etc. *Hansei* for example is based around reflecting on problems, mistakes, experiences and pledging improvement. The philosophies underlying *Hansei* that Toyota considers necessary for *Kaizen* are rooted in Japanese upbringing. The philosophy of *Hansei* is a core aspect of the Toyota culture and it seems to be synonymous to the scientific model (PDCA cycle) developed by Dr W. A. Shewhart and popularised globally by Dr W. E. Deming. Dr Deming introduced the PDCA concept to the Japanese in the 1950's who seemed to have made an instant connection to this concept as they already had an innate PDCA mentality but did not have a terminology to describe it.

## 1.6 Lean in NZ

Lean manufacturing is a new concept in NZ however the focus on lean has been increasing in recent years with NZTE being the main driver behind this increase. They have helped over 20 organisations initiate lean since 2005. Research by Wilson *et al.* (2008) represents the only previous major research conducted on lean in NZ. They looked at how NZTE can transform their current lean strategy into a national strategy for lifting productivity in NZ. Their study focused on assessing how effectively NZTE administered lean to the manufacturing sector with the aim of advising NZTE on how to successfully support private enterprises through change initiatives such as lean.

Wilson *et al.* (2008) discovered that the various lean initiatives conducted by NZTE over the last three years had been very successful, in particular the *Aichi* programme. In all cases the companies have continued with lean implementation after the 12 month period of NZTE co-funding support regardless of actual progress. It is noted that the *Aichi 1* (the first cohort) firms have achieved the most progress and are the closest to being self-supporting in terms of embedding a culture of lean within their operations. They suggest that a three year time frame may be required for successful lean implementations. The progress and benefits accrued by active lean firms in this study, and by default the NZ economy, have been impressive and continue. All firms reported significant savings and performance improvements across a range of measures.

Wilson *et al.* (2008) found that the resident level of knowledge and experience of lean in NZ was minimal to non-existent at both managerial and operational levels. They also found that those firms doing the best were linked through trading relationships with other firms involved in lean in their supply chain. They state that firms who were attempting lean by themselves tended to suffer the most in terms of the lack of knowledge, encouragement, support and motivation. Wilson *et al.* (2008) discovered that for the firms supported by NZTE, the co-funding played a critical role in the decision to adopt lean. Two main reasons were given; firstly it 'de-risked' what was generally an unknown methodology, and secondly, it allowed good initial progress to be made that 'proved' the concept to the sceptics. All subsidised firms stressed the importance of on-going external support as without this support firms felt they would 'soon lose their way'. Wilson *et al.* (2008) found that the initial fears of major staff

resistance were not realised during the implementations. They state that the level of staff 'buy-in' was very high with unskilled and semi-skilled workers tending to adopt lean more readily, whilst skilled workers and trades people tended to be more resistant, although not obstructive.

Wilson *et al.* (2008) state that virtually all organisations had positive experiences with the consultants with many now using their consultants for regular 'health checks' or auditing visits as a means of imposing self-discipline. Firms cited losing momentum and slipping into old habits as the biggest threats to the success of lean in their firms. Virtually all organisations agreed that inertia and being swamped with day-to-day operational issues was the biggest threat to maintaining lean in the future. Wilson *et al.* (2008) recommend that efforts to sustain lean should be focused on setting in place periodic external checks, not on dictating compliance through any disciplinary measures, but rather to encourage compliance through accountability for progress.

The next sections draw together theory and current practices for implementing and sustaining lean and other CI methodologies.

### **1.7 Implementing lean**

Liker (2004) spent over 20 years studying Toyota and he states that there is no 'one way' to do any of the lean processes. He mentions that the one reality of the 'Toyota Way' is that there is always more than one way to achieve the desired result. After 30 years of studying Toyota and practicing lean, Koenigsaecker (2009) defines lean as 'whatever Toyota does'. Liker (2004) and Koenigsaecker (2009) agree that the important thing is to learn, to think about what you have learned and to apply it, and to reflect on the process and continuously improve to strengthen your organisation in the long-term i.e. embed a new organisational culture. In fact a company is never 'Lean', since there is no end to CI and related learning (Koenigsaecker 2009). Toyota's culture can be summarized through the two pillars that support it: '*Continuous Improvement*' and '*Respect for People*' (Emiliani 1998). CI, often called *Kaizen*, defines Toyota's basic approach to doing business. The CI principle embodies the tools and methods used to improve productivity. The '*Respect for People*' principle embodies leadership behaviours and business practices that must be consistent with efforts to eliminate waste and create value for end-use customers.

More important than the actual improvements that individuals contribute, the true value of CI is in creating an atmosphere of continuous learning and an environment that not only accepts, but embraces change (Liker 2004). Such an environment can only be created where there is respect for people.

When Toyota talks about respect for people, the phrase encompasses many things, including designing a system that motivates people to want to improve, teaches them the tools of improvement, and encourages them to apply those tools every day. So at one level, all that Toyota does, is simply continuous improvement through people. Hence lean can be regarded as a people-driven improvement system that can improve any work process with the ultimate goal of building a learning culture that solves customer problems forever (Koenigsaecker 2009). Many of the leading scholars of lean (Emiliani 1998b; Hines and Taylor 2000; Liker 2004; Shingoprize 2008; Womack and Jones 1996) state that it takes three to five years to embed a true lean culture.

Several lean implementation models have been developed by lean scholars and consultants to guide organisations through lean transformations. Five such implementation approaches are discussed next.

### **1.7.1 The 20 Keys**

Japanese consultant Iwao Kobayashi developed the 20 Keys (Table 1) concept as a simple improvement method with concrete and systematic steps for drastically reforming and strengthening every facet of the manufacturing organisation. The 20 Keys lead companies on a course of CI to help improve their productivity. The 20 Keys is a way for organisation's to look at the health of their manufacturing operations and to systematically upgrade it level by level, through 20 different but interrelated aspects all of which are addressed at once. The best way to implement 20 Keys differs from one organisation to another so the consultants and implementers must provide guidance tailored to each organisation. Depending on the particular conditions and characteristics, companies may give priority to certain keys over others, and the order in which the keys are implemented differ. Although the combinations of priorities and implementation sequences are almost limitless, the proper combination becomes apparent as one better understands the 20 Keys. The 20 Keys are closely interrelated, making progress in one key automatically tie in the

progress in the other 19. Each key is divided into five levels and has some criteria to rise from one level to the next. Kobayashi (1995) states that full commitment is needed from all levels of the organisation for successful implementation of the 20 Keys. He mentions that the 20 Keys needs to be implemented as a three year programme aligned to a long-term organisation strategy. Each year of the programme needs to look at implementing seven to eight keys to embed a CI culture in three years.

Table 1: The 20 Keys (Kobayashi 1995).

Key 1: Cleaning and organizing	Key 11: Quality assurance system
Key 2: Rationalizing the system	Key 12: Developing your suppliers
Key 3: Improvement team activities	Key 13: Eliminating waste
Key 4: Reduce inventory	Key 14: Empowering workers to make improvements
Key 5: Quick changeover technology	Key 15: Cross training
Key 6: Method improvement	Key 16: Production scheduling
Key 7: Zero monitor manufacturing	Key 17: Efficiency control
Key 8: Coupled manufacturing	Key 18: Using information systems
Key 9: Maintaining equipment	Key 19: Conserving energy and materials
Key 10: Time control and commitment	Key 20: Leading technology

### 1.7.2 Lean Action Plan

Womack and Jones (1996) recommend a specific sequence of steps and initiatives from getting started to completing the lean transformation. They argue that a full lean transformation takes about five years of commitment. Their lean implementation steps and initiatives are listed in Table 2.

Table 2: Framework for implementing lean (Womack and Jones 1996)

<b>Phase</b>	<b>Specific Steps</b>	<b>Time Frame</b>
<b>Get Started</b>	Find a change agent Get lean knowledge Find a lever Map value streams Begin radical improvements activities to eliminate waste Expand your scope	First six months
<b>Create a new organisation</b>	Re-organise by product family Create a lean function Devise a policy for excess people Devise a growth strategy Remove anchor-draggers Instill a 'perfection' mind-set	Six months through year two
<b>Install business systems</b>	Introduce lean accounting Relate pay to firm performance Implement transparency Initiate policy deployment Introduce lean learning Find right-sized tools	Years three and four
<b>Complete the transformation</b>	Apply these steps to your customers/suppliers Develop a global strategy Transition from top-down to bottom-up improvement	By end of year five

### 1.7.3 Going Lean

Hines and Taylor (2000) have developed a step-by-step guide (Figure 2) to 'going lean'. They state that in order to go lean, organisations need to firstly understand their customers and what they value. To get focused on these needs an organisation must define the value streams inside the company (all the activities which are needed to provide a particular product or service) and, later, the value streams in their wider supply chain as well. To satisfy customers they will need to eliminate or at least reduce the wasteful activities in their value streams that their customers would not wish to pay for. Next organisations have to find a way of setting the direction, fixing targets and seeing whether or not change is actually occurring.

## How to go lean

	1	2	3	4	5
<b>Objective</b> →	Understand customers and what they value	Define the internal value stream	Eliminate waste, make information & products flow, pulled by customer needs	Extend the definition of value outside your own company	Continually aim for perfection
	↓	↓	↓	↓	↓
<b>Method</b> →	Setting the direction, targets and checking results	An internal framework for delivering value	Appropriate methods to make necessary change	Externalise the value focus to the whole value stream	Strive for perfection in the product and in all processes and systems

Figure 2: Step-by-step guide to implementing lean (Hines and Taylor 2000)

### 1.7.4 Toyota Production System House

The TPS house (Figure 3) was developed by Fujio Cho, a disciple of Taiichi Ohno, as a tool to help implement the Toyota Production System across the various Toyota plants and suppliers. There are different versions of the house, but the core principles remain the same (Liker 2004). It starts with the goals of best quality, lowest cost, and shortest lead time – the roof. There are then the two outer pillars – just-in-time and *jidoka*<sup>1</sup>. In the centre of the system are people. People are at the centre of the house because only through CI can the operation ever attain stability. People must be trained to see the waste and solve problems at the root cause by repeatedly asking why the problem really occurs. Finally there are various foundational elements, which include the need for standardised, stable, reliable processes, and also *heijunka*, which means levelling out the production schedule in both volume and variety.

<sup>1</sup> Means never letting a defect pass into the next station and freeing people from machines – automation with a human touch.

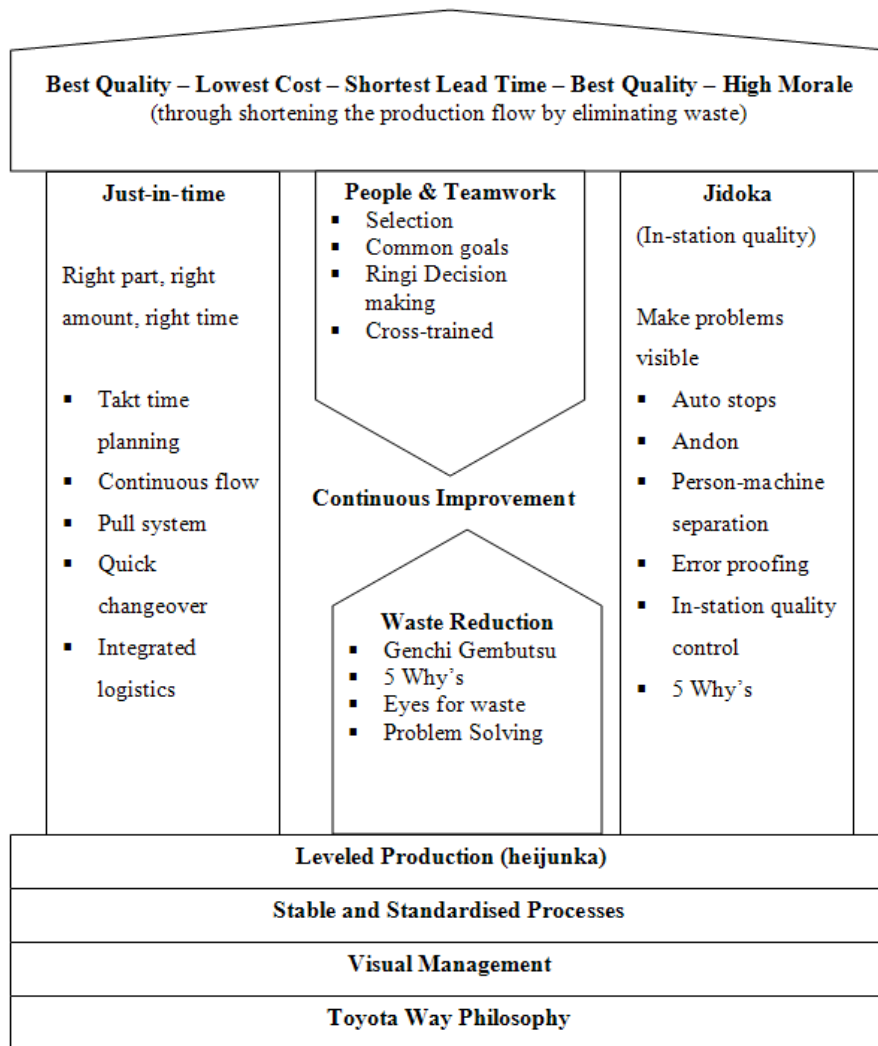


Figure 3: The TPS House (Liker 2004)

### 1.7.5 Shingo Prize Model

The Shingo Prize Model is based on the lean management approach and model taught by Shigeo Shingo. The mission of The Shingo Prize is to build operational excellence in organisations through the promotion of enduring principles of lean, lean systems of management and the wise application of lean tools and techniques across the entire organisational enterprise. The model describes three levels of business improvement - principles, systems, and tools and techniques. Shingo advocates that true innovation is not achieved by superficial imitation or the isolated or random use of tools and techniques and systems but instead requires an understanding of underlying principles (Shingoprize 2008).



The model is composed of the following four dimensions:

- *Dimension 1 - Cultural Enablers*
  - Leadership and Ethics
  - People Development
  - Empowerment and Involvement
  - Environmental and Safety Systems
- *Dimension 2 - Continuous Process Improvement*
  - Lean Principles
  - Value Streams and Support Processes
- *Dimension 3 - Consistent Lean Enterprise Thinking*
  - Enterprise Thinking
  - Policy Deployment
- *Dimension 4 - Business Results*
  - People Development
  - Quality
  - Delivery
  - Cost
  - Financial Impact
  - Competitive Impact

Organisations have to adapt and move through the levels of transformation within each dimension. These dimensions overlay the five business processes of Product/Service Development, Customer Relations, Operations, Supply, and Management, which cover all activities that take place within an organisation (Shingoprize 2008).

#### **1.7.6 Common themes underlying the implementation models**

Although the implementation approaches vary slightly from each other the models discussed above clearly state that lean should be approached as a holistic organisation wide methodology for embedding a culture of CI and not merely as a set of tools. The models advocate embedding a culture focused on identifying and meeting customer

demands through CI. The importance of having an organisational change strategy and full commitment to change is also emphasised within the models.

### **1.8 Sustaining lean conversions**

This section looks at the experiences overseas and NZ companies have had with sustaining lean and TQM initiatives over the last decade. Similarly to lean, TQM has been widely used by organisations as a CI initiative in recent years. TQM is a management paradigm based on the principles of total customer satisfaction, CI, employee involvement and management leadership (Venkateswarlu and Nilakant 2005). Both TQM and lean have evolved into comprehensive management systems and both systems have many overlapping features such as an emphasis on customer satisfaction, high quality, comprehensive employee training, empowerment, management commitment, communications, etc (Shin 2009).

Sustaining the gains from lean transformations has become a challenge for many companies that have started the journey (Woods and Robert 2008). Companies generally experience good initial gains to productivity, quality, staff morale, etc, but the majority fail to sustain these improvements in the long-term (Shin *et al* 1998). Emiliani (2005) states that while thousands of companies worldwide have been engaged in lean transformations for five to ten years or more, most achieve only modest levels of improvements. Hines *et al.* (2006) also express concern about the sustainability of lean in organisations where improvements in productivity are followed by a steady decline to baseline, and sometimes even below baseline levels. In a relatively short time span strategies and processes are abandoned and shop floor employees regress to previous methods of working.

It has been suggested that at least 50% of improvement programmes are deemed by firms to be failures over the longer term and up to 70% fail to achieve all of their intended benefits (Found *et al.* 2006). Venkateswarlu and Nilakant (2005) mention that 75% of American and British firms have introduced some form of improvement initiatives and two out of three of these programmes simply grind to a halt. Their study of five organisations attempting TQM in NZ since the early 1990's showed that only two out of the five organisations had persisted with their initiatives. Redman and Grieves (1999) and Shin *et al.* (1998) quote failure rates between 60-90% for TQM

initiatives. Soltani *et al.* (2005) mention that only 20% of British companies surveyed believe their TQM programme had achieved tangible results. Bhasin *et al.* (2006) state that only 10% of lean implementations are successful. A recent survey by the Lean Enterprise Institute on 999 respondents reported that only 4% characterised their progress as 'advanced' while 46% characterised their lean implementation efforts as 'early'. The survey found that most companies have great difficulty implementing and sustaining lean principles and practices.

The next section looks at common reasons for failure to sustain CI transformations.

### **1.8.1 Common reasons for CI transformation failures**

It is generally accepted that when improvement initiatives such as lean and TQM fail, it is not because there was a basic flaw in the principles of lean or TQM, but because an effective system was not created to execute these principles properly (Shin *et al.* 1998). Improvement initiatives require strong organisational commitment, substantial time and effort, and major changes in the organisational culture and business practices (Sohal 1999). It is important for companies to clearly understand what it takes to succeed and achieve high performance. The following factors are the most commonly published reasons for implementation failures:

- *Lack of SMT commitment*: SMT exhibit wasteful behaviours while trying to eliminate waste and they do not directly participate in improvement activities (Emiliani and Stec 2005; Sim and Rogers 2009; Soltani *et al.* 2005; Venkateswarlu and Nilakant 2005).
- *High turnover of senior managers*: CI efforts will be broken and disjointed with new leaders. Changes in leadership frequently lead to a change in management philosophy (Emiliani and Stec 2005; Redman and Grieves 1999; Venkateswarlu and Nilakant 2005; Woods and Robert 2008).
- *Poor communication between the senior managers and the shop-floor staff* (Dale 1997; Kallage 2006; Sim and Rogers 2009; Witcher 2002).
- *Poor leadership*: this has often been found to be the reason for poor sustainability of change initiatives with many organisations possessing good managers but not necessarily good leaders (Hines *et al.* 2006).

- *Staff resistant to change or lack of staff buy-in due to fear of job losses:* people are generally hesitant to change what they have been doing for many years. Countless managers view change initiatives as a way to reduce labour costs, typically through layoffs which contributes to staff resistance (Emiliani and Stec 2005; Kallage 2006; Redman and Grieves 1999; Sim and Rogers 2009).
- *Compulsions to change:* successful transformations depend on external or internal factors. In the absence of an external ‘pull’ factor or crisis e.g. financial crisis or downturn, a strong internal ‘push’ factor in the form of a champion is necessary (Barker 1998; Emiliani and Stec 2005; Kallage 2006; Venkateswarlu and Nilakant 2005).
- *Experience and fit of champion:* having a champion with appropriate background, knowledge and experience increases the chances of mistake free implementation (Lasa *et al.* 2008; Shohal 1999; Venkateswarlu and Nilakant 2005).
- *Little or no focus or awareness of customer values* (Dale 1997; Emiliani and Stec 2005; Shin *et al.* 1998) .
- *Lack of clear understanding of key principles leads to a piece-meal implementation:* organisations do not understand lean as a comprehensive management system that will remove waste in every business process rather than just operations (Bhasin and Burcher 2006; Emiliani and Stec 2005; Kallage 2006; Shin *et al.* 1998; Worley and Doolen 2006).
- *Employees are poorly trained to undertake improvement initiatives* (Dale 1997; Emiliani and Stec 2005; Kallage 2006; Sim and Rogers 2009).
- *Poor strategy development and deployment:* improvement initiatives should be clearly aligned to company’s strategic priorities, competitive environment and goals (Emiliani and Stec 2005; Kallage 2006; Shin *et al.* 1998).
- *Short-term focus:* successful transformations require management to focus on the long-term without losing sight of important short-term goals (Bhasin and Burcher 2006; Dale 1997; Emiliani and Stec 2005; Redman and Grieves 1999; Sohal 1999).

- *Existence of a blame-culture*: where everyone blames the system, other teams, management, etc, for productivity short comings (Barker 1998; Emiliani and Stec 2005)
- *Failure to embed a CI culture*: organisations need to transform their culture and become consistent with lean or TQM principles (Bhasin and Burcher 2006; Kallage 2006; Shin *et al.* 1998; Sohal 1999).

## **1.9 Theoretical sustainability models**

There has been significant work done in the last five years in sustaining CI initiatives. Several models and frameworks have been developed to guide companies in achieving sustainability. Five of the key publications in the area of CI sustainability are discussed next and summarised by timeline in Table 3. Four of these models focus on lean manufacturing with the fifth focusing on process improvements initiatives. Process improvement activities have generally been conducted using process improvement techniques pioneered by Japanese automobile manufacturers, i.e. lean manufacturing (Found *et al.* 2006).

### **1.9.1 The 4P Model**

Liker (2004) recommends that an organisation adopt the entire 4P (Figure 4) model, which encompasses the 14 key principles of the TPS to make them sustainable. The 4Ps are: Philosophy (long-term thinking), Process (eliminate waste), People and Partners (respect, challenge and grow them) and Problem Solving (continuous improvement and learning). He mentions that most companies are dabbling at just the ‘Process’ level and without adopting the other 3Ps they will achieve little because the improvements will not be sustainable throughout the company.

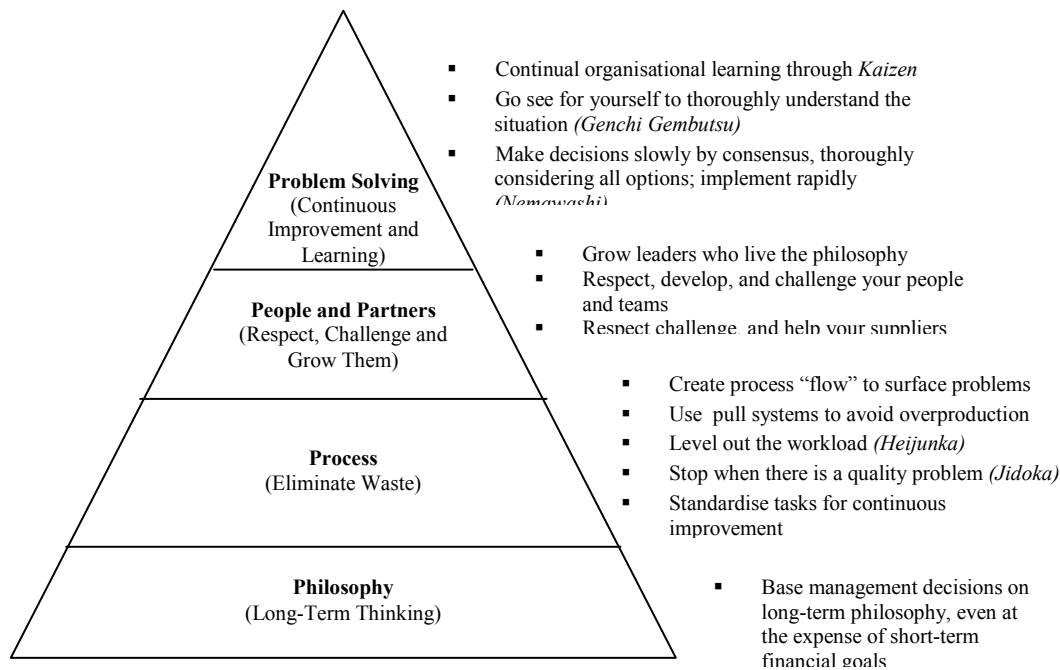


Figure 4: The 4P model (Liker 2004)

### 1.9.2 Lean Management System

Mann (2005) believes that a Lean Management System (LMS) is a crucial ingredient for sustaining a lean conversion and creating a lean culture. A LMS sustains and extends the gains from implementing lean production, and lean cultures grow from a robust LMS. The LMS consists of four principal elements all of which have to be present for the system to work. Lean management and lean production are interdependent, one does not stand long without the other (Mann 2005). The four key elements of the LMS are shown below:

- *Leader standard work*: involves having daily checklists for line production leaders (team leaders, supervisors, and value stream managers) that state explicit expectations for what it means to focus on the process.
- *Visual controls*: requires having tracking charts and other visual tools that reflect actual performance compared with expected performance of virtually any process in a lean operation, production and non-production alike.

- *Daily accountability process*: brief, structured, tiered meeting focused on performance with visual action assignments and follow-up to close gaps between actual results vs. expected performance.
- *Discipline*: leaders themselves consistently following and following up on others, adherence to the processes that define the first three elements.

### **1.9.3 Theoretical Framework**

Found, Beale *et al.* (2006) present a theoretical framework (Appendix 1) made up of a structured approach comprising ten distinct steps to enable a successful and sustainable business process improvement. They suggest that successful and sustainable business process improvements cannot be piecemeal as it involves appropriate technology, people management and process routes, all of which must be aligned to the strategy and objectives of change. Skills and capabilities, in human, technological and process resources, have to be developed, managed and maintained. The change process requires the involvement of the whole organisation, it cannot be simply top-down or bottom-up but involves commitment and buy-in from all levels if it is to succeed and sustain in the long term (Found *et al.* 2006).

### **1.9.4 House of Sustainability**

Hines *et al.* (2006) recommend a five lens approach for sustaining lean attending to people, technology, processes, leadership and strategy and alignment. The five lens 'house of sustainability' (Figure 5) considers the linkages between the five elements and can be applied at a series of intervention levels; including individual, team, shop-floor, company and supply chain. It is only through employing each of the lenses that a truly sustainable business will be created.

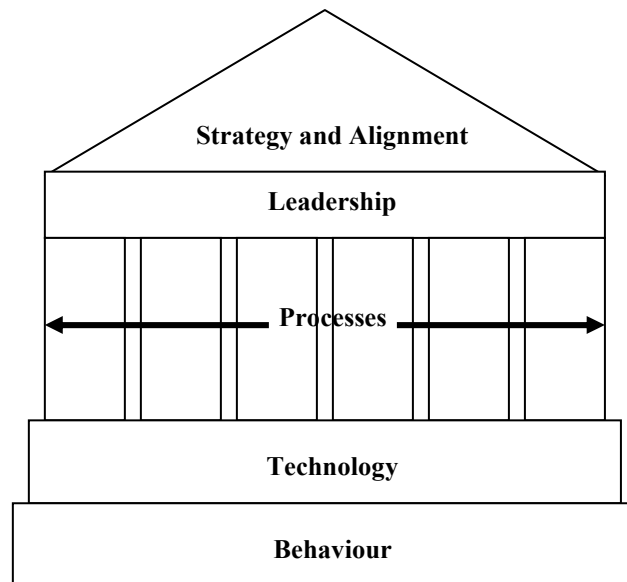


Figure 5: House of Sustainability (Hines *et al.* 2006)

### 1.9.5 The Sustainable Lean Iceberg Model

Hines *et al.* (2008) have extended their ‘House of Sustainability’ into a broader model called ‘The Sustainable Lean Iceberg Model’ (Figure 6). The Iceberg Model was developed as part of the SUCCESS (Sustainable Channeled Change in Every Scale and Situation) research programme which ran from 2004 to 2008. The SUCCESS programme was designed to extend the focus of lean away from implementation to sustaining it over the medium to long-term. Hines *et al.* (2008) argue that applying lean is best explained by an analogy with an iceberg. They mention that it is generally not what you see (above the waterline) but what you do not see (below the waterline) that is more important to sustaining lean. A sustainable lean thinker needs to learn to see and act below the waterline as well as above it. Establishing a sustainable lean organisation involves addressing the five elements (strategy and alignment, leadership, behaviour and engagement, process management and tools, technologies and techniques) of the lean sustainability iceberg at all levels of the organisation, not just on the shop floor (Hines *et al.* 2008).



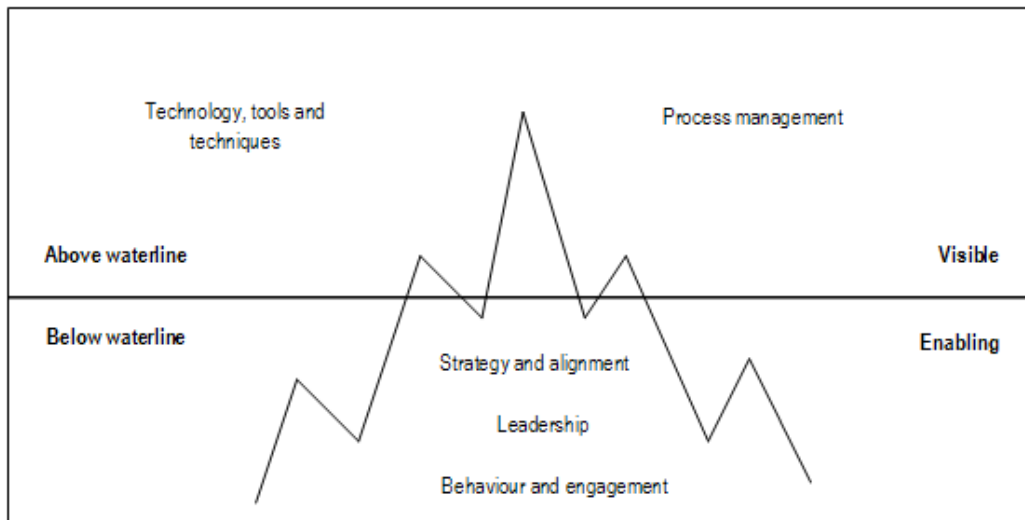


Figure 6: The Sustainable Lean Iceberg Model (Hines *et al.* 2008)

### 1.9.6 Comparing and contrasting the sustainability models

The models discussed in this section have been analysed in Table 3 to determine the commonalities and dissimilarities between them. A comparison of these models shows that there are numerous commonalities between the models. Three (House of Sustainability, Theoretical Framework and Iceberg Model) of the five models have been developed by the same set of researchers. This is because bulk of the current research in the area of lean sustainability has been undertaken by these researchers. The principles discussed in each model were grouped under the five categories of management, culture, tools and technologies, strategy and business process as shown in Table 3. These five categories appeared to be the common dimensions covered in the models. Breaking the models down into these five categories helped pinpoint the key themes within each model and made it easier to compare and contrast the commonalities and differences between them. The models were also listed chronologically to determine if there were any major changes occurring with time.

The analysis showed that the categories covered in the five models were quite similar however the depth of coverage within each of the categories was generally greater with later models. All models cover management, strategy, culture and business processes. Besides Mann (2005) all models also discuss process improvement tools and technologies. Mann's (2005) lack of focus on improvement tools is the only gap between these models. Overall the five models proved to be quite similar in their recommendations and the gap that existed between them was considered minor and

therefore not investigated further. A closer inspection of the themes within each model revealed that the Iceberg Model had the most expansive coverage of the five common themes. The Iceberg Model takes in and expands on earlier research in the area of lean sustainability including the 4P, Theoretical Framework and House of Sustainability models. Although the Iceberg Model introduces the new concepts of below and above the waterline aspects of lean, the five themes discussed in this model are not new. All models elaborate the importance of simultaneously focusing on both '*above the waterline*' and '*below the waterline*' aspects to sustain lean.

Table 3: Analysis of the five sustainability models

<b>Categories</b>	<b>4P model (Liker 2004)</b>	<b>Lean Management System (Mann 2005)</b>	<b>House of Sustainability (Hines at el 2006)</b>	<b>Theoretical Framework (Found 2006)</b>	<b>Iceberg Model (Hines at el 2008)</b>
<b>Management</b>	People and Partners	Leader standard work	Leadership	Make choices regarding process, technology options. Make choices regarding HR policies, employee structure, incentive schemes etc. Embed Future Knowledge transfer and training	Leadership
<b>Strategy</b>	Philosophy	Daily accountability process	Strategy & Alignment	Recognize the need for change Understand the customer requirements and develop strategy for change Clearly communicate the need and strategy for change	Strategy & Alignment
<b>Culture</b>	Problem Solving People and Partners	Discipline	Behaviour	Monitor employee perceptions and understanding Understand current culture and employee behaviours	Behaviour and Engagement
<b>Business Processes</b>	Process	Visual controls	Processes	Understand current process capability and identify waste Develop a model of current organisational climate and capability. Match to customer requirement Develop Future State	Process Management
<b>Tools &amp; Technologies</b>	Process		Technology	Remove the waste from in current system to create early wins and visible results that increases motivation and involvement	Technology, tools and techniques

## **1.11 Benchmarking for continuous improvement**

This section looks at three widely used benchmarking models. The benchmarking models were considered in this review as they have been extensively used across the globe as an alternative to methodologies such as lean and TQM to embed CI cultures. Benchmarking models use periodic auditing to embed CI cultures whereas methodologies such as lean and TQM focus on culture change through ongoing learning. The benchmarking models encourage organisations to benchmark their current status of operation and form a strategy for improvement. Organisations repeat the benchmarking process after a fixed length of time to measure progress and form fresh strategies for further improvements. This process of repeatedly benchmarking and forming strategies for improvements is aimed at embedding a culture of CI. This section compares and contrasts the Deming Prize, the Malcolm Baldrige National Award (MBNA), and the European Quality Award (EQA).

### **1.11.1 European Quality Award**

The European Foundation for Quality Management (EFQM) was founded by 14 of the leading Western European businesses in 1988 when many of the major companies in Europe had realized that their only way of surviving in business was to pay much greater attention to quality (Tummala and Tang 1996). The EFQM established the EQA) in 1992, mainly to accelerate the acceptance of quality as a strategy for global competitive advantage, to stimulate and assess the development of quality improvement activities, and to recognize the companies in Western Europe that demonstrate excellence in the management of quality as their fundamental process for CI (Bohoris 1995). The assessment criterion has nine categories that are divided into two groups - the results and the enablers.

- *Enablers*: leadership, policy and strategy, people (employee) management, resources, processes.
- *Results*: customer satisfaction, people (employee) satisfaction, impact on society, business results.

The award assesses how the customer and people satisfaction, impact on society, and business results are being achieved through leadership, people management, policy and strategy, resources and processes.

### **1.11.2 The Malcolm Baldrige National Quality Award**

The MBNQA was established in 1987 as a standard of excellence that would help US organisations achieve world-class quality. The award promotes three important characteristics, namely, awareness of quality to increase competitiveness, understanding the requirements for excellence in quality, and sharing the information and benefits derived from successful quality strategies that are employed by the companies (Tummala and Tang 1996). Seven categories of criteria are included in evaluating the company's overall strategic and operational strategies employed in implementing quality improvement efforts. These are:

- Leadership
- Information and analysis
- Strategic quality planning
- Human resource development and management
- Management of process quality
- Quality and operational results
- Customer focus and satisfaction

### **1.11.3 The Deming Prize**

The Deming Prize was established by the board of directors of the Japanese Union of Scientists and Engineers (JUSE) in 1951. The primary purpose of the Deming Prize is to find out how well a company achieves quality improvement, productivity improvement, cost reduction, expanded sales, increased profits, etc, from the implementation of total quality control based on statistical quality control techniques. The Deming Prize is based mainly on the process rather than the business results.

The Deming Prize has a checklist containing ten primary factors. The primary factors are further divided into a minimum of four and a maximum of 11 secondary factors.

The primary factors are:

- Policies
- The organisation and its operations
- Education and dissemination
- Information gathering, communication and its utilization
- Analysis
- Standardization

- Control
- Quality assurance
- Effects
- Future plans

#### **1.11.4 Comparing and contrasting the benchmarking models**

The models discussed in this section have been analysed in Table 4 to determine the commonalities and dissimilarities between them. These models were also compared and contrasted with the sustainability models to see how well they align. The principles discussed in each model were grouped under the same five categories of management, culture, tools and technologies, strategy and business processes as the sustainability models. Breaking the models down into these five categories helped pinpoint the key themes within each model and made it easier to compare and contrast the commonalities and differences between them.

Table 4 shows that there are many commonalities and some dissimilarity between the models. These are as follows:

- All models cover the strategy and business process themes.
- All models focus on business results and effects.
- The Deming Prize does not cover the leadership and culture themes.
- The MBNQA does not discuss tools & technology.

Overall, the three models proved to be quite similar in their recommendations. The gap that existed between them was considered minor and was not investigated further. Although there are some variations between the models the overall aim of these models is to embed a culture of CI through benchmarking.

Table 4: Analysis of the benchmarking models

<b>Categories</b>	<b>EQA</b>	<b>MBNQA</b>	<b>Deming Prize</b>
<b>Management</b>	Leadership	Leadership	
<b>Strategy</b>	Policy & Strategy	Strategic Planning	Policies Education & Dissemination Future plans
<b>Culture</b>	People Management People Satisfaction Impact on Society	Workforce Focus	
<b>Business Processes</b>	Processes Customer Satisfaction	Customer & Market Focus Measurement, Analysis, and Knowledge Management Process Management	Quality Assurance Analysis Information The organisation and its operations
<b>Tools &amp; technologies</b>	Resources		Control Standardisation
<b>Other</b>	Business Results	Results	Effects

### 1.12 Selecting a model for developing the research framework

The cross-analysis of the five sustainability models showed that the area of lean sustainability is relatively new with the first major work on this subject being published in 2004. Although the models have been developed for different purposes and over varying timeframes there are many overlaps between them. Based on the recommendations of each model it can be generalised that over time the understanding of what an organisation needs to do to be sustainable has increased. A

comparison of the sustainability and benchmarking models shows that the primary focus of both approaches is on nurturing a culture of CI. The models prescribe that for organisations to sustain CI, they need to focus on the key themes of strategy and alignment, behaviour and engagement, leadership, business processes and tools.

A closer look at the sustainability models reveals that the scope of each of these five key themes has been expanded with each new model with the Iceberg Model providing the most comprehensive guide to achieving sustainability. A cross examination of the sustainability and benchmarking models covered in this review shows that the Iceberg Model once again has the most expansive coverage of the five sustainability themes and it covers most of the recommendations of the other models. In addition, the Iceberg Model focuses exclusively on lean and is the latest body of work on sustaining lean. Based on its comprehensibility, exclusive focus on lean and its recent publication the Iceberg Model was deemed as being the most suitable for developing the framework to study the experiences of NZ companies in sustaining their lean manufacturing initiatives. The recommendations of the Iceberg Model will be expanded further in the following section.

### **1.13 The Iceberg Model – five key themes**

This section presents a summary of the five key themes from the Iceberg Model. In addition to the themes discussed in the Iceberg Model, this section also looks at other recently published work in the areas of leadership, behaviour and engagement, strategy and alignment, process management and tools, technologies and techniques. For example, in addition to lean leadership recommendations from the Iceberg Model recent work in the area of good leadership was also investigated. Recommendations on what companies should be doing in each of these five areas are presented below.

#### **1.13.1 Leadership**

Buckler (1996) states that success with embedding a CI culture will depend on management's ability to create a learning environment where individual, team, and thereby organisational learning is facilitated. The leaders need to have a clear and deep understanding of organisational culture and be engaged with capability requirements to change their organisational culture. Emiliani (2000) argues that it is essential that managers understand the learning process and know how to facilitate its



application throughout their areas of responsibility to cope with and sustain change. Managers lacking common or standard approaches will likely invoke traditional methods, perhaps slightly improved, that are known to be capable of delivering quick results and thus avoid personal risk.

Emiliani (2003) states that conventional management practices perpetuate single-loop<sup>2</sup> learning whereas the beliefs, behaviours and competencies of leaders skilled in the lean management system lead to an organisation where people can engage in double-loop<sup>3</sup> learning to create an environment where change is the norm. Lean leaders strive to eliminate not only waste (*muda*) but also unevenness (*muri*) and unreasonableness (*mura*) in both leadership behaviours and business process (Emiliani 2003). Good leaders develop cross-functional teams that understand the vision and accept their roles in the implementation strategy (Emiliani 2003; Hines *et al.* 2006). Leaders must create an organisation that is moving together towards a common goal (Achanga *et al.* 2006). Hines *et al.* (2006) identify 5 levels of leadership, with the highest level leading to the most sustainable and effective business. ‘Level 5’ leaders channel their ego away from themselves and into the larger goal of building a great company. Good leaders usually have a deep knowledge of CI processes and will often go to the *gemba*<sup>4</sup> and participate in *Kaizen* activities.

Good leaders are usually characterised as having a guiding vision, passion and integrity (Emiliani 2003). Leadership is about establishing direction, developing a vision of the future and setting strategies for making the changes needed to achieve that vision. When leading change they must have high energy levels, be innovative, focus on people, inspire trust, have a long range perspective and challenge the status-quo. The role of the leader is to inspire with words, deeds and actions which involves allowing everyone in the organisation to take part in the strategy, business process and

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2 Single –loop learning: This occurs when errors are detected and corrected and firms carry on with their present policies and goals. Single-loop learning can be equated to activities that add to the knowledge-base or firm-specific competences or routines without altering the fundamental nature of the organisation's activities.

3 Double-loop learning: his occurs when, in addition to detection and correction of errors, the organization is involved in the questioning and modification of existing norms, procedures, policies, and objectives. Double-loop learning involves changing the organization's knowledge-base or firm-specific competences or routines

<sup>4</sup> *Gemba* – the place where value is added

encouraging everyone to get involved in delivering the actual change and reducing fire fighting and non-value adding work (Hines *et al.* 2006). Achanga *et al.* (2006) suggests that leaders need to create interest in the implementation and communicate the change to everyone within the organisation. They state that leaders must provide employees detailed information on the lean manufacturing initiative and why it is needed. Leaders must provide employees with resources such as time and materials to allow the employees to successfully participate in the lean manufacturing effort.

Kennedy's (2008) study on leadership and culture in NZ shows that New Zealander's in general place a comparatively low emphasis on future-oriented behaviours such as planning, investing in the future and delaying gratification. He mentions that in an organisational context NZ managers showed an excessive focus on short-term goals and he advocates that these managers take a longer-term strategic view in order to achieve sustainable adaptation. A summary of the core principles of leadership as prescribed by the Iceberg Model is presented in Table 5. The summary has been extended to include some of the key recommendations of other recent work in this area.

Table 5: Summary of sustainable leadership attributes

Key Theme	Keys Lessons for Staying Lean	Key Skills	Key Tools / Techniques
<b>Leadership</b>	<ul style="list-style-type: none"> <li>▪ Strong decisive leadership with lean experience is needed in the early phase of the programme.</li> <li>▪ Leaders must be prepared to review themselves and the process critically in order to push the business forward.</li> <li>▪ Continually develop lean leaders at all levels, on all shifts and within all areas of the business and adopt a 'leading the lean lifestyle' programme.</li> <li>▪ Leaders' role is to set the direction and develop a vision for the future and inspire and align people to achieve this vision through continuous improvements.</li> <li>▪ Leaders are responsible for developing people by constantly moving them out of their comfort zones and stretching them a little.</li> <li>▪ Leaders create dedicated and fully resourced lean implementation team that understands the vision and accepts their roles in the implementation of the strategy</li> <li>▪ Leaders must strive to eliminate waste in all business processes.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Good communicator.</li> <li>▪ Has a long-term perspective.</li> <li>▪ Respects employees.</li> <li>▪ Inspires change.</li> <li>▪ Trusting and trustworthy.</li> <li>▪ Able to monitor and evaluate outcome.</li> <li>▪ 'Flow' thinker.</li> <li>▪ Creates a learning environment.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Lean leaders programme</li> <li>▪ 'Level 5' leader</li> <li>▪ <i>Gemba</i></li> </ul>

### 1.13.2 Strategy and alignment

Emiliani (1998a) states that the early process-oriented mass production methods have resulted in corporate cultures where eventually the voice of the customer and other stakeholders is no longer being heard. Cobb *et al.* (1998) advocates that change efforts need to focus on increasing alignment with customers and alignment of employees with the organisational strategy. The strategy fundamentals should provide consistency of purpose throughout the whole organisation and these fundamentals should serve as a corporate charter that gets all the units of the organisation going in the same direction and at the same speed (Sussland 2003). Hines *et al.* (2008) study revealed that many businesses fail to establish a coherent strategy, vision and purpose and that less than 5% of people were directly contributing to effective change.)

The following recommendations are made by Hines *et al.* (2008):

- The strategy needs to describe what the organisational aim is and why this is important.
- The strategy should guide the employees to focus their change activity.
- All the people in the organisation need to clearly articulate what the organisational strategy is and be able to demonstrate what they are doing themselves in their normal job to help organisation achieve this strategy.
- The company's strategy should be fully communicated and deployed throughout the organisation.

The process of strategy deployment should be based on *hoshin kanri*, a methodology originally developed by the Japanese (Kondo 1998). Strategy deployment provides a systematic and detailed approach that deploys the strategies all the way down into specific action plans. The process of strategic deployment goes top-down (ownership of strategy is passed down through the managerial levels) and bottom-up (at each managerial level, the appointed owner of a strategy enlists the co-operation of his colleagues from other functions or units in order to carry out the strategies) (Sussland 2003). In *hoshin kanri*, annual policies are decided after top management's policy proposals have been reviewed and revised by large numbers of middle managers. The discussion process that takes place before policy is finally decided is known as 'catch-ball', since the policy 'ball' is thrown back and forth between top and middle managers before a final decision is made (Kondo 1998). The aim of this process of

‘catch-ball’ is to convert mandatory objectives set by senior management into employees’ own self-set targets. Kondo (1998) discovered that hoshin kanri proved extremely effective in furthering companywide improvement plans by uniting the efforts of all employees and motivating them.

A summary of the core principles of strategy and alignment as prescribed by the Iceberg Model is presented in Table 6. The summary has been extended to include some of the key recommendations of other recent work in this area.

Table 6: Summary of sustainable strategy and alignment attributes.

Key Theme	Keys Lessons for Staying Lean	Key Tools / Techniques
<b>Strategy and alignment</b>	<ul style="list-style-type: none"> <li>▪ Take time to define clear and stretching critical success factors and build in a plan-do-check-act (PDCA) cycle to improve the deployment process.</li> <li>▪ Use Visual Management Systems (e.g. A3s) at all levels of the organisation to deploy and sustain the management process. A3s become the focus of regular review meetings to monitor progress and take corrective action.</li> <li>▪ Work to build up the capability of individuals and teams to self-manage the business cockpits at all levels.</li> <li>▪ Deploy words and numbers to ensure full ‘line of sight’ is achieved, so that people know the business plans and their contribution to making them happen. All employees should be engaged from the outset.</li> <li>▪ Use key performance indicators (KPIs) to monitor improvement performance. KPIs should be measured and monitored regularly.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Policy deployment (<i>Hoshin Kanri</i>)</li> <li>▪ Catchball</li> <li>▪ PDCA</li> <li>▪ Visual Management (A3 planning and storyboards)</li> <li>▪ KPIs</li> <li>▪ Rewards system</li> </ul>

### 1.13.3 Behaviour and engagement

Emiliani (1998) argues that success with lean manufacturing can be limited unless it is recognized that the behaviour of employees must change concurrently with changes in business processes. Emiliani (2000) refers to the ‘*respect for people*’ pillar as instilling lean behaviours in people. He states that lean behaviours together with lean manufacturing gives greater chance for long-term sustainability. Emiliani (2000) goes on to state that the leaders of companies seeking to implement the lean production and lean behaviours solution must be mindful of the challenges that they are subscribing to because it requires dedicated unlearning of embedded mindsets and habits. Like lean manufacturing, it is a five to ten year challenge for a well-established organisation to develop even the most fundamental capabilities for sustained practice of lean behaviours.

One of the critical factors that may determine the success of a lean project is the organisational culture, as the creation of a supportive organisational culture is an essential platform for the implementation of lean manufacturing (Achanga *et al.* 2006). Bessant and Francis (1999) argue that the evolution of continuous improvement is an evolutionary learning process, with a gradual accumulation and integration of key behaviours over time. An important feature of any CI system is the feedback of some form of recognition to motivate the employee and to reinforce the behaviour that the organisation is trying to embed (Bessant and Francis 1999).

Dahlgaard and Dahlgaard-Park (2006) state that employees must be given both the freedom to plan and to decide, and the capability to take over this responsibility. To have success with lean manufacturing also requires a company culture where everybody is proactively working in reducing waste and in helping each partner. A lean organisation must have the ability to learn from its mistakes. The ability of an organisation to learn requires an ability to change how it thinks which requires a culture characterized by trust, shared responsibility, and openness to experimentation without fear of failure (Dahlgaard and Dahlgaard-Park 2006).

Kappleman and Richards (1996) advocate that one solution to changing organisational culture is early employee participation in the change process. Employee empowerment, by providing workers with opportunities to influence decisions, promotes worker motivation and reduces worker resistance toward organisational changes. They discovered that early training provided an opportunity to empower and motivate employees and also provides an opportunity to demonstrate management's commitment to empowerment and establish early worker buy-in to the change, thereby reducing employee resistance and increasing the chances of programme success. Emiliani (1998b) states that the concept of lean behaviours is analogous to lean production. Lean behaviours are defined simply as behaviours that add or create value. In contrast, behaviours that inhibit workflow are analogous to wasteful batch and queue mass production methods. These behaviours are termed 'fat' behaviours, and are defined as behaviours that add no value and can be eliminated. Once lean behaviours are deeply understood, they must be practiced diligently under all conditions until they become sustaining behaviours that replace old habits.

A summary of the core principles of behaviour and engagement as prescribed by the Iceberg model is presented in Table 7. The summary has been extended to include some of the key recommendations of other recent work in this area.

Table 7: Summary of sustainable behaviour and engagement attributes.

Key Theme	Keys Lessons for Staying Lean	Key Tools / Techniques
<b>Behaviour and engagement</b>	<ul style="list-style-type: none"> <li>▪ To inject pace into the programme take experienced, motivated and multi-disciplined people to form an internal lean team.</li> <li>▪ Encourage sharing and learning throughout the programme, take every opportunity to get people together to discuss continuous improvements. Encourage teamwork.</li> <li>▪ Lean organisations need lean people who are both competent and capable of pushing themselves and their teams out of the comfort zone and into the stretch zone.</li> <li>▪ Training, support and good communication with all employees encourage them to join lean and create lean behaviours. Open, democratic and honest work environment lead to engaged employees and environment where they can excel. Behaviour change and communication are key to engagement.</li> <li>▪ Create a ‘Lean Culture’ of waste elimination &amp; continuous improvement. Encourage ‘Lean Behaviour’ of adding or creating value.</li> <li>▪ Lean organisations have emotionally engaged employees who can envisage link between them and their customers. Lean employees challenge the status quo.</li> <li>▪ ‘Roadblocks’ should be negotiated early and motivated employees are encouraged. Use appropriate and satisfactory rewards to keep employees motivated.</li> </ul>	<ul style="list-style-type: none"> <li>▪ 7 lean skills</li> <li>▪ Team cultures</li> <li>▪ Lean coaches</li> <li>▪ Continuous improvement</li> <li>▪ <i>Kanban</i></li> <li>▪ Problem Solving</li> <li>▪ Catchball</li> <li>▪ Rewards system</li> </ul>

#### 1.13.4 Process management

Implementing the principles of lean thinking in an organisation, or an extended enterprise, inevitably means changing one or more business processes and adopting new ways of doing business including the use of new tools and techniques. Two things are important when looking at businesses processes. First, is identifying which processes are key to ensuring that a business can successfully operate its core business; and second, how to design and optimise the key processes in order to deliver value to the customer, business or value stream (Hines *et al.* 2006).

Value stream mapping (VSM) is a tool designed to improve the business processes. VSMS are one-page diagrams depicting the process used to make a product. VSMS

identify ways to get material and information to flow without interruption, improve productivity and competitiveness, and help organisations implement systems rather than isolated process improvements (Emiliani and Stec 2004). VSMS help organisations see waste that exists in business processes. Eliminating waste focuses employee efforts on the value creating activities that customers desire and are willing to pay for. VSMS should be created by cross-functional teams of people who are directly involved in the process under consideration.

A summary of the core principles of business processes as prescribed by the Iceberg model is presented in Table 8. The summary has been extended to include some of the key recommendations of other recent work in this area.

Table 8: Summary of sustainable business process attributes.

Key Theme	Keys Lessons for Staying Lean	Key Tools / Techniques
Processes	<ul style="list-style-type: none"> <li>▪ The application of value stream mapping tools needs to focus on longer-term management, not just mapping.</li> <li>▪ Use mapping tools to identify disruption in flow (waste). Gemba used to develop maps. Mapping determines the baseline so improvements can be measured and monitored. This helps sustain the effort and encourages people to improve continuously.</li> <li>▪ Use a combination of ‘Pillar’ and ‘Platform’ approach to improve processes; possibly starting with pillars for demonstration of improvement benefits and platforms to roll-out improvements across company.</li> <li>▪ Senior management need to select strategic key value streams that need sustained improvement focus by addressing pillars and platforms.</li> <li>▪ Continuously apply customer value analysis to inform and improve all other key business processes. All employees need to understand the ‘Voice of Customer’ before attempting waste reduction.</li> <li>▪ Lean organisations have leadership structures based on the value stream requirements.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Mapping tools</li> <li>▪ Pull systems</li> <li>▪ ‘Voice of Customer’ insight tool</li> <li>▪ Pillar/Platform approach</li> <li>▪ Flow</li> </ul>

### 1.13.5 Tools, technologies and techniques

To gain motivation and commitment to the change, early involvement in activities such as 5S to remove the waste in the current system and transferring knowledge and skills through training can be effective (Found *et al.* 2006). Liker (2004) states that starting with a project or two to generate some enthusiasm is the right thing to do. The

application of continuous improvement tools in manufacturing is most effective when they are used concurrently (Emiliani 1998a). The tools and concepts are most productive when daily activities and simple teachings are coupled, and can result in significant improvements to corporate culture and financial performance. However, tools used separately from one another lose their synergistic quality, and can greatly limit efforts to become a lean manufacturer.

Sustainable change is achieved by aligning the appropriate technology with strategy and process and then training employees so that they have the correct technical skills to maintain various systems (Found *et al.* 2006). Misaligned or inappropriate technology leads to inefficiencies in the system and can result in expensive failures. Having technology without the skills to operate and maintain it leads to sub-optimal performance. It is only by taking a holistic approach, that includes consideration of the most appropriate and applicable technology, that long-term sustainable change is realisable (Hines *et al.* 2006).

A summary of the core principles of sustaining tools, technologies and techniques as prescribed by the Iceberg model is presented in Table 9. The summary has been extended to include some of the key recommendations other recent work in this area.

Table 9: Summary of sustainable tools, technologies and techniques attributes.

Key Theme	Keys Lessons for Staying Lean	Key Tools / Techniques
<b>Technology, tools and techniques</b>	<ul style="list-style-type: none"> <li>▪ Tool selection should be driven by the needs of the customer, the business and the people within the business; they should be pulled, not pushed. Tools need to be part of policy deployment process. Employees need to understand why they are using it and how it will help.</li> <li>▪ Early application of the basic tool and techniques needs an emphasis on self-sustaining systems of management.</li> <li>▪ Use appropriate ‘bundles’ and ‘combinations’ of Lean tools &amp; techniques to achieve the specific value stream goals and bottom-line improvements.</li> <li>▪ Use simple and proven technologies to better manage and make the bridge between customer and supplier demand profiles.</li> <li>▪ Have visible and up-to-date information at the point of operation. Visualize problems and use the plan-do-check-act (PDCA) method in improvement projects. Monitor all improvement projects with KPIs.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Mapping tools</li> <li>▪ Pull systems</li> <li>▪ VOC insight tool</li> <li>▪ Pillar/Platform approach</li> <li>▪ Flow</li> </ul>



### **1.13.6 Applying the five key themes**

A review of recent work in the areas of leadership, strategy and alignment, behaviour and engagement, process management and tools, technologies and techniques has added greater substance to the five key themes of the Iceberg Model. The key lessons for staying lean in each theme have been summarised in the preceding tables. These key lessons will form the basis for assessing organisation sustainability in the next phases of this project.

### **1.14 Contribution this study makes to literature**

‘Lean Sustainability’ is a relatively new area of research globally. The main body of research on lean sustainability internationally suggests that sustaining lean initiatives has been a challenge for many organisations and many have failed in their attempts. It is highly likely that NZ organisations will encounter problems and face similar issues sustaining their lean transformations. The study by Wilson *et al.* (2008) is the only major research conducted on lean in NZ to date. Their study focused on assessing how effectively NZTE administered lean to the manufacturing sector with the aim of advising NZTE on how to successfully support private enterprises through change initiatives such as lean. This is the first study on lean sustainability in NZ. This study will focus on the experiences of NZ organisations in sustaining their lean journeys and will aim to develop a guideline to help other organisations both locally and internationally in sustaining their lean transformations.

Most of the prominent international studies (Emiliani and Stec 2005; Found *et al.* 2006; Hines *et al.* 2008; Koenigsaecker 2009; Liker 2004; Sim and Rogers 2009) on lean and TQM sustainability have focused on large organisations. 99% of NZ organisations are SME’s (Massey 2009) and on an international platform even many of the ‘large’ NZ companies (Table 10) would be considered SME’s (Table 11). It is therefore highly likely that this research will be conducted on NZ SME’s. On a global scale this study will be contributing to research on sustaining lean transformations in SMEs (Table 11).

Table 10: Definitions of organisation size in numbers of employees in New Zealand (Collins 2008).

Firm Categorization	MED5 (2007)	Cameron & Massey (1999)	Collins, Lawrence and Roper (2007)
Micro-enterprise	-----	0-5	-----
Small	0-19	6-49	0-9
Medium		50-99	10-99
Large	More than 99	More than 99	More than 99

Table 11: Examples of international definitions of organisation size in numbers of employees (MED 2005).

	Micro	Small	Medium	Large
European commission	<10	<50	<250	-
United Kingdom	<10	<50	<250	250+
Australia	<5	5-19	20-200	200+

### 1.15 Conclusions

The review of literature shows that productivity growth is a problem for the NZ manufacturing sector. The NZ Government is addressing this issue by using lean as a model to help boost productivity growth. Overseas experience has shown that organisations have generally struggled and even failed in their attempts to embed CI methodologies such as lean. It is highly likely that NZ organisations will face similar problems in sustaining their lean transformations. Several theoretical lean sustainability models alongside three of the most widely utilised benchmarking models were reviewed to ascertain the most suitable model for studying lean sustainability in NZ. The benchmarking models were considered in this review as they have been widely used across the globe as an alternative to methodologies such as lean and TQM to embed CI cultures. A review of these theoretical and benchmarking models identified the Iceberg Model (Hines *et al.* 2008) as most comprehensive in its coverage of the common themes covered in these models. The five key themes advocated in this model were expanded to include other recent work in similar areas.

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These five key themes will be used as a basis to assess organisational lean sustainability in the subsequent phases of this project.

## **Chapter 2: Methodology**

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### **2.0 Introduction**

The methods used to study the experiences of NZ organisations in sustaining lean manufacturing are described in this section. The Iceberg Model (Hines *et al.* 2008) was used to develop the framework for this study and the key recommendations of this model form the constructs for measuring organisational lean sustainability. The selection of the case study organisations was based on the criterion for research, i.e. they form a representative sample of the NZ manufacturing sector and have implemented lean for some time. The research methodology was designed using an iterative process involving the researcher, project supervisors, and a social scientist from Massey University's Geography department.

Case study research techniques were seen as most appropriate for the phenomenon under investigation. Case study research techniques will be utilised to evaluate the organisations against the research constructs. The approach adopted for this study is consistent with the prescriptions for case study research by Eisenhardt (1989), Voss *et al.* (2002) and Yin (2003) in that we intentionally selected theoretically useful cases, considered qualitative and quantitative data, and will allow the study to change course as themes emerge. The sample frame was selected from a representative NZ population based on the criterion for research. Mainly qualitative data will be collected through semi-structured interviews. The data collection and analysis will be done in an iterative process to augment generalisability of emergent themes.

### **2.1 Problem definition**

Lean manufacturing is a relatively new concept in NZ with a number of manufacturing organisations having recently initiated their lean journeys. Some organisations have undertaken lean independently whilst several have initiated lean improvements with the help of NZTE. The NZTE lean programme kicked-off in 2005 with new companies joining this programme each subsequent year to the present day. NZ companies have used a range of approaches such as 20 Keys, lean consultants, etc to implement lean changes.

A review of literature has shown that sustaining lean initiatives has been a problem for many overseas organisations and it is likely that NZ organisations will face similar problems. Hence, the overall focus of this research is to:

*‘Study the experiences of NZ organisations in sustaining lean manufacturing initiatives’*

As advocated by Eisenhardt (1989) this research question will be used to identify the kind of organisation to be approached, and once there, the kind of data to be collected.

## **2.2 Research population**

Eisenhardt (1989) suggests that the definition and choice of the research population should be related to the way the initial research subject was defined and that the concept of a population is crucial, because the population defines the set of entities from which the research sample is to be drawn. She states that the selection of an appropriate population controls extraneous variation and helps to define the limits for generalising the findings. Yin (2003) suggests that the research subject can only be addressed if the population under investigation meets certain criteria. The selection of the population for this research was conditional upon the criteria that organisations were representative of the NZ manufacturing sector and they need to have been involved in implementation of lean for some years since the leading advocates of lean suggest that successful lean transformations take about three to five years.

The key questions in selecting a population for this study were:

*‘What is a representative NZ manufacturing organisation?’*

*‘Where do we find a population meeting the criteria for this research?’*

Lean concepts being relatively new within the NZ SME sector meant that there were a limited number of organisations that met the criterion for this research. Massey (2009) states that 99% of the NZ manufacturing sector is made of SMEs meaning that this study had to focus on SMEs within the NZ manufacturing sector. The NZ manufacturing sector contained a mix of companies that had implemented lean over varied lengths of time using different approaches. Several large (Table 10) companies

had been implementing lean independently for some years but they did not form a good representative sample of the NZ manufacturing sector.

The NZTE Lean Programme participants were the next alternative considered for this study. The NZTE participants consisted of 22 companies that had implemented lean changes over varying lengths of time using two distinct approaches. Wilson *et al.* (2008) showed that the average number of full time employees within the NZTE participants was 70 and according to descriptions by Cameron & Massey (1999) and Collins, Lawrence and Roper (2007) (Table 10) these organisations were classified as SME's in NZ. The MED<sup>6</sup> definition for SME's was not used because it did not align well with international definitions and there was no category or inclusion of firms with more than 20 and fewer than 100 employees.

Since the NZTE companies were SMEs that had implemented lean for several months to several years, they presented a valid population to study lean sustainability in NZ. NZTE was approached for assistance to get access to these organisations and a meeting was held with the person in charge of overseeing the lean participants. NZTE agreed that it was important to study the experiences of these companies in sustaining lean for future lean programmes and agreed to provide contact details of the 22 companies that were part of their lean participants. The NZTE participants were thus used to fulfil the aims and objectives of this study. NZTE notified all these companies about the aims and objectives of this research and requested their participation providing an accelerated way of getting access to these organisations. Selecting the NZTE cluster presented a group that had gone through a programme of similar nature thus providing the opportunity to select a well-structured and controlled sample. Selecting this population also helped reduce extraneous variation and clarified the domain of the findings as sustaining lean in a NZ manufacturing organisation.

### **2.3 Constructs**

The organisational lean sustainability was measured using the Iceberg Model. Using this model helped define the specific constructs to investigate. Eisenhardt (1989) suggests that such a priori specification of constructs is valuable because it permits

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researchers to measure constructs more accurately. Using the Iceberg Model meant that we were testing against the proposition that a company is sustainable if they are competent in leadership, behaviour and engagement, strategy and alignment, business processes and tools, technology and techniques. These five key concepts formed the constructs for this research and the specific propositions of the Iceberg Model were used to evaluate these constructs. The constructs represented the dimensions that influenced good implementation and long-term sustainability of lean.

#### **2.4 Ethical considerations**

As a prerequisite for doing this research the ethical issues of this project had to be thoroughly considered before the methodology could be finalised. The research design team had two discussions (Appendix 2) regarding the ethical issues associated with this project. After thoroughly considering all the ethical issues associated with this research the team came to the conclusion that since no sensitive information, such as company names, profit numbers, etc was being collected this project was deemed to pose 'low risk' to the participants. The low risk notification was submitted to Massey's ethics committee and their approval was gained before the research method was finalised. All key informants were briefed on the ethics of this project and their 'participation rights' were explained to them prior to the commencement of each interview. The key informants were asked to sign a consent form (Appendix 3) acknowledging that they understood the risks and rights of participation before the interview began.

#### **2.5 Case study research**

This research was designed using an iterative process involving the researcher, project supervisors, and a social scientist (Dr Juliana Mansvelt) from Massey University's Geography department. Dr Mansvelt has many years experience in conducting and supervising qualitative research. She ensured that the pros and cons of various research techniques were considered without bias. She provided a non-engineering perspective on the research design phase, population and sample frame selection, research protocol design and data analysis techniques. Most importantly, she validated the robustness and suitability of the research methods for answering the research aims and objectives of this study.

### **2.5.1 'How' and 'Why' questions**

This research looks at the complex issue of organisational sustainability and according to Voss et.al (2002) and Yin (2003) asking 'how' and 'why' questions allow such complex issues to be tested. Such questions help trace operational links over time, rather than mere frequencies of incidence. Consequently, 'how' and 'why' questions were used to develop the research protocol (Appendix 3).

### **2.5.2 Case study methods**

'How' and 'why' type questions are explanatory and favours the use of case studies, histories and experiments (Yin 2003). Case study methods in particular allow the question of 'how' and 'why' to be answered with a relatively full understanding of the nature and complexity of the complete phenomenon. Case study research has been widely used in the operations management field in order to test complicated issues (Eisenhardt 1989). Hence case study research methods were used to address the 'how' and 'why' type questions used in the research protocol. Case study research enabled the selection of theoretically useful cases and allowed the study to change course as themes and patterns emerged. Case study methods helped retain the holistic and meaningful characteristics of real life events such as individual life cycles, and organisational and management processes. Eisenhardt (1989) states that one of the main advantages of case study research is that it increases the chance of being able to determine the link between cause and effect. The case study method also allowed this research to deliberately cover contextual connotations since they were thought to be highly pertinent to the phenomenon of study. Studying the organisations history, socio-economic and economic environments provided a holistic and dynamic analysis of the change transformations.

### **2.5.3 Rich data**

Yin (2003) advocates that rich data is required in addressing complex subjects. Smith (2003) mentions that collecting rich data to study complex organisation phenomena allows one to trace events, delineate processes, and make comparisons. Through obtaining rich data, researchers gain thorough knowledge of their research problems (Smith 2003). The rich data can provide new leads or raise questions that otherwise might never have been asked (Rowley 2002). Collecting rich data meant seeking full descriptions of an organisation's lean journey.



### 2.5.4 Reliability and validity of research

According to Yin (2003) four tests are important in establishing the quality of case study research. These tests are: construct validity, internal validity, external validity and reliability. This research addressed these four tests as summarised in Table 12 below.

Table 12: Actions taken in the study design to improve validity and reliability

<b>Tests (Yin 2003)</b>	<b>Action taken in the study</b>
<i>Construct Validity</i> - is the extent to which we establish correct operational measures for the concepts being studied.	Triangulation through multiple sources of evidence.
<i>Internal Validity</i> - is the extent to which we can establish a causal relationship, whereby certain conditions are shown to lead to other conditions, as distinguished from spurious relationships.	Within case and cross case comparisons.
<i>External Validity</i> - is knowing whether a study's finding can be generalised beyond the immediate case study.	Replication logic used in multiple-case study.  Having a focus group review preliminary cross-case findings.  Comparison of theory.
<i>Reliability</i> - is the extent to which a study's operations can be repeated, with the same results.	Using a protocol.

### 2.5.5 Multiple vs. single case study

This study was carried out over eight months and a multiple-case study approach was utilised. This approach was used as there were 22 companies available for study and assessing multiple case studies improved the generalisability of findings. The evidence from multiple cases is often considered as more compelling and the overall study is therefore regarded as more robust (Voss *et al.* 2002). Multiple cases may reduce the depth of study, when time is constrained, but can both augment external validity, and help guard against observer bias. Multiple cases can be regarded as equivalent to multiple experiments. The more cases that can be marshalled to establish or refute a theory, the more robust the research outcomes are (Rowley 2002).

Using single cases have limitations such as the ability to generalise conclusions, misjudging of a single event, and of exaggerating easily available data. These risks

exist in all case research, but are somewhat mitigated when events and data are compared across cases (Voss *et al.* 2002).

### **2.5.6 Triangulation**

The term used for systematic comparisons of different ways of looking at the same problem is triangulation. Triangulation is defined as occurring when data from multiple sources from different data collection methods support the same conclusion, or at the least, do not contradict it (Yin 2003). The triangulation made possible by multiple data collection methods provided a stronger substantiation of constructs and theory. The triangulated method of data collection for this study consisted of in-depth interviews at two organisational levels, observations and field notes. Data collected from the observations and the field notes was used largely to corroborate evidence gained from the in-depth interviews. A CI focus group was used as a further source of data triangulation for this study. The CI focus group is discussed next.

#### **2.5.6.1 Continuous improvement focus group**

A focus group discussion was conducted in July 2009 at Massey University with 12 industry-based CI students. Denzin *et al.* (1994) states that a focus group is where the interviewer asks group members very specific questions about a topic after considerable research has already been completed. Stewart *et al.* (1990) state that focus groups can be used at any point in a research programme. They state that focus groups are commonly used to interpret previously obtained qualitative results as was the case in this research. The focus group discussions were used to triangulate the preliminary findings of the case studies. The participants were from various primary and public sector organisations. They had different levels of involvement with CI with most being aware of the common methodologies for implementing CI although not all had experience in implementing the methodologies. The participants were asked to identify which of the key recommendations from the Iceberg Model existed within their organisations and also to identify if and how the common problems experienced by the case study organisations in sustaining lean related to their companies. The discussions were recorded using a simple questionnaire (Appendix 4) and the responses were compared and contrasted by the researcher to establish commonalities and differences. The findings of the focus group are presented in Chapter 4.

### **2.5.7 Key informants**

Two key informants were interviewed from each case study organisation. One key informant was from the senior-management level and one was from the middle-management level. NZTE provided contact details for each organisation and in all cases the initial organisational contacts were senior-level managers with some involvement in the lean initiatives. In all cases the two informants were selected by this key contact. The key contact was not always one of the key informants. The prerequisite for key informant selection was some level of direct involvement in implementing lean so that the informant could give a better insight into the organisation's lean journey. Eisenhardt (1989) advocates that in researching case study data it is important to seek out the person(s) who are best informed about the data being researched. The senior level key informants carried out roles such as operations management, manufacturing management, CEO, etc. The middle-management informants were mostly department team-leaders or production supervisors. Staff from two different levels will be used to investigate if the CI culture is embedded through out different levels of the organisation as Hines *et al.* (2008) advocates that a sustainable lean organisation has all employees fully engaged and immersed in the change initiative from the outset. Interviewing middle-management allows us to test how far lean aspects have infiltrated down the organisation, giving a good idea of sustainability.

### **2.5.8 Protocol**

Qualitative research does rely on data collection methods that may be subject to bias such as researcher bias or over-reliance on one source (Voss *et al.* 2002). Voss *et al.* (2002) recommends that in order to negate the possible effects of some of these biases the researcher must develop a documented, systematic approach to data collection in the form of a research protocol to allow other researchers to assess potential bias. Yin (2003) agrees that protocols are essential for a multiple case study. The protocol should contain the instrument as well as the procedures and general rules to be followed in using the protocol. The protocol plays a major role in increasing the reliability of case study research and is intended to guide the investigator in carrying out the data collection from each case study.

The core of the protocol is the questionnaire which outlines the subjects to be covered during the interview, states the questions to be asked, and indicates the specific data required. The protocol for this research is attached in Appendix 3. The protocol contains the company information sheet, project information sheet, consent form, and interview questionnaire. The case study companies were contacted by telephone and e-mail to request participation in the study. The value and relevance of the research, and the time and resources required, were outlined once the participants agreed to the interview. Before the commencement of the individual interviews the informants were guided through the information sheet and the consent form (Appendix 3).

#### **2.5.8.1 Surveys**

The use of a survey questionnaire was considered during the design phase of this research but was judged to be unsuitable for this study. Surveys primarily provide objective or quantitative data (Yin 2003) but this study required qualitative data to be collected to answer the research question. Surveys can try to deal with phenomenon in context but the ability to investigate the context is extremely limited (Eisenhardt 1989) and it was crucial that the organisational context was examined in this study to gain a fuller understanding of organisational experiences. Surveys are advantageous where the research goal is to describe the incidence or prevalence of phenomenon or when it is to be predictive about certain outcomes. This research looked at establishing enablers and inhibitors to sustaining lean and not the magnitude of gains from lean.

#### **2.5.8.2 Interview questionnaire**

Semi-structured interviews were conducted using open-ended questions to extract data from the case study organisations. Open-ended questions were used to encourage interviewees to provide extensive and developmental answers. The questions were developed in an iterative process over four meetings involving the research design group and an exhaustive pilot stage. The questions were based on the key recommendations of the Iceberg Model. The Iceberg Model offers a set of criteria for attaining lean sustainability and the interview questions were designed to measure conformity to these key criterion. The questions were designed to carry out guided conversations rather than structured queries as recommended by Yin (2003). The open-ended questions gave respondents the freedom to talk about the good or bad

changes, changes they did not favour, relationships, impressions, etc. This encouraged the interviewees to reply as they saw fit. For example, instead of asking a direct and leading question such as *'how do you lead the initiative?'* a more open-ended question in the form of *'how do you inspire them to engage in lean?'* was asked to get interviewees talking about leadership.

Semi-structured interviews enabled the researcher to vary the conversation around what the interviewee was saying. The interviews were designed to have a minimum number of questions to ensure that the questions did not dominate the flow of conversation and to ensure the flow went towards the topics under scrutiny. The questions varied slightly according to the level of the interviewee and the order the questions were asked also varied depending on the flow of the conversation. The interview questions were identical for each case study, but still allowed for exploration in areas that seemed particularly interesting at each company. The questionnaire served both as a prompt for the interview and as a checklist to make sure that all topics had been covered. Prompts were used during the interviews to keep the informants focused on the constructs under investigation. The interviews were conducted using plain and simple terminology so as to avoid the use of technical or theoretical terms and jargons. This ensured that any incidence of 'leading' the informant and thus introducing 'interviewer bias' was reduced. The interviews primarily collected qualitative data but some quantitative data was collected in regards to size, history, age, structure, etc of the organisation in order to set the context of the case study.

### **2.5.8.3 Pilot study**

The case research protocols were piloted at two organisations. Both organisations were attempting lean transformations independently and were in different stages of implementation. Undertaking pilot interviews meant that the questions were tried and tested and the researcher knew what to expect, in order to enhance validity of the protocol. The pilot organisations had no involvement with the NZTE lean programme or any other lean cluster. One was a large NZ organisation, whilst the other was a SME. The interviews at the large organisation were arranged by one of the project supervisors through personal contacts and the interview at the SME was organised by the researcher who knew the informant through prior employment.

Two mock interviews were carried out at the large organisation and one at the small organisation. The project supervisors attended the first mock interview to critically assess the researcher's interview techniques. The researcher had no previous experience with qualitative interviews and had underestimated the difficulties of using this method for data collection. The researcher found it difficult to cope with the challenges of active listening and could not engage the informant into a guided conversation during the first mock interview. He simply ended up asking structured queries ensuing in 'yes' and 'no' type of answers from the informant. On the completion of the first interview the project supervisors made several recommendations to help improve the researchers interviewing skills. With the guidance of the project supervisors and through conducting two further mock interviews the researcher rapidly improved his interviewing skills. The researcher's interview skills continued to improve after every interview and it is clear that training and experience is the best way to improve ones skills. The mock interviews also helped overcome the challenges of handling a Dictaphone, especially the problem of remembering to turn it on before starting an interview. Overall, the pilot studies resulted in minor changes to the questionnaire and interview protocols but greatly enhanced the researcher's interviewing skills and confidence.

## **2.6 Sampling**

Sampling involves two actions; the first is setting boundaries that define what you can study and connect directly to the research questions and the second step is creating a sample frame to help uncover, confirm, or qualify the basic processes or constructs that underpin the study (Eisenhardt 1989). The traditional way of sampling is to identify a population, and then to select a random or stratified sample from that population (Yin 2003). However, in case research, samples of cases are often built by selecting cases according to different criteria (Eisenhardt 1989; Yin 2003). Yin (2003) suggests that when building theory from case studies, case selection using replication logic rather than sampling logic should be used. Each case should be selected so that it either; predicts similar results or produces contrary results but for predictable reasons.

The research sample for this study was built by selecting cases from the NZTE population. The NZTE population is divided into different clusters based on the year the organisations initiated lean and the approach they undertook to implementing lean (Figure 7). All organisations were supported by an NZTE nominated consultant for 12 months. NZTE employed two different approaches to initiate lean with the lean clusters with the *Aichi* cluster using the 20 Keys approach and the *Direct* cluster using lean consultants. NZTE piloted the *Aichi* lean manufacturing programme in 2004 to guide businesses through the lean manufacturing process. The *Aichi* programme ended in 2008 with 15 companies having participated in this programme. NZTE has also sponsored eight other firms in since 2007 on their lean journeys through their *Direct* programme. Sampling from the NZTE population allowed us to study how length of implementation (timeline) and different lean implementation approaches impacted lean sustainability. The impact of time on lean sustainability was investigated by selecting companies with different lean implementation times. The impact of the approach on lean sustainability was studied by selecting cases from the *Aichi* and *Direct* cluster. It is likely that the similarities and differences in approaches and timelines amongst the case study organisations will either predict similar results or produce different results but for predictable reasons. Thus, the goal of sampling was to choose cases that were likely to replicate or extend the emergent themes.

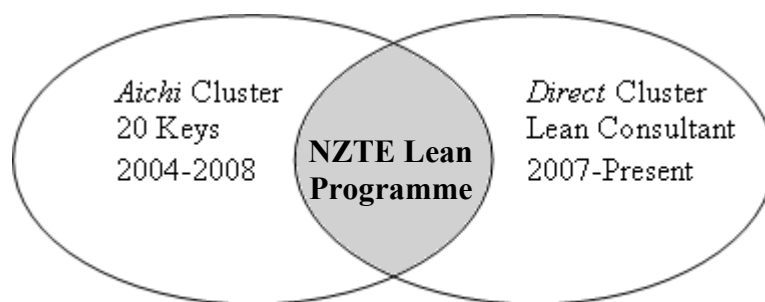


Figure 7: Relationship between NZTE *Aichi* and *Direct* cluster

### 2.6.1 Variables

The two key variables for this research are length of implementation (timeline) and the approach used to implement lean (approach). These variables are described in Table 13.

Table 13: Research Variables

Variable	Description
Timeline	To determine how time affects sustainability.
Approach	To determine how different approaches affect sustainability

### 2.6.2 Research sample selection

Of the 22 companies shown in Table 14 below only 11 companies were selected to fulfil the variables of this study. Table 14 lists companies according to the year they implemented lean and it also shows how the case studies are related to the company names. Replication logic and random selection was used where appropriate to select the case studies however, most of the time the company selection came down to the ones that were willing to participate. Eleven cases were seen as sufficient to augment theory, generalisability, external validity and guard against observer bias. Eleven cases were also seen as sufficient to provide compelling support for the initial set of constructs within the time and financial resources available. Eisenhardt (1989) suggests that there is no ideal number of cases however a number between 4 and 10 cases usually works well. With fewer than 4 cases it is often difficult to generate theory with much complexity and its empirical grounding is likely to be unconvincing. With more than 10 cases it quickly becomes difficult to cope with the complexity and volume of the data (Eisenhardt 1989).

From the eleven companies selected in this case study, seven companies belonged to the *Aichi* cluster and the remaining four companies belonged to the *Direct* cluster. Table 15 shows cluster distributions for the case study companies. All *Aichi* members used the 20 Keys approach to initiate lean activities. The *Aichi* members used the same consultant for training on the 20 Keys approach. The *Direct* member companies did not use a defined framework for initiating lean. They were trained on the basic principles of lean manufacturing and led through specific improvement activities such as 5S, Value Stream Mapping, etc by a lean consultant. All four *Direct* companies shared the same consultant. This study strived to include a greater number of organisations that had been implementing lean for a longer duration. As mentioned previously, evidence suggests that length of implementation does have a major bearing on sustainability. Hence, three *Aichi I* members were chosen for this study to get a better insight into the relationship between time and sustainability.



Table 14: Research population – NZTE lean clusters

<b>Company</b>	<b><i>Aichi</i> Member</b>	<b>Timeline</b>	<b>Approach</b>	<b>Case Study Organisation</b>
Company A	1	2005-2006	20 Keys	N/A
Company B	1	2005-2006	20 Keys	Case Study I
Company C	1	2005-2006	20 Keys	Case Study D
Company D	1	2005-2006	20 Keys	Case Study G
Company E	2	2006-2007	20 Keys	Case Study B
Company F	2	2006-2007	20 Keys	N/A
Company G	2	2006-2007	20 Keys	Case Study J
Company H	3	2007-2008	20 Keys	N/A
Company I	3	2007-2008	20 Keys	N/A
Company J	3	2007-2008	20 Keys	Case Study F
Company K	3	2007-2008	20 Keys	Case Study H
Company L	3	2007-2008	20 Keys	N/A
Company M	3	2007-2008	20 Keys	N/A
Company N	3	2007-2008	20 Keys	N/A
Company O	3	2007-2008	20 Keys	Case Study A
Company P	<i>Direct</i>	2007	Lean Consultant	Case Study K
Company Q	<i>Direct</i>	2007	Lean Consultant	N/A
Company R	<i>Direct</i>	2007	Lean Consultant	N/A
Company S	<i>Direct</i>	2007	Lean Consultant	N/A
Company T	<i>Direct</i>	2008	Lean Consultant	Case Study E
Company U	<i>Direct</i>	2008	Lean Consultant	N/A
Company V	<i>Direct</i>	2008	Lean Consultant	Case Study C
Company W	<i>Direct</i>	2008	Lean Consultant	N/A

Table 15: Cluster distributions for the case study companies

<b>Proposed No. of Case Studies</b>	<b>NZTE Classification</b>	<b>Year of Implementation (Time)</b>	<b>Approach</b>
3	<i>Aichi 1</i>	2005	20 Keys
2	<i>Aichi 2</i>	2006	20 Keys
2	<i>Aichi 3</i>	2007	20 Keys
2	<i>Direct</i>	2007	Consultant
2	<i>Direct</i>	2008	Consultant

### 2.6.3 Final research sample

Out of the 11 companies selected only 9 were able to participate in this study. Due to severe financial difficulties Case study J and K had ceased operations during the data collection phase and were not able to participate. Case study J was an *Aichi 2* member and Case Study K was a *Direct* member that initiated lean in 2007. Losing these organisations from the sample did not have a significant impact on the replication logic. The final sample contained six organisations from the ‘20 Keys’ approach and three from the ‘Consultant’ approach. The final sample also contained a good spread of organisations across the various timelines as shown in table 16.

Table 16 Proposed number vs. the actual number of case studies conducted.

Proposed No. of Case Studies	Actual No. of Case Studies	NZTE Classification	Year of Implementation (Timeline)	Approach
3	3	<i>Aichi 1</i>	2005	20 Keys
2	1	<i>Aichi 2</i>	2006	20 Keys
2	2	<i>Aichi 3</i>	2007	20 Keys
2	1	<i>Direct</i>	2007	Consultant
2	2	<i>Direct</i>	2008	Consultant

### 2.7 Data collection

Data collection began in 2008 and was completed in March 2009 with each site visit lasting two to three hours. All further correspondence after the site visits were done via email. Each of the senior-management level interviews lasted on average between 45 to 60 minutes with the middle-management interviews lasting on average 30 to 45 minutes. The key informants generally had only an hour available for the interviews. An hour mostly proved sufficient to explore the constructs under investigation. The site tours lasted on average no more than 30 minutes and all the organisations were eager to demonstrate their change efforts.

All interviews were conducted by the principal researcher and as recommended by Voss *et al.* (2002), the researcher endeavoured to keep previous interviewee responses in mind while simultaneously probing the current informant, and noted the significance of what was left unsaid as well as what was said, and so on. The informants were encouraged to explain their views and where appropriate, to provide examples. The exactness of what people said was important for this research in order

to study relationships, patterns, cause and effect of operational links, etc; therefore the interviews were recorded using a Dictaphone. Yin (2003) suggests that such recordings can contribute towards reduction of observer bias, especially if the evidence is presented verbatim rather than summarised.

Most but not all data was collected through interviews. To augment the on-site interviews observational tours of the manufacturing facility were carried out. As argued before, the use of multiple data sources or triangulation is important in case research. Deliberately seeking confirmation from multiple data sources leads to more reliable results (Eisenhardt 1989). The observations were used for verification and clarification of interview responses, as well as providing the researcher with a feel for the overall work environment and systems. Observations enabled the researcher to reach his own understanding and allowed him to collect data on routine activities that may never have been discussed in the interview. The site tour was also used to observe visual displays of lean strategies, process improvements, standard operating procedures (SOPs), etc as lean transformations generally have a large visual aspect (Hines *et al.* 2008). In addition to the formal collection of data the researcher's impressions, opinions, ideas, etc on each organisation's lean experience was also recorded as soon as they occurred and was used to push the researcher's thinking during data analysis.

## **2.8 Iterative process of data collection and analysis**

Data collection and analysis was done in an iterative way as advocated by Eisenhardt (1989), Voss *et al.* (2002) and Yin (2003) where each case study data was documented and analysed before carrying out subsequent case studies. Using the iterative process of data collection and analysis allowed the researcher to make adjustments and improvements during the data collection process. Yin (2003) mentions that when conducting case-based research it is not uncommon for the research questions to evolve over time and for the constructs to be modified, developed or abandoned during the course of the research. The use of this iterative process allowed the development of more knowledge than would have been possible with a single fixed research protocol.

Upon the completion of data analysis for Case Study A, the research design team was invited to evaluate the findings and provide guidance on extracting key themes from further case studies. This exercise assisted the researcher in looking beyond initial impressions into deeper meanings underlying the data. After reviewing the key themes the research design team recommended adjusting the interview protocol to further explore the emergent themes. Several changes were made to the interview protocol after Case Study A and throughout the course of this study. Appendix 3 presents the original and final interview protocols. The research protocol underwent the following changes.

- Specific questions on lean education, motivation for change and the effectiveness of the consultant were added to Part B (Lean Background).
- The leadership construct (Part D) was expanded to further explore the issues of SMT commitment and capabilities of the internal lean champion.
- The behaviour and engagement (Part E) construct was expanded to further explore the issue of staff resistance.
- The business processes construct (Part F) was expanded to further explore the issue of lack of awareness of customer value.
- Specific questions on the informants' impressions of lean sustainability and the effectiveness of NZTE's lean forums and clusters were added to Part G (Reflection).

## **2.9 Data analysis**

As recommended by Eisenhardt (1989) the case study data was analysed using within-case data techniques followed by a search for cross-case patterns and a comparison of the emergent themes with literature. The cross-case patterns and comparison with literature was not attempted until all nine within-case studies were completed to reduce bias.

### **2.9.1 Within-case analysis**

The first step in data analysis was to examine each organisation independently through a within-case study analysis. Eisenhardt (1989) mentions that there is no standard format for within-case study analysis. However, the overall idea is to become intimately familiar with each case as a stand-alone entity. This process allows the unique patterns of each case to emerge before pushing to generalise patterns across

cases. Within-case analysis for this study began with a detailed documentation of each case study. Documentation included transcription of interviews and typing of observations, ideas and insights that arose during or subsequent to the field visit. This was done as soon as possible after each case study, both to maximise recall and to facilitate follow-up and filling of gaps in the data collection. All voice recordings were transcribed verbatim. The researcher transcribed five case study recordings and a research assistant was hired to transcribe the final four case studies. The research assistant was briefed on the confidentiality issues surrounding the case study data. In general it took four hours to transcribe a 60 minute interview verbatim. All field notes, impressions and ideas were typed by the researcher.

Having developed detailed case descriptions, the next step was to analyse the pattern of data within cases by constructing an array or display of the data. This study utilised cognitive mapping (Eden and Ackerman 1998) techniques to display each case study data. An example of a cognitive map can be found in Appendix 6.

### **2.9.1.1 Cognitive mapping**

Cognitive methods have been developed and widely used to investigate and depict thinking. Cognitive mapping is a decision modelling technique that can be used to develop comprehensive and holistic models of complex or ‘messy’ problems or situations. It is of particular benefit where the issues surrounding a research question are complex and interacting as is the case in this research (Grigg and Walls 1999). The origins of this technique lie in Kelly's ‘Theory of Personal Constructs’ (Eden and Ackerman 1998). Cognitive maps are sometimes referred to as causal or concept maps.

Cognitive maps enabled the researcher to gain an in-depth understanding of key issues within each case study by showing relationships between various concepts, constructs, theories and ideas relating to the research question. The maps were used to unearth the common themes underlying the experiences of the case study organisations in sustaining their lean transformations. The maps provided valuable clues on the informants’ perceptions of the common issues giving indication as to where the core of the problem or issue lay. Cognitive mapping, by producing a representation of how the informant perceived particular issues or situations acted as a valuable technique

for helping analyse case study data. Regardless of the research technique being applied, being able to understand the informant's perception of the problem is vital to the success of a study (Yin 2003).

### **Developing case study themes**

Interview transcriptions and site observations were analysed to develop cognitive maps of the data collected. The maps helped build a picture of how the participants related things to each other. The researcher looked to establish how informants' connected the content together. During analysis, both descriptions about what the informants were saying and the reasons for why they were saying it were investigated. Interviews were treated as a series of stories being told about particular things and the story was influenced by the context. The informants' understandings of cause and effect were investigated by looking at descriptors e.g. *what does lean mean to them?* The maps were used to determine chains of causality and connection and arouse consistent themes. The maps looked for solutions to the primary research focus by answering the question;

*'What have the organisations experienced during their lean transformation journeys?'*

Some of the secondary questions used to address the aforementioned primary question were:

*Why have they undertaken lean? What approach have they undertaken to initiate lean changes? What short and long-term improvements have they realise? How have they progressed? If they have or will sustain the changes they have made? Etc.*

These questions guided the construction of each cognitive map and these maps became the working blocks for analysing the rich and complex data. The informants' opinions or a group of opinions represented the concepts in each map. Concepts were linked or not linked to each other. Once an array or display of the key concepts had been constructed, the researcher looked for explanation and causality behind the concepts (Miles and Huberman 1994). Cognitive maps were analysed visually to identify the themes underlying the concepts. Seeking meanings behind what the

informant was saying helped achieve this. The most important themes were identified by looking at the causality arrows. Concepts with many links represented issues that were particularly important to the case study and the project. Similar concepts were colour coded to make clusters which became high level constructs. A high level construct or a group of constructs represented an important theme. The emerging themes in each map were colour coded to ascertain which issues were most important to each case study. This process helped to identify the similarities and differences between the maps. Once the main map was developed for each case study with a category of themes, subsequent meta maps were drawn to elaborate on the causality behind each key theme. A3 sheets were used to keep the maps on one sheet of paper allowing the entire cross links to be drawn rather than having to try to move between different pages and increasing the chance of missing issues. Appendix 6 shows the cognitive map for case study A with the circles representing important constructs. Appendix 7 shows the higher-level map for case study A with a summary of the key themes or problems experienced by Company O in sustaining lean.

### **2.9.2 Cross-case analysis**

Coupled with within-case analysis was a cross-case search for themes. Cross-case patterns were investigated once a full understanding of each case study was achieved. The cross-case search for themes forced the researcher to look beyond initial impressions and see evidence through multiple lenses. The key themes from all within-case studies were compared and contrasted to each other to determine the commonalities and differences between individual cases. Cross-case analysis was essential for enhancing the generalisability of conclusions drawn from the individual case studies and increasing the internal validity of the findings.

Once the common cross-case problems were identified a cause-effect and root-cause analysis was done to determine the root cause behind these common problems. The cause-effect diagram (Chapter 4 Diagram 8) helped think through causes of the common problems experienced by the case study organisations. This technique helped the researcher consider all possible causes of the problem, rather than just the ones that were most obvious. The cause-effect approach combined brainstorming with concept mapping. As shown in the diagram the mapping began with the common cross-case problems. Next, all the factors or concepts that were contributing to these

problems was identified through brainstorming and noted. Causal arrows were drawn to establish links between the concepts and the problems. The concepts included people, systems, equipment, materials, external forces, etc. The concepts with the most number of linking arrows were considered as main themes underlying the common problems experienced by the organisations.

The root-cause analysis (Chapter 4 Diagram 9) was used to validate the findings from the cause-effect analysis. The 5 Whys technique (Bicheno 2000) was used to unearth the root-cause of the each common problem. Each problem was analysed in isolation without taking into consideration the link to other problems or concepts. The 5 Whys technique required asking ‘why?’ several times till the true cause of each problem was established.

### **2.9.3 Comparing emerging themes with literature**

It is commonly stated in qualitative research publications that in explanatory research it is important to review the emergent theory against the existing literature. Reviewing emergent theory involved asking what is similar, what is different, and why, between literature and the research findings. Tying the emergent theory to existing literature enhanced the internal validity of this research. The cross-case findings were referenced to the Iceberg Model and other relevant literature to raise questions about whether the findings were consistent with published research. Sources of differences were examined and are discussed in Chapter 4.



### **Chapter 3: Within-Case Analysis**

This section presents the findings from the within-case analysis of the nine case studies. All cases are presented under a similar format with the only major variation being Case Study B where the two different lean approaches undertaken by the organisation are discussed separately.

The within-case studies generally follow the format as described below:

- Introduction
- Company description
- Decision to go lean
- Strategy for change
- Implementation steps
- Staff Engagement and behavioural changes towards lean
- Adding value to the end-product
- Changes from implementing lean
- Sustaining the lean momentum

As mentioned in Chapter 2, Organisations J and K could not participate in this study as they had ceased operations. These two companies had gone into receivership as a result of the economic downturn some months before the data collection phase of this study. Organisation J undertook the 20 Keys programme in 2006 and Organisation K undertook the *Direct* approach in 2007 but neither succeeded in embedding a CI culture.

## **3.1 Case Study A – Company O**

### **3.1.1 Introduction**

This case study was conducted at Company O in December 2008. Two key informant interviews and a site tour were conducted at this site. The key informants were the Operations Manager (OM) and the Production Supervisor (PS). The OM is part of the SMT and the PS is part of the middle management team. The OM was responsible for overseeing the lean project while the PS was directly involved in planning, implementing, and monitoring shop-floor improvement activities.

### **3.1.2 Description of organisation**

Company O is SME operating in a small provincial NZ city. They have 46 full time employees and specialise in the design and manufacture of medical devices. They were founded 47 years ago and have a single manufacturing facility supplying both domestic and international customers. A board of directors (BOD) oversee the strategic plans for the organisation whilst a CEO is in charge of the day-to-day operations. The BOD stipulates annual goals for the company and the senior management team draw out departmental tasks to achieve these goals within the year. These tasks are then relayed verbally to the staff at the beginning of each year. In 2005, the BOD formulated four key pillars aimed at stimulating and sustaining long-term organisational growth. These four pillars were:

1. To design and lead.
2. Have a '*World-Class*' manufacturing facility.
3. Strong brand identification.
4. Strong '*World-Class*' customer service.

Company O had an effective relationship with NZTE prior to the formulation of these four pillars and was aware of the subsidised initiatives NZTE was running. The sequence the pillars were undertaken reflected the availability of these NZTE initiatives. In 2006, they were part of NZTE's Better-by-Design (BBD) programme, which was aimed at helping them accomplish pillar 1. In 2007 the focus shifted to pillar 2. The first step in achieving pillar 2 involved moving into a new factory and the second step involved becoming one of the *Direct* funded NZTE lean companies to

improve the manufacturing process. Company O were not only seeking to improve their manufacturing process to 'World-Class' standards, they also hoped to boost productivity without having to invest more money in staff or machinery.

### **3.1.3 The decision to go lean**

The OM had some experience with lean manufacturing prior to his engagement with NZTE. His understanding of the lean philosophy was limited although he had some experience with implementing lean tools and techniques. His understanding of lean was based around the 'commercial' lean products available in the market. He viewed lean as a set of tools and techniques that are applied in a linear step-by-step method to get to an end point – *'Lean equals whole lot of tools – whatever you do to get yourself down to single piece flow'*. The OM had experimented with cellular design and single piece flow tools with some success. He had applied these tools in an ad hoc way with the limited financial resources that were available to him. His main focus prior to the NZTE programme was on achieving single piece flow, as this would enable them to work on multiple products at once. However, he did not regard this work as *'implementing lean'* and believed that they only truly kicked off lean manufacturing in 2007 through of a formal lean programme. This showed that he had a compartmentalised view of lean manufacturing.

Company O had dabbled with lean tools in the past to improve efficiency and was fully aware that achieving the pillars would be a costly exercise. They were not prepared to fully commit to lean before the subsidised NZTE programme was made available. Throughout the discussion the OM emphasised that they were financially constrained due to a downturn in the global economy and they saw the subsidised initiative as a viable means of implementing lean. It is likely that without the NZTE subsidy they would not have embarked on a lean transformation. Therefore the main driver for Company O undertaking lean was the NZTE funding. There was no significant external or internal pressure on them to change. They had experienced increased competition from Chinese manufactures in recent years but this did not play a part in their decision to undertake the lean initiative.

### 3.1.4 Strategy for change

The pillar guiding the lean initiative was ‘World Class Manufacturing’ though it was not clear what being a ‘World Class Manufacturer’ encompassed. It seems that ‘World Class Manufacturing’ was used a catch phrase for the year. They did not have an action plan to operationalise their vision and they did not set any KPI’s to measure progress. There was no work done on identifying the underlying problems or challenges the company was facing which meant that they did not know what they were working towards and what it would take to get there. The failure to identify prevailing internal or external factors to ‘pull’ the change initiative meant that the lean initiative was ‘pushed’ onto the employees without getting them ready for change. The vision of ‘World Class Manufacturing’ was not deployed beyond the SMT level. This was made apparent by the PS who was unable to articulate the vision.

The organisation did not have a clear strategy for the lean transformation, as they had opted for the *‘just do it’* approach. They also failed to formulate an exit strategy for the consultant. The NZTE programme was purely aimed at the core manufacturing processes with no plans to implement lean in any of the supporting departments. The NZTE programme was treated as a stand-alone project and no effort was made to align this programme with the previous work the OM had attempted. Although the OM knew a little about lean, the NZTE programme did not focus on training the OM to lead the change initiative, instead the consultant was charged with leading the initiative and the OM became a member of the a lean team. There was little buy-in from the other five senior managers as none directly participated in the lean initiative. This showed a clear lack of commitment from the SMT towards the change initiative.

The OM decided that he would be part of the assembly team to optimise gains in this area. The OM was not aware that part of his role as the champion was to take on a leadership role and learn how to lead the change initiative once the consultant left. It is likely that the brief for the consultant did not say that one of the key tasks for the engagement was to equip the OM with the capability to lead in the future. Consequently the OM failed to develop the necessary skills to lead the project once the consultant left. As soon as the consultant left the OM resorted back to what he was comfortable in which was applying ad hoc tools and techniques. He was contemplating implementing *Kanban* tools onto the manufacturing process at the time

of this study. The SMT also plan to shift machines closer together to free up more space for warehousing, a strategy that does not align with the lean philosophy. The approach Company O took in implementing lean clearly shows that they viewed lean as a set of tools for short-term productivity growth and they failed to see lean as a continuous improvement methodology.

### **3.1.5 Implementation steps**

Company O had no history of workplace-learning at any level prior to the NZTE initiative and they had no plans to continue with organisational training following the lean initiative. Organisational training was seen as a costly exercise. Their lean training began with the SMT organising the factory staff into four cross-functional lean teams. The monthly trainings were only focused at the shop-floor level employees. The training involved introducing the teams to the principles of lean manufacturing with a specific focus on the 5S tool. It was clear from the discussions with the informants that the shop-floor understanding of lean manufacturing was limited to 5S's. This was validated by the PS stating that – *'We've only looked at 5S and we haven't even completed that, it's taken a whole year. 5S is our bible till we get told something else'*. During the programme the shop-floor focused solely on improving the core manufacturing process. The supporting processes such as the toolshop, dispatch, etc were not included in this programme as they were not part of the core manufacturing process. Once again this shows the compartmentalised understanding of lean manufacturing held by organisation.

Through the 5S programme the employees were taught several simple visual management techniques such as colour coding trolleys for different parts. The lean teams worked on improving the processes by removing clutter, labelling and colour-coding products and raw materials and making a place for all the tools that they needed. Shadow boards were erected where necessary to hold the tools. 5S audit sheets were created to enable the management team to assess progress on a monthly basis. A review of the 5S boards during the site tour revealed that the audits had not been done for some months, suggesting that the organisation was having trouble sustaining the lean drive.

### **3.1.6 Staff engagement and behavioural changes towards lean**

Overall, the lean teams were satisfied with the consultant and his training methods. The SMT believed that the consultant training was sufficient for the employees to gain a good grounding in lean. This training was also the main mechanism used to get staff buy-in to the project. After some initial resistance to change most of the shop floor staff had bought into 5S after seeing improvement from making changes. A good number of the employees found their jobs boring and 5S was something new for them. Several resistors still existed on the shop floor but the managers did not have the leadership skills to deal with them. They employed a *'they'll come around eventually'* approach to this problem. The lean groups were encouraged to come up with ideas for changes to instigate a bottom-up drive for continuous improvement. However, the SMT had not put any effort into formalising the bottom-up drive concept and the system never eventuated.

### **3.1.7 Adding value to the end-product**

Company O had attempted to understand what their customers actually valued in the products through the BBD initiative but the SMT had failed to align the staff to their customer demands. When the key informants spoke about customer value all they saw was quality control and defect prevention. This suggested that their understanding of customer value revolved around quality and defects. There were no wider issues associated to customer value whenever customers were mentioned.

It is highly likely that the improvement initiatives were not adding real value to the end product.

### **3.1.8 Changes from implementing lean**

A clean and tidy factory is the biggest change Company O has seen. They have made good progress on their 5S's and have seen significant improvements to the housekeeping culture. Both informants felt that as a result of the factory being more organised, items were much easier to locate and this resulted in an increase in productivity. The OM believed that his work with cellular design and single piece flow combined with the 5S programme had led to a productivity increase of 26% in 2007. However, it was unclear whether the organisation's productivity growth was due to changes in the market forces or a result of lean manufacturing since they did not have a robust mechanism to measure improvements. They relied heavily on visual

monitoring and past experiences to judge the effectiveness of the changes they were making. The assessment of progress was based on anecdotal evidence. There was little evidence of employees continuously revisiting previous improvement activities to reassess and further improve them. Completion of an improvement activity was seen as the end point of a task, not a beginning of a continuous improvement process.

### **3.1.9 Sustaining the lean momentum**

It was clear that Company O was struggling to continue the initial momentum and drive the consultant provided. Both informants mentioned that the lean initiative had stalled once the consultant departed and things were quickly sliding back to the old ways. The shop floor employees started to resort back to their previous work habits and the OM reverted back to his old ways of implementing one off lean tools. Production deadlines had taken precedence over quality improvements and lean is only 'done' when they have downtime. This was evident from inspecting the factory as none of the improvement boards had been updated for some months. The PS stated that - 'we will work on 5S next year when we are less busy'.

The informants blamed the loss of lean momentum on factors such as production and financial pressures, and losing the consultant. The OM remarked that their greatest inhibitor to continuing on the lean journey was the lack of finance and production pressures. He believed that it was crucial to continue receiving support from a NZTE funded consultant to drive the lean project forward. The PS believed the lean initiative stagnated because the SMT did not allocate ample time and financial resources for the employees to carry out lean activities. The informants were correct in saying that lean changes were costly but in reality changes cannot be made without financial investments. Company O not only needs to view lean manufacturing as a long-term investment and not a short-term cost but they also need to address several key issues if they want to embed a true culture of continuous improvement. These key issues are discussed next.

### **Compartmentalisation of lean**

Company O did take a synergistic approach to implementing the four pillars. There was no continuity from one pillar to the next with each being treated as a separate self-defined entity requiring a different set of resources over a fixed timeframe. They

had compartmentalised their implementation of each pillar by shifting from one pillar to the next every 12 months. There was very little evidence of any alignment or continuity between the pillars or NZTE initiatives. They had undertaken three different initiatives over three years with the previous. The annual movement from one pillar to the next required the organisation to pull all resources away from the preceding initiatives to the subsequent ones. The progress of the preceding initiatives was restricted once this resource was relocated.

The NZTE lean programme was treated as a separate entity specific to one particular pillar only. Lean manufacturing was seen as a tool to realise their '*World Class Manufacturing*' pillar and their approach towards implementing lean had followed their misconception. They have not changed what they were previously doing and have only managed to introduce a few new tools into their existing system. The improvement initiatives are back to what it used to be with the OM doing what he can and when he can with his limited knowledge. Future improvement plans primarily revolve around implementing *Kanban* tools through the factory. Both informants were shown and explained the Lean Iceberg Model and both believed that they had only attempted the tools aspect of lean and were very much '*above the waterline*'.

A compartmentalised understanding of lean has also meant that the organisation failed to shift from the traditional profit-driven ethos to a customer-value oriented philosophy. Company O was not engaged with their customer values, which meant that they were not aware of which activities added real value to the end product. Customer satisfaction takes the shape of quality inspection and defect prevention instead of adding value to the product through continuous improvement processes.

### **Lack of change strategy**

Company O did not develop a strategy to operationalise their vision. They were not engaged with what they needed to do, what the end point was and what actions needed to be taken if they were to go off track. They did not have a rigorous process to establish if they had improved and they relied on anecdotal evidence to measure change. Company O did not have an entry or exit plan for the consultant. They had an existing way of making improvements which they put aside during the NZTE phase, and now they have turned back to the previous improvement systems.



### **Lack of SMT commitment to change**

The SMT failed to demonstrate any significant commitment towards the improvement initiative. The PS mentioned that they only saw the managers on the shop floor when there was a problem. It was left to the consultant to provide the impetus to improve. The SMT passed the responsibility for generating the lean drive onto the employees after the consultant left. The employees were expected to come up with improvement suggestions to keep driving the initiative forward however this concept never eventuated into a formal system.

### **Not developing lean champion's capabilities**

The SMT did appoint a champion to oversee the initiative but they did not develop a strategy to give him the capabilities to lead the change into the future. The OM was the lean champion but he failed to develop the necessary skills to lead the lean initiative forward. He decided to undertake a participatory role during the NZTE programme and relied on the consultant to provide the necessary leadership.

### **Subsidised funding 'pushing' change**

They were financially constrained and were not prepared to fully commit to lean until funding was made available. Company O relied heavily on the NZTE subsidy to ease the financial pressures of making changes. They had some capabilities with lean but it was working in a fragmented way. The lean initiative stalled once the funding dried up. It is likely that they would not have undertaken lean if it was not funded.

Company O did not have the resource capabilities to make the radical changes they had planned. They were financially constrained and were not prepared to fully commit to lean until funding was made available. They had some capabilities with lean but it was working in a fragmented way. When funding came along they made a 'push' for full lean implementation. They failed to identify any strong external or internal factors to 'pull' the change initiative. The consultant used a standard 'recipe' to 'push' lean with a focus on one commonly used lean tool. This resulted in the mere attachment of a popular tool onto the existing organisational procedures and culture. This 'recipe' served to oversimplify the complexity and scope of such a change process and the effort required to successfully implement it. The lean initiative stalled once the

funding dried up. It is likely that they would not have undertaken lean if it was not funded.

## **3.2 Case Study B – Company E**

### **3.2.1 Introduction**

This case study was conducted at Company E in early 2009. Company E undertook the 20 Keys lean initiative as an *Aichi 2* member. Two key informants were interviewed and a site tour was carried out at Company E. The key informants were the Operations Manager (OM) and the Team Leader (TL). The OM is responsible for overseeing the day-to-day operations of the business and a board of directors (BOD) oversee strategic planning. The OM has been working at this organisation for 18 months and was appointed after a major organisational restructure in 2007. The 20 Keys project was defunct by the time the OM arrived at the organisation and he has since introduced several new ‘embryo’ projects to revive the continuous improvement drive. This case study will discuss the two lean approaches undertaken by Company E; the 20 Keys approach through *NZTE’s Aichi* lean programme which was undertaken before the restructuring and the ‘embryo’ projects which had no NZTE links and were undertaken after the restructuring. This section will give an account of the 20 Keys initiative and why it was not sustained and will also provide an insight into the new ‘embryo’ projects. The TL is the only surviving member of the previous middle management team and was in the best position to give a detailed insight into the 20 Keys initiative.

### **3.2.2 Description of organisation**

Company E is a large food manufacturing company with three manufacturing sites in NZ. They began operating in 1996 as an SME and grew rapidly by acquiring well-known NZ food brands into their portfolio. By 2006 they had grown into a large organisation supplying the Australasian and UK markets. This case study was carried out at their largest manufacturing site (Site A) which is situated in one of NZ’s main centres. Site A was managed by the owner-operator until 2007. The 20 Keys programme was implemented only at Site A and was initiated in 2006. Site A has been in operation for 14 years and have approximately 50 full time employees. Site A had a history of high staff turnover and low productivity. They had a history of poor people management, as there had been no effort put into employee development and retention for many years. The manufacturing division was having major problems meeting deadlines and productivity rates were particularly low as a result. The

employee and manufacturing problems largely came down to the owner-operator's and the SMT's poor management skills. The BOD had given the owner-operator an ultimatum to improve the operations at Site A and he jumped at the opportunity to implement lean when NZTE offered them a place on their lean initiative. He saw the 20 Keys programme as a good opportunity to improve the manufacturing operations and employee relations.

### **3.2.3 The 20 Keys initiative**

Company E commenced their 20 Keys initiative at the start of 2007 with an NZTE nominated consultant. NZTE had aimed to develop a cluster of local lean practitioners by simultaneously instigating the 20 Keys programme in three different food manufacturing companies. Company E was expected to implement the 20 Keys programme concurrently with two other food manufacturing companies in the hope that these organisations could learn from each other's experiences. However, they failed to establish an effective relationship with the other two companies and the concept of knowledge sharing did not eventuate. A lack of leadership from within the organisation played a significant role in the failure of this venture.

#### **The decision to go lean**

As the interviewees were not part of the decision making the following is their belief of why the lean initiative was undertaken. It is likely that the owner-operator decided to undertake the 20 Keys initiative as a desperate measure to fix the manufacturing and staffing problems. Site A was performing poorly in all aspects and the BOD demanded radical changes to be made to improve the performance of the site. It is probable that the owner-operator saw the 20 Keys programme as a likely solution to his organisational problems.

#### **Strategy for change**

Despite having some serious problems the organisation failed to use this as a basis to develop an action plan for change. The consultant was charged with implementing the 20 Keys programme in the manufacturing department without any link to an overall organisational goal. The 20 Keys programme was implemented in isolation with a focus on delivering short-term improvements. There was no strategy in place to implement the 20 Keys as part of a long-term methodology for embedding continuous

improvement. The focus of the initiative was simply on making step-by-step incremental improvements to the core manufacturing processes beginning with 5S activities. No KPIs were set to measure and monitor the improvements. The only target staff had was moving through the various levels of each Key.

### **Implementation steps**

Individual areas were broken down into ‘mini-businesses’ and groups were given ownership of these businesses. This was done to encourage ownership and buy-in to the 20 Keys project and ensure that all employees were directly contributing to achieving the 20 Keys. The consultant provided monthly training sessions on the 20 Keys. Only members of the management teams directly participated in the training sessions and were expected to transfer their knowledge on to the shop floor employees. The main objective of the training was to give staff an overview of all 20 Keys with a specific focus on Key 1. With a basic introduction to the concepts of lean the shop floor staff were expected to implement these changes with supervision being provided by the team-leaders. The owner-operator did not take a direct part in the training and he failed to take on a leadership role. He also failed to appoint a champion to lead the improvement effort. In effect it was the shop floor employees who were given the task of driving and implementing changes. The response to the training and knowledge imparted by the consultant was positive. The employees enjoyed having the opportunity to do problem-solving activities and learning something new.

### **Sustaining the lean momentum**

Based on the TL’s understanding of the 20 Keys it can be concluded that the training only focused on the introducing the basics concepts of the 20 Keys. No emphasis was placed on developing the capabilities of the organisational members to lead the implementation of changes. The SMT were not committed to change and little progress was made with the 20 Keys initiative and in reality no gains were made from it. Consequently, the 20 Keys programme did not result in the radical changes that the owner-operator was seeking. The BOD stepped in towards the third quarter of 2007 to make the changes required to keep Company E in operation. The BOD decided to restructure the entire organisation. The owner-operator, all the senior managers, most of the middle managers and many of operations staff were asked to stand down from their roles and specialists in areas such as operations, planning, logistics, etc were

employed. The BOD appointed an overseas-trained OM to take over the daily running of the business. The restructuring took all focus away from the 20 Keys initiative and the project was abandoned before the training was completed.

Despite the abandonment of the lean initiative the TL attempted to make changes and make some improvements to the manufacturing operations. She held shares in the company and feared the worst if any improvements were not made. The TL stated that individuals who owned shares in the company showed the greatest willingness to implement lean and see the changes eventuate. The TL made some changes to the housekeeping systems on the shift she was overseeing. Her quest to continue on the lean journey was greatly hindered by the major loss of lean knowledge and understanding as a result of the restructuring. Company E failed in their efforts to implement the 20 Keys programme and the reasons for this failure are discussed next.

#### **Erroneous understanding of lean**

Company E had no experience with lean manufacturing prior to the NZTE engagement and their understanding was based on what they had learnt from the 20 Keys programme. They failed to understand lean as an organisation-wide customer value focused continuous improvement methodology. They viewed lean as a short-term tool for solving manufacturing problems.

#### **Lack of change strategy**

They had no action plan for implementing the 20 Keys initiative. The 20 Keys programme was attempted in isolation with no link to an overall organisational strategy. There was no evidence to suggest that Company E did any strategic planning and/or deployment as the TL could not articulate the company goals and objectives and there were no sign of any visual display of a vision or strategy through the site.

#### **Lack of SMT commitment to change**

The owner-operator did not participate directly in the training and relied on the shop floor to make the improvements but these employees did not have the skills to make such changes. His understanding of lean manufacturing was minimal and he was not aware of the role he had to play as the leader to direct such a change initiative. He also

failed to appoint an internal champion to lead the initiative during the implementation stage and lead it into the future.

### **Employee resistance**

The attempted lean implementation led to resistance on the shop floor and created a negative perspective of lean manufacturing. Lean was viewed as just another management fad and lean meant increased workloads to most people. This created distrust between the shop floor and management and employees failed to buy-in to the initiative.

### **High-staff turnover**

Many of the employees trained in lean lost their jobs as a result of the restructuring. The majority of the new staff members had had no previous exposure to lean manufacturing. Some individuals were still motivated to continue with the improvements but progress was greatly impeded by the low level of lean understanding within the organisation.

### **3.2.4 The Operation Manager's 'embryo' projects**

The OM had previous exposure to lean manufacturing through his tertiary education and work experience. He was the lean champion in his previous role for a food manufacturing company and this role basically involved setting up a 5S system. It seems that his experience with lean did not have a large bearing on his appointment as the OM, however he had taken it upon himself to be the lean champion and drive the continuous improvement culture at the organisation. The OM mentioned that the lack of financial resources and employee resistance due to lack of lean understanding were holding him back from fully committing to lean. The OM was certain that a government-subsidised consultant was what they needed to embark on a full lean transformation. He believed that the consultant would provide the necessary impetus for change and keep them on track if they started to slide back to their old ways. Company E did not have any workplace-training systems in place and the financial constraints meant the OM could not afford external training or education on lean. The OM set up several 'embryo' projects to slowly train the staff on lean and revive the continuous improvement process. The focus of these projects was on building organisational lean knowledge and understanding by introducing common lean tools

and techniques to improve the housekeeping system, process control, and reduce work in progress. The ‘embryo’ projects were to run for two years before the OM embarked on a full lean transformation.

### **Strategy for change**

The ‘embryo’ projects were implemented in an ad hoc manner. The projects were monitored using several KPI’s; however these KPI’s were not aligned to a strategy as the OM *‘did not believe in having an organisational vision or a lean strategy as they were too fuzzy’*. The KPIs measured were overall equipment efficiency, defect rates and productivity. The OM did not ‘label’ his projects as lean as there was some resistance from the shop floor towards lean already. He had not told the staff about his lean plans and he was simply aiming to give the staff an introduction to lean with the ‘embryo’ projects before embarking on the full transformation. He hoped that the benefits gained from the ‘embryo’ projects would eliminate the resistance towards lean before the drive towards full lean transformation. The ‘silent’ approach has created some confusion on the shop floor as the TL was still persisting with the 20 Keys initiative whilst the OM was initiating the ‘embryo’ projects. It is likely that the lack of a formal strategy and the poor communication between the different levels were the reasons behind this problem.

### **Sustaining the lean momentum**

The implementation of ‘embryo’ projects had seen the reduction of work-in-progress stock, implementation of a system for process control and an improvement of the housekeeping system. The OM was starting to see more buy-in to the projects from the employees as they were seeing the benefits from the changes that were happening. The site tour revealed a clean and tidy factory however there were little visual displays of information around the factory. It was difficult to tell from the site tour that the organisation was actively working on embedding a continuous improvement culture. No value stream maps were visible and the TL did not know what a value stream map was. The organisation was very much divorced from its customer value and the shop floor only heard about their customers if they had stock outages or customer complaints. It seems that the manufacturing business viewed the internal warehouse as their main customer. The warehouse carried large amounts of stock and manufacturing generally worked towards replenishing stock as it was sold.



On examining the Iceberg Model the OM remarked that it was easy to get people doing *'above the waterline'* facets but it was difficult to achieve *'below water line'* aspects and they were not actually achieving any *'below the waterline'* aspects yet. He stated that *'changing the culture was the hardest thing'*. The TL's response to the model was that – *'we are very much above the water line and we are a long way off lean becoming a way of life'*. Some of the key challenges facing this company in changing to a continuous improvement culture are discussed below.

### **Erroneous understanding of lean**

The OM's understanding of lean was very much tools and techniques focused and his approach reflected his understanding. The approach undertaken by the OM has compartmentalised lean into a tool for the manufacturing operations. The 20 Keys initiative had already created a misunderstanding of lean on the shop floor and the OM's approach merely heightens this misconception. Company E needs to shift its thinking of lean to an organisation wide customer-value based philosophy if it is to sustain the *'embryo'* projects.

### **Lack of change strategy**

Company E does not have an organisational vision and they don't have an action plan for the *'embryo'* projects. The *'embryo'* projects have been applied in an ad hoc manner. This has created some confusion on the shop floor as the TL is persisting with the 20 Keys approach. It is likely that Company E will merely observe short-term gains without any long-term benefits if they continue with the ad hoc application of the *'embryo'* projects.

### **Employee resistance**

The employee resistance that was built up from the 20 Keys implementation still exists on the shop floor. The lack of lean understanding and the continual poor communication between the different levels has exacerbated staff resistance. The restructures have created a bad image of lean manufacturing and staff are suspicious of change programmes. This had prompted the OM to take on a silent and incremental approach to implementing lean changes. Overcoming employee resistance is possibly the biggest challenge facing Company E in sustaining lean.

### **3.2.5 Commonalities between the two approaches in sustaining lean**

It is clear that there are some commonalities between the two different approaches undertaken at Company E. An erroneous understanding of lean, lack of strategic planning and employee resistance has been the common elements with both the 20 Keys and the 'embryo' projects. These problems were significant in the downfall of the 20 Keys initiative and are likely to hinder the long-term sustainability of the 'embryo' projects.

### **3.3 Case Study C – Company V**

#### **3.3.1 Introduction**

This case study was conducted at Company V in February 2009. Company V is one of the newest members of NZTE's *Direct* lean programme having begun their lean transformation in February 2008. This section presents the findings from the two key informant interviews and the discussions with a third informant during the site tour. The main informants were the CEO and the OFI administrator. The third discussion and site tour was carried out with the Production Manager (PM). The CEO and the PM are part of the SMT and the OFI administrator is part of the middle management team. The CEO oversees the day-to-day running of the business and he instigated the lean programme. The PM looks after the manufacturing operations and oversees the planning, implementation and monitoring of shop-floor improvement activities. The OFI administrator is responsible for managing the lean OFI system.

#### **3.3.2 Description of organisation**

Company V is a large NZ organisation based in one of NZ's main centres. They have 160 full time employees and have been operating as different entities over the last 50 years. They specialise in the design and manufacture of complex aviation products and have a single manufacturing facility supplying both domestic and international customers. Company V was run by the owner-operator who was also the majority shareholder until December 2006. Prior to 2006, the organisation had invested a significant amount of resource into developing the product they are currently manufacturing. The product development had taken longer and had cost more than the initial budget and after the product was ready for manufacture the customer orders had not flowed through in time to recoup this investment. The lower than anticipated sales and high cost of development led to severe financial stress and the organisation was heading towards bankruptcy in 2006. The company was rescued towards the end of 2006 when a new group of investors purchased the business and took over from the old shareholders including the owner-operator. The new group took charge of the company in December 2006 and appointed a shareholder-CEO to revive the organisation.

### **3.3.3 Lean education and background**

The majority of the SMT, including the CEO, are tertiary graduates but most had had limited exposure to lean manufacturing prior to the involvement with NZTE. The CEO got his first genuine insight into lean manufacturing at a NZTE workshop. The PM joined the organisation after the shareholder changes. He had been exposed to lean manufacturing in his previous job in the UK and his lean knowledge and experience played a major part in him attaining the PM's role. The OFI administrator had had no previous exposure to lean prior to the NZTE engagement. Her role with the lean project is focused on setting-up and administrating the OFI system. She is responsible for ensuring that every single OFI is actioned and the employees are made aware of the outcomes. She is responsible for overseeing that the PDCA cycle is completed on each OFI. All shop floor staff have gone through some formal industry based training as they are required to deal with technical specifications and have to adhere to stringent industry regulations. Company V is actively seeking to improve the lean knowledge on the floor by recruiting people who are experienced in lean and/or providing formal lean training including lean courses through an external training provider. The training is aimed at the middle and lower-level management and shop floor staff. The middle and lower-level management also receive external training on leadership, staff management, and general project management skills. The SMT see the value in continuous learning, and they do make an effort to continuously learn about lean through reading publications.

### **3.3.4 The decision to go lean**

The CEO and his SMT spent the first 12 months – *'stabilising the organisation in terms of rectifying the order books, identifying revenue streams, getting suppliers back on line, re-establishing and re-negotiating credit terms, etc'*. Once the organisation was stable the CEO shifted his focus towards changing the negative culture that had been created on the shop floor by the previous owner-operator's authoritarian style and the financial situation of the company. The CEO was seeking to boost productivity growth over the coming years and he figured that the only way to achieve this was by changing the negative culture on the shop floor. The CEO had established that he needed to change the negative culture but he was not sure on how to achieve this.

In 2007 NZTE invited the CEO to attend a series of workshops they were running in the region. These workshops introduced local manufacturers' to the manufacturing initiatives NZTE were running at this time. The initiatives were BBD, Manufacturing Plus and Lean Manufacturing. The collective implementation of these initiatives was meant to lead an organisation to a culture of continuous improvement. After attending the introductory workshops the CEO was convinced that he needed to undertake the NZTE initiatives to achieve the cultural transformation he was seeking. The CEO was the only one from Company V to attend the first workshop and he asked several other members of his SMT to attend the subsequent workshops to get their buy-in to the initiatives. The SMT attended several workshops, spoke to other manufacturer's who had experienced implementing these initiatives and also visited several organisations to personally experience the changes. Upon completion of the workshops the SMT came to the consensus that they needed to be part of this initiative if they were to implement a culture of continuous improvement. The SMT were aware that they had limited internal capability to make such changes and it would have taken them a lot longer to initiate such a major change initiative without the support of NZTE. The NZTE subsidy eased some of the financial pressure on the organisation but it was not the key reason for undertaking these initiatives.

NZTE had offered Company V a spot on their manufacturing programme in mid 2007 but the CEO decided to delay implementing the initiatives until the organisation was ready for such a big change. He was aware that attempting an organisational transformation was a major commitment and he wanted to get the process right the first time as the failure of this programme would merely aggravate the shop floor negativity. Once the business was 'stable' the CEO embarked on changing the organisational culture. Company V initiated the BBD, Manufacturing Plus and Lean Manufacturing in parallel in February 2008. The BBD programme was aimed at identifying niche markets and determining exactly what their customers were looking for in the products. The Manufacturing Plus programme was aimed at identifying the changes they needed to make to the manufacturing processes to satisfy customer needs and Lean Manufacturing was seen as the tool for making these process changes.

### **3.3.5 Strategy for change**

The organisation had a clear vision spanning five years and they had a strategy to get to this vision. This vision was reviewed every year and each department had to come up with 100-day action plans to align with the strategy. Their overall vision was to drive productivity growth over the next five years by implementing a continuous improvement culture. The strategy to achieve this vision was to use lean tools and techniques to drive process improvements. The OFI system was the main lean tool used to drive the process improvements with the key aim creating a closed-loop bottom-up drive for continuous improvement. This system was seen as an instrument for giving the shop floor a 'voice' in the changes and help in improving the communication between them and the management teams. The OFI system was also the main mechanism deployed by the SMT to gauge staff resistance and obtain buy-in to the change initiative. The SMT strongly believed that having monetary rewards incorporated into the OFI system would undermine their vision of a change in culture as staff might be only '*paying lip service*' for temporary rewards.

Company V decided to give the lean initiative an in-house name in order to promote greater shop floor buy-in and ownership. A review of the informants' responses shows that using an in-house name has led to greater buy-in and ownership from the shop floor. Company V also appointed a member of the SMT team as their lean champion to lead the initiative into the future. He had over 30 years experience in the manufacturing industry but had no involvement with lean manufacturing until the NZTE programme. The lean champion took responsibility of the improvement initiatives once the consultant left. During the NZTE engagement the champion took a participatory role in the training and improvement activities. The champion did have many years experience in managing staff but it was not clear how good his leadership skills were and no effort was made to gauge and/or improve his ability to lead the lean initiative whilst the consultant was onboard.

### **3.3.6 Implementation steps**

The shop floor staff were first organised into different process improvement teams (PIT) based on the various sectors they were working in and the consultant then began introducing these teams to a few common lean manufacturing tools and techniques. The PIT and SMT were introduced to concepts such as process mapping, flow, root-

cause analysis, 5S's, standardisation, etc with the SMT getting additional training on strategising, planning and management. After a brief introduction to the lean tools and techniques the consultant set about instigating the improvement activities with each PIT. The shop floor focused on 5S's and flow whilst the SMT concentrated on setting up the OFI system and standardising their products and operations. The consultant adopted a *'just-do-it'* approach to implementing changes as he believed that the principles of lean manufacturing were best learnt by real-time implementation of lean tools and techniques. The PIT focused on the starting point of the manufacturing process as they wanted to identify and solve problems at the source. Each internal sector became a supplier and/or a customer to other sectors. This was done to help individuals understand how their actions impacted their 'customers'. The 5S activity boards and the OFI boards were clearly visible during the tour and were up-to-date. The factory seemed untidy and disorganised but this was due to the constant changes that were occurring as a result of the improvement activities. The processes were being realigned to improve flow and the entire process was changing from a job-shop setup to a production line.

The SMT team including the CEO actively participated in the 5S activities to show their commitment. They spent significant time on the shop floor conversing with the staff about lean, encouraging them to make suggestions and getting their *'hands dirty'*. The SMT got involved in improvement activities on a day-to-day basis and they motivated staff through constant positive feedback and encouraging people to talk about lean. The CEO was strongly committed to embedding a continuous improvement culture and his commitment has been critical in keeping the staff focused and motivated to keep improving.

The PIT were responsible for making suggestions together with an implementation plan for improvements and the OFI team assessed each suggestion based on how well it aligned with customer demands. The OFI team was responsible for ensuring that each suggestion was actioned and the loop closed with a feedback. If an employee had his or her suggestion approved he was expected to take a leading role in implementing these changes. The CEO took personal responsibility for pushing the OFI team to action the ideas and he had formal reviews with the team once a fortnight. The OFI system had created healthy competition amongst the shop floor staff and this led to

the generation of some industrious ideas. OFI's have included suggestions on product and work station improvements, health and safety issues, and process and systems improvements.

### **3.3.7 Staff engagement and behavioural changes towards lean**

Giving the shop floor ownership of the problems through the OFI system has seen a gradual shift in their thinking from the old negative blame-culture to a pro-active problem solving culture. The staff have responded very positively to having a 'voice' in making improvements. The first major resistance facing the SMT was from the workers union. The union viewed lean as just another management fad to increase shareholder returns. The SMT decided to continue with the changes even without the backing of the union and the union changed their stance once they saw the improvements happening on the shop floor and within the employees.

Most of the employees had bought into the change initiative. The *'just-do-it'* approach had worked in demonstrating changes and getting the resistors to change their mindset. Most staff were eager to make improvements to their workplaces and the processes. However, they were still experiencing some resistance from staff who had adopted a *'wait and see'* approach as they also thought the initiative was just another management fad and the OFI's were just additional work. The SMT were working diligently to get the resistors to buy-in to the initiative by displaying OFI boards in the common areas and making people aware of how the improvements were benefiting the organisation. The number of new staff putting in OFI's was constantly increasing, which showed that more staff were buying-in to the initiative. There was also some resistance from the SMT who could not see the benefits of lean, but overall the SMT are committed to the initiative and all of them were participating directly in training and most had been involved in improvement projects.

### **3.3.8 Adding value to the end-product**

The BBD initiative helped Company V understand their customer value and focus on their market niche. The BBD initiative has enabled the organisation to shift to a customer-value oriented philosophy. Although the informants had a clear understanding of their customer values, they had failed to deploy and align the shop floor with these values. The SMT failed to see their processes as value streams and



this led to pockets of disconnected improvements. The shop floor disengagement with these customer values meant that some waste was being created from suggestions that did not align with the customers. However, any improvements made on the shop floor had to align with customer demands meaning that although there was some wasteful activities occurring and the improvements were compartmentalised, the focus was always on customer satisfaction.

### **3.3.9 Changes from implementing lean**

The single biggest change as a result of the lean initiative has been the change in the staff mindset. Staff are seeing the benefits from making the improvements and they are coming up with industrious ideas for improvement. The number of OFI's that were being submitted had naturally slowed down as most of the easier and cheaper improvements have been made leaving the 'harder' ones. The productivity had increased 42% since the new shareholder take over, however it was not clear if all the improvements came about from lean or partially from 'stabilising' the organisation. Company V had effectively used process maps to change from a job shop set-up where they made one product at a time to a production line. However, these process maps were not visible anywhere in the factory during the site tour. The workplaces were a lot tidier and organised and this resulted in the build times decreasing. They have standardised production to a few standard bases that can be adapted to meet customers' requests as opposed to the one-off specialised products they use to make. Having a production line means that staff now get to work in a team environment rather than individuals working on different jobs which has improved staff morale.

### **3.3.10 Sustaining the lean momentum**

Evidence suggests that shop floor staff still tend to revert to their old ways when the production pressure is high suggesting that they have yet to fully embed a culture of continuous improvement. This is not surprising as Company V is in the very early stages of their lean implementation however they have set a good foundation for building a continuous improvement culture. Even though lean was initially pushed onto the organisation the CEO made the decision to delay implementation until they had stabilised the company and had worked out a strategy for change. Whilst lean was seen as a tool specific to the manufacturing part, the organisation's key focus was always on changing their culture to one of CI. They have listened to the 'voice' of

their customers and have focused on improving customer satisfaction. They have a vision and a well-developed strategy with action plans to realise this vision. The SMT have identified a champion to lead the initiative into the future and have successfully implemented the OFI system. The OFI system and the in-house name for the initiative have given staff ownership of the change process leading to a greater buy-in. The CEO has invested time and money into training people and recruiting lean experts and most importantly, the CEO had made this change process his priority and his strong commitment has provided the project with genuine impetus.

The CEO was not able to view the Iceberg Model as he was out of time, however the OFI administrator believed that they had done a lot of good work '*above the waterline*' and they were not too far off achieving '*below the waterline*' aspects. The OFI administrator was correct in her analysis of the model as Company V has done the basics right and are well on their way to implementing a continuous improvement culture. They need to continue with their current approach and as aforementioned most importantly the CEO needs to stay committed to the course if they are to sustain these changes. However, they do need to address some important issues which will enhance their chances of sustaining this culture in the long-term. These issues are discussed next.

### **Not developing the lean champion's capabilities**

The SMT did appoint a champion to oversee the initiative but they did not identify and/or develop his capabilities to lead the change into the future. Having a champion with the correct skills to lead such a change process is critical to long-term sustainability of change initiatives.

### **Alignment with customer value**

Company V was not seeing their processes as a value stream and although the improvements are focused on satisfying customer demands, the changes are happening in a disconnected manner. They need to view their entire process as an interconnected stream that adds value to the end-product. The SMT have seen customer value merely as a KPI. The SMT need to engage and align each staff member to their customer values so that they can visualise their actions in terms of value adding versus wasteful activities. If the staff members are aligned to their

customer values their suggestions would be better aligned to identifying and eliminating non-value adding activities.

## **3.4 Case Study D – Company C**

### **3.4.1 Introduction**

This case study was conducted at Company C in early 2009. Company C was an *Aichi I* member in NZTE's 20 Keys programme and they initiated lean manufacturing in 2005. They were into the fifth year of their lean implementation at the time of this case study. Two key informant interviews and a site tour were done at this organisation. The key informants were the Operations Manager (OM) and the shop floor Team Leader (TL). The OM is a major shareholder in the firm and he was the instigator of the lean initiative. The TL had been working at the organisation for five years and was part of the middle management team and was directly involved with planning, implementing, and monitoring shop floor improvement activities.

### **3.4.2 Description of organisation**

Company C is an SME based in one of NZ's main centres. Three directors who have owned the firm since its inception 21 years ago oversee the business. There are 43 full time employees and the directors are still involved in the operation of the company on a daily basis. They have recently employed a CEO to oversee the day-to-day operations of the organisation. Company C is a job-shop making one-off products. Each product they manufacture is unique and has to be specially designed for the particular customer.

### **3.4.3 Lean education and background**

The informants had no formal training in lean manufacturing prior to the NZTE engagement. The OM had some exposure to lean through his readings and through interactions with other manufacturing organisations prior to the NZTE programme. He was a member of the lean cluster set-up by NZTE to promote dialogue and knowledge sharing amongst local lean practitioners but he felt that the discussions were unstructured and he did not gain much from these gatherings. The shop floor education level was low and all training including lean manufacturing was done in-house. The organisation was financially constrained to provide staff with external training however they did see the importance of ongoing training and have developed an internal system. They have set-up a *Kaizen* room where the lean champion

conducts regular lean training sessions with staff. The *Kaizen* room has become the centre for training and project assessment.

#### **3.4.4 The decision to go lean**

Due to a downturn in demand and increasing competition from Asian manufactures Company C was under severe financial stress and was heading towards bankruptcy in 2005. NZTE initiated their 20 Keys programme in 2005 and identified Company C as a 'high growth potential' company. It didn't take much to convince the SMT to commit to the NZTE 20 Keys programme when they were offered a place on the *Aichi* initiative. The SMT committed a large amount of money to this project for the first 12 months and hoped that the 20 Keys programme would rescue the business from bankruptcy. The subsidy provided by NZTE did ease some financial pressure of implementing changes but the main reason for Company C undertaking the 20 Keys was to avoid bankruptcy. The 20 Keys programme was initiated in 2005 through a NZTE nominated consultant.

#### **3.4.5 Strategy for change**

The 20 Keys programme was focused on fixing historical problems and radically changing the manufacturing operations to deliver immediate gains in profitability. The 20 Keys programme was not part of a wider organisational strategy. It was implemented in isolation in to deliver short-term productivity gains. The action plan for improvements was to decrease product-manufacturing time to boost productivity. It was hoped that the improvement in efficiency would make them more competitive in the market place leading to an increased market share and financial returns. The SMT were focused on changing the factory from individual basis to a team focus, standardising the process and products where possible, and creating manufacturing streams to reduce the cost of production. The 20 Keys programme was meant to deliver these changes but the consultant found that he could not apply many of the keys to a job-shop environment. The consultant basically introduced them to different tools and techniques of lean manufacturing and it was up to the SMT and shop floor staff to determine which tools and techniques were most relevant to them. Company C consequently adapted some of the Keys to suit their operations. They made little progress with the traditional 20 Keys but they had essentially developed their own set of 20 Keys. Their initial improvements were targeted towards the biggest bottlenecks.

The SMT developed time vs. dollar KPIs for the manufacturing sector and these were intended to keep the operations staff focused on minimising the cost of the product. These targets were clearly visible around the factory during the site tour.

### **3.4.6 Implementation steps**

The consultant held half-day introductory courses where he introduced all staff members to the basic concepts of the 20 Keys. The senior and middle management teams also visited other factories to observe and learn from their implementation efforts. The SMT were involved in the training courses but they did not directly partake in the improvement activities. The team leaders were responsible for driving the changes at the shop floor level. They firstly focused on implementing Key 1 across all manufacturing operations and this project spanned approximately eight months before the SMT switched their focus to their most problematic area in terms of historical bottlenecks. They attempted to carry out value stream mapping to visualise the process as a stream but they struggled to map their process due to the non-standard nature of their products. They changed the previous single-workstation set-up into manufacturing cells and arranged the cells according to product flow. They also focused on standardising products and processes whilst reducing the batch sizes. An OFI system was implemented to encourage staff buy-in and encourage them to come up with improvement ideas. The OM also worked on reducing work in progress and inventory. In addition to the manufacturing process changes the SMT worked on improving the raw-material handling system. They had had past problems with out-of-stocks hence they focused on working with their suppliers to establish a better raw material re-ordering system.

The organisation was satisfied with the consultant's performance but they felt that he was learning along side them, as he had never dealt with a job-shop before. Apart from 5S's the consultant achieved little else but basic introductory to his standard lean package. However, both respondents felt that understanding the basic concepts of lean was adequate to start the implementation process. The TL felt that the consultant was unrealistic with his expectations in some cases, as staff could not process what he was teaching. The consultant needed to simplify his descriptions so the shop floor staff could absorb what he was teaching. It took some staff longer to uptake information but they found it easier to understand the concepts through real-time participation in

improvement activities. The OM oversaw the projects for two years before handing over the lean champion's role to a postgraduate lean manufacturing student based at Company C. The new champion was charged with further standardising the processes and systems. He was also responsible for document control, updating the information boards around the factory, reviewing the improvement projects, and addressing and closing each OFI. The final say on the implementation of the OFI was made by the SMT based on how the suggestion linked to productivity growth. The actual implementation of the OFI was left to the owner of the suggestion where possible.

#### **3.4.7 Staff engagement and behavioural changes towards lean**

The SMT faced significant resistance from the shop floor when they first informed them of the changes that were going to happen. The staff were not enthusiastic about making such radical changes to their work environment with the longer serving staff providing the greatest resistance. The organisation also faced much resistance from staff seeing lean as more work for no extra remuneration. The SMT failing to participate directly in the activities also created resistance on the shop floor. However, in general the guys who were lower down the management hierarchy were the most enthusiastic about lean as they saw this as an opportunity to increase their knowledge and demonstrate their capabilities. The SMT attempted to counter the resistance by taking a rigid stance and telling staff that major changes needed to happen if the company was to stay afloat and if they did not like the idea they were welcome to find another job. One person left the organisation as he disapproved of the change initiative. Although many still resisted change they had no other choice but to participate in the change initiative.

The level of resistance had gradually decreased over the years as people gained a better understanding of lean. Seeing the benefits from making changes also played a major part in getting staff buy-in. Staff were very responsive to any improvements that decreased the frustration levels of working on the shop floor. The OFI system also helped gain staff buy-in as it helped enhance staff ownership of problems. Working in teams and having a clean and tidy factory provided the greatest motivation for the staff to keep improving. Nonetheless there were some resistors on the shop floor and staff were still frustrated with the poor communication between the departments, especially with the SMT.

### **3.4.8 Adding value to the end-product**

The only external entity involved with the lean initiative was their suppliers when the SMT were fixing raw material issues. Waste was primarily measured in the time it took to make products and they '*didn't do anything with the customer*' to understand what they actually valued. Throughout the discussions both informants linked the word 'value' to the dollar value of the product or organisational productivity. They had attempted to carry out value stream mapping activities but the uniqueness of their products meant that each product had its own value stream, as there was little commonality between the end products. The organisation had struggled with the 'traditional' value stream mapping process to a large extent.

### **3.4.9 Changes from implementing lean**

The continued fluctuation in demand for products and the downsizing made it unclear to judge how the change initiative had affected productivity. However, the organisation has made major changes to the manufacturing operations. They had not made much progress with the traditional 20 Keys programme however the new lean champion had adapted the 20 Keys into their own set of 'Keys' to suit the job-shop environment. They have organised the factory into product streams to improve flow and reduce human motion. They have set up manufacturing cells where staff work in teams rather than the previous individual workstation set-up. They have managed to standardise some of their operations across different products and have successfully created SOPs, which has contributed to a reduction in the production defect rate. However, some staff are still struggling to change their mindset to making smaller batch sizes as they cannot see their processes as value adding streams. Their view on manufacturing is still very much compartmentalised to making large batches of single products. Implementing the 5S's has improved working conditions and the staff are generally less frustrated. Staff buy-in into the initiative increased significantly with the implementation of the OFI system. The introduction of *Kanbans* alongside other system changes had contributed to an improved raw-material control. SOPs, *Kanbans* and shadow boards were clearly visible during the site tour and had been kept up-to-date.



### **3.4.10 Sustaining the lean momentum**

Company C had merely used the 20 Keys as a tool to improve manufacturing operations and deliver short-term productivity gains. They had successfully implemented several lean tools and seen some improvements but they were not seeing meaningful long-term improvements. Production took priority and improvement projects were put on hold when deadlines had to be met. The shop floor was inclined to resort to their old ways when they were busy. The TL mentioned that *'it is easy to forget about continuous improvement culture when you are busy'* showing that the organisation has yet to embrace a culture change.

On viewing the Iceberg Model the OM commented that *'below the water line aspects were the tough stuff. We started above the waterline and we are now changing to do some of the stuff below the waterline so we can move ahead'*. The OM had realised that to continue making improvements they needed to focus on *'below the waterline'* aspects and take a long-term approach focused on culture change – *'we have got to a point that to improve or get much better we need to focus on our planning process and we need to work on continuous education as well'*. They have realised that they need to consider the entire business as a value adding stream and not only focus on the manufacturing department. They have also come to the realisation that the only way to sustain these improvements is to change the organisational culture i.e. embed a continuous improvement culture. The OM has taken his focus away from the manufacturing to the other departments within the organisation to help them change their mindset. His main focus is on increasing lean knowledge and understanding throughout the organisation through ongoing training. The TL's view on the model was similar to the OM view. He believed that they had achieved a lot *'above the waterline'* but were struggling with the *'below the waterline'* concepts, with the biggest problem being poor leadership and commitment from the SMT. The reasons behind Company C failing to sustain lean are discussed next.

### **Erroneous understanding of lean**

Company C saw lean manufacturing as a tool for short-term productivity growth and not as long-term holistic methodology for embedding a continuous improvement culture. Their understanding of lean was based on the 20 Keys which they viewed as a 'standard' step-by-step tool for manufacturing operations. Their limited understanding

of lean manufacturing meant that they struggled to implement this ‘standard’ manufacturing tool to their ‘non-standard’ job-shop environment. They spent significant time adopting and developing their own set of keys so that they could continue with down the step-by-step approach.

### **Lack of change strategy**

They implemented the 20 Keys in isolation with no link to a wider organisation strategy. Company C had not understood the voice of their customers and they did not identify the root-cause of their problems. Their focus had always been on short-term productivity growth and their approach to lean reflected this. They did not use their financial crisis as a driver for change and failed developed a holistic action plan and improvements were made in pockets. Their implementation approach did not address the real problems that persisted. The KPIs changed with every new product they made and they focused on the productivity of each item. Company C did not have a robust system for measuring improvements and the lack of a formal auditing system meant that it was easy for the staff to slide back to their old ways. They were evaluating productivity on a regular basis but this did not give a clear indication of how the improvement projects were progressing.

### **Lack of SMT commitment**

Most off the SMT did not participate directly in the improvement activities and only the OM showed commitment to the change initiative. Overall, the SMT commitment was weak within the organisation. The SMT failure to actively drive the initiative had impacted the progress of the initiative and their ability to get full staff buy-in. Company C would have found it easier to change people’s mindset if they had all the SMT fully committed to the initiative from the start.

### **High-staff turnover**

During the consultant’s involvement and through further in-house training Company C had built up a pool of staff that were well trained on the 20 Keys programme. The pool of knowledge disappeared when they downsized due to the shrinking markets. Their progress with lean slowed down with the loss of this knowledge. The low pay rates were also a key reason in high levels of staff mobility. Staff got trained on the 20

Keys and used this knowledge as a base for seeking further employment. However, this did not stop the organisation from training each and every staff about lean.

### **Employee resistance**

The SMT faced much resistance from the staff at the start of lean initiative, as they did not like the idea of such radical changes. Staff resistance had declined gradually through the years as they began seeing the benefits of the improvements they were making. Nonetheless, the management team struggled with getting the staff to maintain the new systems they had implemented and some people continued to resist change. Remuneration issues and lack of SMT commitment exacerbated staff resistance.

## **3.5 Case Study E – Company T**

### **3.5.1 Introduction**

This case study was carried out at Company T in early 2009. They were a *Direct* funded company with NZTE and initiated lean manufacturing in 2007. They were 12 months into their lean initiative when this case study was carried out. Two key informant interviews and a site tour were done at this organisation. The key informants were the Engineering Manager (EM) and a shop floor Team Leader (TL). The EM was an experienced lean practitioner and he was the lean champion at the time of this study. The TL had been working at Company T for some years and he had been involved with planning, implementing, and monitoring shop floor improvement activities.

### **3.5.2 Description of organisation**

Company T is a SME based in one of NZ's main centres. They are a job-shop making large manufacturing and agricultural products. Each product is custom made to the end-users needs. All design and manufacturing operations occur on-site and they have a large export cliental. Company T has been in operation for 35 years and has 60 full time employees. The business gained a new shareholder-CEO in 2007. The EM joined the company two months after the new CEO and he manages the day-to-day running of the business.

### **3.5.3 The decision to go lean**

The CEO had been exposed to lean at previous organisations and was a strong advocate of lean manufacturing however he had little experience in the implementation process. He approached NZTE to join their lean programme in 2007 and NZTE agreed to fund him as a *Direct* member, providing consultant support for 12 months. Not long after being accepted on NZTE's programme, the CEO initiated the lean transformation. The CEO did not directly participate in the lean initiative and the consultant was charged with driving the lean initiative on the shop floor.

### **3.5.4 Strategy for change and implementation steps**

The organisation had a vision but they did not develop a strategy to align the improvement projects with this vision. Their entire approach to the lean initiative was

unplanned and lean was driven as a manufacturing tool for downtime. The lean implementation was merely an ad hoc application of common tools and techniques to the manufacturing process during downtime. The TL 'stated that *'as soon as we have a little downtime, it's back to the lean projects'* validating the compartmentalised approach Company T took with lean. It was left to the consultant to develop an action plan for the change initiative alongside the shop floor staff with little involvement from the SMT. None of the shop floor staff had any previous experience with lean manufacturing. The consultant's strategy focused on introducing the staff to some basic lean tools and techniques with the main focus on organising the shop floor using 5S tools.

The consultant split the shop floor staff into cross-functional lean teams and he carried out training during his once-monthly visits. The consultant introduced all shop floor staff to the basic concepts of lean and the team-leaders received a more in-depth focus on leading changes. They picked the most problematic areas to focus improvements on initially. The task for implementing the changes was given to the team-leaders but most of them struggled to cope with this added responsibility. They did manage to start the implementation of 5S's and they attempted to improve the flow through factory but overall they achieved very little during their 12-month lean programme. The EM stated that they had only made *'one months progress with lean in the 12 months they had been implementing it'*. This statement was validated during the site tour, as there was little evidence that any improvements had taken place, as the factory was still disorderly and hazardous in many aspects. They only had basic signage and several shadow boards on the walls.

The EM had previous experience in lean manufacturing through his tertiary studies and employment in UK. While the consultant was focusing on the manufacturing section the EM was initiating improvements with the other departments. He had adopted a holistic approach to lean focussing on a long-term culture change. He had carried out detailed value stream mapping in the sales and design departments but had only done basic value stream mapping on the shop floor. However, Company T had not attempted to understand the voice of their customers and there was no alignment between any of their improvement activities with their customers. There was no alignment between the consultant and the EM during the 12-month lean programme

either. The consultant's role was compartmentalised into a change agent on the shop floor primarily driving short-term improvements whilst the EM focused on initiating an organisation-wide long-term culture change. The EM had planned to roll-out his strategy after the consultant had completed his tasks.

### **3.5.6 Changes from implementing lean**

Overall, the staff buy-in to lean was good and this was mostly due to the consultant's ability to sell the benefits of lean. There was an acceptance for lean on the shop floor and they were aware that lean would be an ongoing process. There was some resistance at the very start related to the word 'lean', which was perceived as job losses but the lean training helped clarify this misunderstanding. Apart from an appreciation and a basic understanding of some common tools and techniques of lean, Company T has achieved very little on the shop floor. They had one notice board in the factory, which was out-of-date and disorderly. They were at the preliminary stages of the 5S project and had only achieved minor improvements to product flow through the factory. Besides 5S's the shop floor staff had struggled to apply the concepts of lean manufacturing to their job-shop environment.

After the consultants departure the EM took over the champion's role for the entire organisation and began a 'full' lean transformation. He was still formulating a strategy for change during the time of this case study and no improvement activities had been initiated. His initial focus was on completing a detailed value stream map of their entire process and creating a feedback loop with the customers and the shop floor. An upcoming project of note was the implementation of an OFI system on the shop floor to create a bottom-up feedback loop.

### **3.5.7 Sustaining the lean momentum**

Company T's progress with lean manufacturing was inconsequential. They were only just embarking on a true lean transformation after the consultant's engagement. The consultant merely acted as an educator for the shop floor staff and his biggest achievement was getting staff buy-in to lean. The consultant's involvement had resulted in very few improvements of note. Both informants shared a similar view on the Iceberg Model. The TL stated that they were merely touching the surface of '*above the waterline*' aspects of lean and the EM mentioned that embedding '*below*

*the waterline*' aspects was the real challenge of lean and that Company T should have put more emphasis on these aspects from day one. The reasons for Company T failing to make much progress with their lean initiative are discussed next.

### **Erroneous understanding of lean**

Their approach to lean reflected their compartmentalised understanding of lean. Lean was seen as a tool for the manufacturing department, it was not seen as a holistic organisation-wide methodology for culture change. They basically saw lean as a tool for downtime and had no strategy or KPI's in place to guide the initiative. They did not do any measurement of improvements and progress was based on anecdotal evidence. Production took precedence and lean was only attempted during downtime. The shop floor approach of lean reflected this understanding as they were under the impression that lean was just a tool for downtime. The consultant's role was compartmentalised into the driver for manufacturing improvements with no alignment with the EM. The EM only got involved with the shop floor once the consultant completed his term. The EM was running his own initiatives with the other departments whilst the consultant was working with the shop floor staff.

### **Subsidised funding 'pushing' change**

The organisation did not have any external or internal drivers for change. The NZTE subsidy was the main driver behind the implementation of the lean initiative. The CEO liked the idea of lean manufacturing but in fact the funding convinced him to commit to lean. When funding came along they made a 'push' for full lean implementation. The CEO did not develop an action plan for change and merely pushed the lean programme onto the shop floor hoping to eliminate manufacturing waste.

### **No internal lean champion**

Company T realised the need for a lean champion early on and appointed the consultant as the champion. The consultant was only there once a month in the capacity of the trainer and he did not manage to sufficiently develop the capabilities of team-leaders to drive the change initiative. They needed to have selected an internal lean champion to work alongside the consultant from the start to provide

continual drive for change. Alternatively, they could have appointed the EM as the lean champion immediately after his appointment and aligned his activities with the consultant.

**Lack of SMT commitment to change**

The SMT showed very little commitment to change. Some of them did not buy-in to lean and none of them got directly involved in any of the improvement projects. The drive for change was left to the shop floor team-leaders. The team-leaders understood the basic concepts of lean but they found that the consultant training did not sufficiently equip them with the ability to implement changes on the shop floor.



## **3.6 Case Study F – Company J**

### **3.6.1 Introduction**

This case study was conducted at Company J in early 2009. Company J was an *Aichi* 3 member in NZTE's 20 Keys programme and they initiated lean manufacturing in 2007. They were into the second year of their lean implementation at the time of this case study. Two key informant interviews and a site tour were done at this organisation. The key informants were the Operations Manager (OM) and the lean champion. The OM was the instigator of the lean initiative. The lean champion was part of the middle management team and was in charge of implementing the 20 Keys by creating action plans and participating in improvement activities.

### **3.6.2 Description of organisation**

Company J is a family owned and managed SME in one of NZ's main centres. The present general manager founded the business 32 years ago and they currently employ 32 full time employees. Many of the founder's family members including the OM have been involved with Company J for many years. The OM has been involved with the business for over 20 years and looks after all the manufacturing operations. They have two manufacturing plants in close proximity to each other. Their major site, which has been in operation since the business started, employs 14 full time employees and manufactures their core products. They manufacture a wide range of industrial products for both domestic and international clients. However most of their products are custom made and the factory is set-up as a job-shop with most products made and despatched within hours of receiving the orders. Some products are even manufactured within minutes of receiving the order. They have recently diversified into a new range of products and have set-up a second smaller manufacturing site next to the old site. This site employs two full time employees and is also run as a job-shop.

The OM appointed the leading hand from their main site as the lean champion when they initiated the 20 Keys programme. This leading hand was later promoted to a production supervisor's position in the new site and the OM appointed a different team-leader as the lean champion for the main site so that each site had a champion. The interview for this study was carried out with the original lean champion. The new

champion was undergoing lean training at the time of this case study. His training was being undertaken by the NZTE nominated consultant after the initial 12 months engagement with NZTE and Company J was independently funding the consultant for this additional training.

### **3.6.3 Lean education and background**

The shop floor staff had no experience with lean manufacturing prior to the NZTE engagement. The OM had a tertiary diploma in engineering but he also had no prior lean involvement. The entire organisational lean knowledge came from the 20 Keys programme. The OM had continued expanding his lean knowledge through reading books and engaging with other organisation's implementing lean after the 20 Keys training. The OM was a member of a lean cluster run by the consultant for local manufacturers to share ideas and problems. The OM was finding these meetings helpful however he found that none of the companies on this forum are job-shops. He found that *'his biggest challenge was that no one was in same boat that he was in'* which made it difficult for people to relate to his issues. The original champion was undertaking an extramural tertiary qualification in commerce but his studies had no lean component. Apart from monthly consultant visits there was no other formal training happening within the organisation. Prior to NZTE engagement the only formal training they did was on ISO 9002<sup>7</sup>. They had been running an ISO 9002 quality system for some time but had discontinued associating with the ISO in 1999. However they still use the ISO 9002 quality structure for end-product quality control.

### **3.6.4 The decision to go lean**

The concept of lean was totally foreign at Company J prior to their engagement with NZTE. The organisation was operating in surplus although productivity rates had been stagnant for a few years. They had no real crisis or urgent need to make changes. The SMT were simply looking for a method to incrementally improve what they were doing and see long-term organisational growth by removing operational waste. The

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<sup>7</sup> ISO 9002 – The International Organisation for Standardization (ISO) is the world's largest developer and publisher of international standards. ISO 9002 is a quality assurance model made up of quality system requirements. This model applies to organisations that produce, install, and service products. ISO expects organisations to apply this model, and to meet the requirements, by developing a quality system. ISO 9002 is now obsolete.

SMT wanted to do more with the resources they already had and eventually come to a stage where they had surplus manufacturing capacity to push for greater sales volume. The SMT were introduced to lean through NZTE's 20 Keys programme and two of the manager went on a trip to Japan to experience lean first-hand. Experiencing lean in action convinced the managers that the 20 Keys programme would help them achieve the steady growth they were seeking. Lean was seen as a tool that would give staff a new perspective on manufacturing operations and help remove the waste from their processes.

### **3.6.5 Strategy for change**

The implementation of the 20 Keys programme was compartmentalised to the manufacturing department. The 20 Keys initiative was not part of a wider organisational strategy. Neither of the informants could articulate a clear and defining organisational strategy showing that organisation did not have a comprehensible strategy. Their initial focus was on implementing the housekeeping system and improving product flow through the factory. The OM monitored '*on time shipping of goods*' as the KPI to see how the factory was improving as historically their biggest problem had been late deliveries to customers. Despatch was their biggest bottleneck and they were focusing making the items flow better to push the on time delivery close to 100%. Over the next five years they planned to implement at least five different keys with the long-term plan of getting all manufacturing operations to the 20 Keys level.

The consultant was charged with assessing the factory and developing an action plan for the implementation of the various keys. The OM planned on a top-down drive for change for the first two years and then pass the impetus onto the staff to drive the initiative from bottom-up into the future. The shop floor staff were aware of the KPI the OM was monitoring but they were not engaged with it. They felt that monitoring this KPI did not show them how they were progressing with individual projects. Staff were also finding it difficult to carry out monthly improvement audits due to heavy production pressure and they struggled to keep track of how they were progressing.

### 3.6.6 Implementation steps

The initiative kicked-off with the consultant introducing all staff to lean via a video. The manufacturing staff had monthly 20 Keys training sessions with the consultant over 12 months. The first three sessions focused on introducing the basic concepts of the 20 Keys to all staff. After these sessions they moved onto implementing shop floor improvements based on the action plans they had been drawn up by the consultant. The lean champion received no added training on leading the change initiative but he was in charge of overseeing the implementation of the action plans. Staff were responsible for implementing changes in their specific work areas and they initially focused on housekeeping. This involved identifying and eliminating obvious sources of waste. After the factory was clean and organized they worked on improving the product flow through the factory with an emphasis on reducing product-manufacturing times. These improvements led to changes in the factory layout.

The shop floor staff struggled to apply the 20 Keys to their job-shop environment. The OM stated that *'the biggest task the consultant faced was applying the concepts of a production line in a job-shop'*. They also found that the consultant training was not sufficient to know how to implement many of the changes required of them. The lean champion also discovered that his training did not sufficiently equip him with the necessary skills for leading the change initiative. Although the consultant is presently involved with the organisation purely as a trainer the lean champions' still relied on him to direct the improvement activities and draw action plans for implementation. The staffs' lack of ability to implement the changes had slowed the progress of their 20 Keys project and they are still at the preliminary stages of the two keys they attempted.

The original lean champion moved to the new facility and implemented the keys he was trained on with a particular focus on getting product flow correct from the outset. The site tour did show that the new facility was well organised and products flowed in a logical manner. There were various visual aids such as improvements boards, audit results, SOPs, etc around the site. The same consultant was training the new champion on lean manufacturing and once again focusing on housekeeping and product flow. Both lean champions were responsible for carrying out monthly housekeeping audits to monitor progress however their auditing efforts had been quite poor to date. The

lean champions had not yet formed the habit of doing regular audits and felt that production was their main priority and lean was something they did at the end of the month.

### **3.6.7 Staff engagement and behavioural changes towards lean**

The OM faced significant resistance from the shop floor when he first introduced them to lean. They had ample orders so job loss was not an issue on the shop floor; the main issue was a lack of lean understanding. People were resistant to changing what they had been doing many years. A couple of the senior staff felt that they would lose control over their sections as a result of lean and two staff members left the organisation as they disapproved of the planned changes. There was still some resistance to lean on the shop floor but as the level of understanding for lean has increased over time the resistance has gradually decreased. The OM focused on improving the level of lean understanding on the shop floor to counter this resistance. Although he did not have an ongoing training mechanism for the shop floor staff he viewed lean as a manufacturing tool, the OM did spend time on the shop floor talking to staff about lean and regularly encouraging them to think about improvements. The manager was actively trying to change staff mindset by involving them in the problem solving process and asking for improvement suggestions and continuously talking about the 20 Keys. The OM had attempted to implement an OFI system but the staff had not taken the scheme on-board and the OFI system was defunct.

### **3.6.8 Adding value to the end-product**

There was no link between the customer and the shop floor improvement projects. Company J had compartmentalised lean as a tool for improving their manufacturing operations and did not see the need to involve their customers' in the improvement process. The informants believed that if they decreased product delivery period their customers would be satisfied.

### **3.6.9 Changes from implementing lean**

The biggest change at the main site was the change in factory layout leading to improved flow. The change in layout resulted in on time product delivery increasing from 60 to 80%. However the OM found that he had to keep pushing the shop floor to maintain these levels. The shop floor staff were working more as a team now from

product start to finish to despatch and they had daily meetings they received feedback on productivity and discussed problems. The site tour of the main factory revealed a clean and tidy site where product was flowing in a logical manner however there were very few visual aids displayed around the shop floor. They did have productivity boards, which showed weekly efficiencies, but there was no sign of an improvements board. The tour did validate that they had simply focused on the housekeeping and flow improvement tools in the manufacturing department. There was no sign of lean activities in the other departments.

### **3.6.10 Sustaining the lean momentum**

Company J was finding that production pressures limited how much time they could spend on improvement projects. They did not have the financial capability to have someone doing lean full-time and were struggling with regular audits. Lean was still seen as additional chore on top of what they were already doing. The champion stated that *'lean stopped at the end of month particularly when they got many orders'* showing that lean manufacturing was very much seen as a tool for downtime. The shop floor staff did to break their old habits and they frequently slid back to their old ways when production pressures were high showing that the old culture is still persistent on the shop floor. The OM had realised that if they were to sustain the initiative he needed to keep driving the initiative and increase lean awareness in the organisation. However the OM firstly needs to improve his own knowledge and understanding of lean as he saw lean as a tool for the manufacturing operations. On viewing the Iceberg Model the OM commented that *'we are still developing and think we are very much above the waterline'*. Although the OM is committed to finishing the 20 Keys programme, the organisation needs to address several key issues if they are to truly sustain lean. These issues are discussed next.

### **Erroneous understanding of lean**

Company J had compartmentalised lean a 'standard' tool for the manufacturing department. Lean manufacturing was merely seen as a tool for the manufacturing department with no link to their customers their implementation process followed this approach. They failed to see lean as a holistic organisation-wide methodology for embedding a culture of continuous improvement. They viewed lean as a tool that would deliver long-term organisational growth by identifying and eliminating waste

from the manufacturing operations. None of the organisational members had any previous lean experience or knowledge and the organisation's understanding and approach to lean was based on the 20 Keys programme. They also struggled with implementing the keys in a job-shop environment they saw lean as a 'standard' tool for manufacturing.

### **Lack of change strategy**

They implemented the 20 Keys in isolation with no link to a wider organisation strategy. Company J had not understood the voice of their customers and they did not identify the root-cause of their problems. Their implementation approach did not address the real problems that persisted. Their focus had always been on implementing the 20 Keys as a tool for long-term productivity growth. They did have an audit system on the shop floor but the champions' were doing the audits in an ad hoc manner when they had downtime from production and it was easy for the staff to slide back to their old ways. Even when they did carry out audits and identified problems they discovered that they lacked the skills to draw action plans for improvements. They were evaluating 'on time product delivery' on a regular basis but the shop floor was disengaged with this measure. The shop floor staff could not see how their improvements were making a difference and this was a source of discouragement on the shop floor.

### **Not developing lean champion's capabilities**

The lean champion found that the consultant training did not equip him with the skills that he needed to lead the changes. The low levels of lean knowledge within the organisation including the SMT exacerbated this problem, as the lean champion had no one for assistance in the absence of the consultant. He had to rely on the consultant to develop action plans for and steer improvement activities. Company J should have focused on developing the skills of their champion while the consultant was involved.

### **Employee resistance**

There was significant resistance from the staff towards lean. The resistance came down to a lack of understanding of lean. Staff could not see the benefits of change and thought lean was just additional work on top of their existing workload and they

tended to slip back to their old ways whenever they got busy. The consultant's failure to develop the capabilities of shop floor staff to implement improvements aggravated this problem as staff found lean implementation too big a task. The resistance did gradually decrease as the understanding of lean increased on the shop floor but some resistors were yet to change their mindset.



## **3.7 Case Study G – Company D**

### **3.7.1 Introduction**

This case study was conducted at Company D in early 2009. Company D was an *Aichi 1* member in NZTE's 20 Keys programme and they initiated lean manufacturing in 2005. They were into the fifth year of their lean implementation at the time of this case study. This section presents the findings from a key informant interview and the discussions with a second informant during the site tour. The key informant was the Manufacturing Manager (MM) who was also the organisational lean champion. The discussion was carried out with a Team Leader (TL) who was part of the middle management team and was directly involved with planning, implementing, and monitoring shop floor improvement activities.

### **3.7.2 Description of organisation**

Company D is a large enterprise based in one of NZ's main centres. They employ 112 full time employees and have been operating for 62 years. They are a shareholder company that manufacture products for domestic and international customers. The organisation had not undertaken any other structured improvement initiatives prior to the 20 Keys programme however the SMT had tried several in-house improvement projects over the years. The TL had been employed at Company D for quite a few years and the MM joined the company in 2005 to oversee the manufacturing operations. A general manager (GM) oversees the organisation.

### **3.7.3 Lean education and background**

The shop floor staff had no experience with lean manufacturing prior to the NZTE engagement. The MM had a tertiary qualification in science but he also had no prior lean involvement. All organisational lean knowledge came through the *Aichi* programme and their understanding of lean was based on the 20 Keys. The training was carried out by a NZTE nominated consultant and the company had no other official training occurring. After the initial 12-months training with the NZTE consultant, further lean training was carried out in-house by either the MM or the team-leaders. The MM was in contact with a different consultant for guidance on lean issues and was also an active member of the lean cluster set-up by the NZTE consultant. The cluster catered for local manufacturers implementing 20 Keys and meetings took place once a week focusing on current marketplace issues. They also

discussed the various concepts of the Toyota Management System during these meetings.

#### **3.7.4 The decision to go lean**

Company D had experienced strong growth for several years and was in an excellent fiscal shape in 2005. A strong growth in their market sector had greatly increased demand for their products and boosted profitability. The SMT discovered that they could not meet all the demand because they had unacceptable levels of rejects, re-work and late deliveries in the manufacturing sector. The GM figured that in order to meet the high demand and further boost profitability they had to improve the manufacturing efficiencies. In 2005, Company D was identified as a high-growth potential company by NZTE and the GM was invited to their introductory lean workshops.

The GM attended the NZTE workshops and went on a factory visit to Japan to witness lean manufacturing first-hand. The GM liked the idea of lean and saw the 20 Keys initiative as a way to improve the manufacturing operations to take advantage of the high demand. Company D was one of several companies vying for the subsidised funding and they were one of six organisations offered a spot on the programme. The offer of financial assistance by NZTE convinced the GM to commit to the 20 Keys programme. The MM stated that *'they didn't have a crisis and the NZTE funding was the key behind the decision to implement lean'* confirming that the subsidy was the main reason for undertaking lean. The previous MM had resigned prior to the NZTE engagement and the GM appointed the new MM in 2005 to oversee the manufacturing operations including the 20 Keys programme.

#### **3.7.5 Strategy for change**

Company D's vision was continuous strong organisational growth but they did not have an action plan linking the 20 Keys to this vision. The MM trained with other *Aichi 1* companies in a pilot group with the NZTE consultant and he was overwhelmed by the magnitude of the 20 Keys programme. The MM felt that these radical changes would be treated with major resistance, as staff would most likely perceive lean as just another management fad. The SMT decided that the most logical

way to implement the 20 Keys initiative was to adopt a low-key incremental approach.

The consultant was given the responsibility of drawing action plans for improvement activities and the MM took responsibility of overseeing the completion of the plans. These action plans focused on shop floor improvements and were discussed with all shop floor staff so they were aware of what changes were taking place and what their responsibilities were. These plans were reviewed and adjusted annually to realign with the changes in internal and external factors. However, the site tour did not reveal any visual displays of the vision or strategy around the shop floor. There was a solitary improvements/production board in the entire site that was messy but up-to-date. The TL was responsible for the upkeep of this board.

The MM decided to focus purely on cleaning and organizing (Key 1) the shop floor during the initial stages of the 20 Keys programme and slowly work their way through the other keys over the coming years. After initially focusing on the manufacturing department the MM introduced Key 1 into some of the other departments within the organisation. He also focused on developing SOPs within the various departments. Key 1 and SOPs was still their main focus at the time of this case study. The TL was charged with formulating SOPs and the upkeep of Key 1 standards on the shop floor. The SMT used productivity growth as the KPI to measure and monitor the improvements. Individual staff efficiency was also monitored using their productivity figures. This was done to encourage staff to eliminate wasteful habits.

### **3.7.6 Implementation steps and improvements from implementing lean**

The consultant carried out introductory sessions with the shop floor sections after which each section embarked on implementing Key 1. The SMT liked the idea of lean but they did not show any direct commitment to lean and only the MM participated in the training. However the MM did not directly participate in any improvement activities. The consultant drew up process maps to highlight wasteful activities and the staff were charged with eliminating these wastes. The process maps revealed significant sources of waste and the shop floor staff completely redesigned their layout, eliminated 80% of work in progress and 30% of walking and lifting that they were doing. They also compressed their work space to 60% of their original size. One

of the most satisfying projects for the staff was the introduction of shadow boards to tidy up work place clutter. The site tour revealed these shadow boards alongside a basic *Kanban* system and numerous SOPs. Nonetheless the factory was disorderly and these basic tools and techniques were the only real changes the organisation had seen over the years they had been implementing lean. The SMT had introduced an OFI system but the shop floor staff had lost interest in this system as none of the SMT were actively encouraging them to use this tool.

### **3.7.7 Staff engagement and behavioural changes towards lean**

The previous MM had an authoritarian style and so giving the shop floor staff some control over their workplace was received favourably. Giving staff the responsibility for making decisions enabled the MM to get better buy-in to the initiative and motivated staff to change. The incremental approach to implementing the 20 Keys also meant that there was only minor resistance from the shop floor staff. The organisation was not attempting any radical changes so shop floor staff viewed lean merely as a cleaning and organising tool to make their jobs easier. The small amount of resistance soon eroded as staff started seeing how the changes were helping them. One of the senior managers strongly opposed the idea of lean but the GM manager changed his view through by giving him the ultimatum of commitment or redundancy. However, the MM and the TL had to constantly push the shop floor staff to maintain the housekeeping standards as they slid back to their old ways when production got busy. This showed that the 20 Keys programme did not have any impact on breaking old workplace habits and staff were still seeing lean as something extra they did on top of their existing chores.

### **3.7.8 Adding value to the end-product**

The consultant had done process maps in individual areas such as manufacturing, customer service, distribution but he had not mapped the whole process from start to finish. The departmental roles were compartmentalised and they were not seeing their process as a value-adding stream. There was no link between the customer and the 20 Keys initiative and the shop floor was not aligned with their customer demands. Whenever the MM was probed about customer value his response was that the sales and marketing departments were responsible for dealing with customers. They were not seeing their process as streams adding value to the customer, instead they had

compartmentalised customer value as a sales and marketing responsibility. Their approach to customer value once again reflected their compartmentalised understanding of lean manufacturing.

### **3.7.9 Sustaining the lean momentum**

Company D had made very little progress with lean. Besides reaching level 2.5 out of 5 with Key 1 in over four years they have achieved little else with their lean initiative. On viewing the Iceberg Model the MM stated they were still at the very early stages of '*above the waterline*' aspects of lean but he believed that by adopting an incremental approach they had well-established '*below the waterline*' aspects throughout the organisation. The MM was correct in his impressions of '*above the waterline*' efforts of the organisation but he was clearly mistaken about what achieving '*below the waterline*' aspects encompassed. Company D has failed to embed a culture of continuous improvement. The reasons for their failure are discussed next.

### **Subsidised funding 'pushing' change**

The organisation did not have any external or internal drivers for change. The NZTE subsidy was the main driver behind the implementation of the lean initiative. The GM liked the idea of lean manufacturing but in fact the funding convinced him to commit to lean. He initiated lean as soon as he was given the opportunity to be part of the subsidised programme.

### **Lack of change strategy**

The SMT did not develop an action plan for change and they implemented the 20 Keys in isolation with no link to a wider organisational strategy. Company D had not understood the voice of their customers and they did not identify the root-cause of their problems. Their implementation approach did not address the real problems that persisted. Their focus had always been on implementing the 20 Keys as a tool for long-term productivity growth.

### **Erroneous understanding of lean**

Company D's approach to lean reflected their compartmentalised understanding of lean. They saw lean manufacturing as a tool for short-term productivity growth and not as long-term holistic methodology for embedding a continuous improvement

culture. They viewed the 20 Keys as a 'standard' step-by-step tool for manufacturing operations. Production took priority and improvement projects were put on hold when deadlines had to be met. The shop floor was inclined to resort to their old ways when they were busy.

#### **Lack of SMT commitment to change**

Most off the SMT did not directly participate in the improvement activities and only the MM showed commitment to the change initiative. Overall, the SMT commitment was weak within Company D. The SMT's failure to actively drive the initiative has impacted the progress of the initiative. The drive for change was left to the shop floor team-leaders. The team-leaders understood the basic concepts of lean but they found that the consultant training did not sufficiently equip them with the ability to implement changes on the shop floor.

#### **Not developing the lean champion's capabilities**

The SMT did appoint a champion to oversee the initiative but they did not develop a strategy to give him the capabilities to lead the change into the future. The OM was the lean champion but he failed to develop the necessary skills to lead the lean initiative forward. He decided to undertake a participatory role during the NZTE programme and relied on the consultant to provide the necessary leadership.

## **3.8 Case Study H – Company K**

### **3.8.1 Introduction**

This case study was conducted at Company K in early 2009. Company K was an *Aichi 3* member in NZTE's 20 Keys programme and they initiated lean manufacturing in 2007. They were into the second year of their lean implementation at the time of this case study. The 20 Keys initiative was headed by the GM. Two key informant interviews and a site tour were done at this organisation. The key informants were one of the Key Leaders (KL) and a shop floor Team Leader (TL). The KL was part of the senior management team and his primary role was planning manufacturing runs. The TL was part of the middle management team and was directly involved with planning, implementing, and monitoring improvement activities in the despatch area.

### **3.8.2 Description of organisation**

Company K is an owner-operator SME in one of NZ's main centres. They have been operating for 30 years and have 55 full time employees. They are a job-shop manufacturing custom engineering components for domestic and international clients. The TL had been employed at Company K for quite a few years and the KL joined the company in 2007 just prior to the commencement of the 20 Keys initiative. They had a history of high staff turnover and redundancies and they have tended to employ unskilled staff over the years as they have struggled to find and/or keep skilled workers.

### **3.8.3 Lean education and background**

The GM had been working at Company K for some years and had been exposed to lean manufacturing during his 25 years in the UK manufacturing sector. Although the GM had been exposed to lean previously he had limited knowledge and experience in implementing lean. His expertise was in quality control systems and he had previously overseen the ISO 9001<sup>8</sup> accreditation at Company K prior to the 20 Keys initiative.

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<sup>8</sup> ISO 9001 is the internationally recognised standard for the quality management of businesses. It applies to the processes that create and control the products and services an organisation supplies. It prescribes systematic control of activities to ensure that the needs and expectations of customers are met. It is designed and intended to apply to virtually any product or service, made by any process anywhere in the world.

The organisation had developed a functional quality control system as part of the ISO 9001 requirements.

The owner-operator was aware of and had some understanding of lean manufacturing but he had no formal training on the principles and the implementation of lean. The GM and the owner-operator attended the introductory lean workshops with NZTE and the 20 Keys workshops with the consultant. The GM also went on a tour to Japan with NZTE to witness lean manufacturing first-hand. None of the other organisational members had been exposed to or had any knowledge of lean prior to the NZTE engagement. They did not have a structured ongoing training system within the organisation. The KL had a Bachelors degree in engineering from overseas and was pursuing a Masters degree in engineering extramurally through a university. He had not been exposed to lean manufacturing in either his undergraduate studies or his post-graduate studies. He was undertaking the Masters degree for career development and felt that his studies would be beneficial to the organisation also.

#### **3.8.4 The decision to go lean**

Company K has been adversely affected by market fluctuations and economic downturns in recent times. In 2005, Company K was struggling to compete against growing competition from Asian manufacturers and was forced to downsize the business through redundancies. They were in a poor fiscal health although they were not at crisis point. The owner-operator decided to undertake lean manufacturing in 2007 to improve the organisational productivity. He approached NZTE for assistance and was selected as an *Aichi 3* member on the 20 Keys programme. They initiated the 20 Keys programme with the NZTE nominated consultant in 2007. The GM was appointed the lean champion and four key leaders who were part of the SMT were selected to look after different keys.

#### **3.8.5 Strategy for change**

Organisation did not have a clear organisational strategy and the implementation of the 20 Keys programme was compartmentalised into a tool for short-term productivity growth. The 20 Keys improvements only focused on the manufacturing departments but the SMT did not set any KPIs to measure and monitor the improvements. Key leaders were designated the responsibility for implementing different keys based on



their skills and role within the organisation. The consultant was charged with training the key and team leaders and these leaders were responsible for training shop floor staff. The key leaders were responsible for leading the changes. The site tour showed that they did use basic visual management tools but these primarily focused on weekly production figures. The team leaders were made responsible for weekly housekeeping audits whilst the key leaders were responsible for monthly key audits.

### **3.8.6 Implementation steps**

The consultant found it difficult to apply the 20 Keys to the job-shop environment. He conducted once a month training sessions with team and key leaders on the basics of 20 Keys. The key leaders were expected to administer internal training from their sessions with the consultant. The training was a basic introduction to the concepts of 20 Keys. The lean champion and the owner-operator did not attend the training session after the initial introductory training for the senior managers and the impetus for change was left to the consultant and the key leaders. The consultant drew process maps for each department to identify waste and developed action plans based on these process maps. The process maps showed where the waste was, where they could improve, and what further staff training was required. The process maps revealed numerous sources of waste throughout the manufacturing department. Lean teams were formed within each department and the entire manufacturing operation focused on implementing Key 1 to eliminate waste.

The other key finding from the process mapping exercise was that Company K was not measuring overall equipment efficiencies (OEE). They had no record of how each machine and its operator was performing. Hence, one of the first changes they made was to start measuring the OEE for each machine. The SMT began using the OEE as the KPI to measure and monitor 20 Keys improvements from that point on. The SMT discovered that their internal staff training was dreadfully insufficient over the years as the OEE showed that staff were only working at 23% efficiency and this was largely due to the fact that staff did not fully understand their machines and the processes. The operators were technically inapt and had no problem solving skills. They did not have a structured training system in place and most operators were simply '*pushing buttons*'. They found the 20 Keys programme challenging as most of them had not done formal training before and they did not fully understand how their

processes and machines functioned to apply the concepts of lean. The SMT realised that if they were to see gains they had to firstly improve staff understanding and skill on their machines and processes. The key leaders embarked on training their staff on efficient utilisation of their equipment first and foremost before improving their understanding of the entire manufacturing processes including quality control.

The SMT also initiated the OFI system with a monetary reward system at the outset of the 20 Keys initiative. They were using the reward system to motivate staff but have seen very few good suggestions being forwarded. The SMT discovered that due to a poor understanding of lean and their own processes and machinery the suggestions they were getting were '*silly and meaningless*'. The OFI system had been of little value to Company K due to the poor suggestions being submitted.

### **3.8.7 Adding value to the end-product**

The consultant did process mapping within individual departments but he did not create any organisation-wide value stream maps as the company did not have any standard products. The training was compartmentalised to individual departments with each key and team leader having his or her action plans. There was no link between the customers and the improvements on the shop floor focused simply on short-term improvements. Company K failed to visualise their processes as a value-adding stream because they saw lean merely as a tool for the manufacturing sector.

### **3.8.8 Staff engagement and behavioural changes towards lean**

The key leaders encountered strong of resistance from the shop floor staff at the commencement of the initiative. Redundancies were the major source of employee resistance. Employee's linked lean with further redundancies and were reluctant to buy-in to the 20 keys programme. Due to fluctuations in the engineering market redundancies had been common within the organisation. Most of the shop floor staff felt that lean was just another way of cutting back on staff numbers. It took the SMT sometime to overcome the staff resistance through education, training, and demonstrating improvements. They piloted improvements in one of the smaller manufacturing departments to get staff buy-in. Once the staff realised that lean was not another tool for further redundancies and after seeing the improvements from the pilot project most of the staff bought-into the 20 Keys programme. The staff started

seeing lean as an opportunity for personal and career growth as most of them were unskilled. Staff became eager to learn new skills and apply them. The key-leaders used the OEE rates for staff feedback and motivation.

### **3.8.9 Changes from implementing lean**

The focus on improving the OEE had led to an increase of efficiency from 23 to 45%. This meant that they had created spare capacity and the owner-operator had hired a new sales manager to source more work. They had also succeeded in improving the quality of their products through better staff training and this meant that their rating amongst customers had improved resulting in increased sales. The increased OEE and increased sales had improved organisation productivity and they had extended the manufacturing hours and hired more shop floor staff. However, both informants believed that the biggest improvement within the Company had been the up-skilling of the workforce and staff taking ownership of the problems. They were at level 2.5 out of 5 with Key 1 implementation. The site tour did reveal a tidy factory. They made some layout changes to improve flow and had implemented a *Kanban* system for raw material handling. They had erected several shadow boards for tools and tidied up the raw material handling and despatch areas. They have made very little progress in the other Keys.

### **3.8.10 Sustaining the lean momentum**

Company K continued to use the consultant for monthly health-checks as the key-leaders and the lean champion found that they struggled with the lean implementation without the consultant's expertise. The company was funding him independently after the initial 12 months engagement through NZTE. The SMT relied on the consultant to drive the initiative because they lacked the knowledge and the commitment to actively drive improvements. The key leaders and team leaders have monthly meetings with consultant to assess performances of the business areas and the consultant draws action plans for their progress.

On viewing the Iceberg Model the KL stated that they had focused largely on '*above the waterline*' concepts and had not done much work '*below the waterline*'. Company K had focused on Key 1 and staff training during the lean implementation process. They realised that they needed to fix some fundamental problems first before they

could proceed past Key 1. Their single biggest hindrance was the operators understanding of their machines and processes. They have embarked on improving staff skill levels before proceeding any further with the lean programme. The staff's lack of ability to grasp the concepts of lean and their own processes contributed to the slow progress of the lean initiative. Their focus on Key 1 and staff training has resulted in considerable short-term gains in terms of productivity. However, they need to address several issues if they want to see meaningful long-term improvements. These issues are discussed next.

### **Erroneous understanding of lean**

The organisational lean understanding was compartmentalised to a standard tool for the manufacturing operations to improve short-term productivity growth. The KL stated that '*they still tended to put lean on back-burner when they were busy*' showing lean was very much driven as a tool for downtime. They tended to prioritise production and leave improvements for downtime.

### **Lack of change strategy**

The SMT did not develop an action plan for change and they implemented the 20 Keys in isolation with no link to a wider organisational strategy. Company K had not understood the voice of their customers and they did not identify the root-cause of their problems. Their implementation approach did not address the real problems that persisted. Their focus had always been on implementing the 20 Keys as a tool for long-term productivity growth.

### **Lack of SMT commitment to change**

The SMT relied on the consultant to drive the changes. The lean champion and the owner-operator liked the idea of lean but they did not show any commitment to the initiative. They did not directly participate in the improvement activities. The lean champion simply took on an advisors role and relied on the consultant to provide the drive to change. The lack of commitment stemmed from their lack of lean understanding and experience in implementing lean changes. They continued to use the consultant after the NZTE engagement because the organisation lacked an internal lean expert.

**High-staff turnover**

Company K had a high turnover rate of skilled staff and had to resort to employing unskilled staff to fill the void. The high staff turnover coupled poor training meant that the skill and experience level was low on the shop floor and operators had limited understanding of their machinery and processes. The shop floor employees struggled to apply the concepts of lean to their work place due to this poor understanding. The 20 Keys initiative had made the SMT realise the value of ongoing training and they were focusing on training staff to a high-level.

## **3.9 Case Study I – Company B**

### **3.9.1 Introduction**

This case study was conducted at Company B in early 2009. Company B was an *Aichi I* member in NZTE's 20 Keys programme. They have multiple manufacturing sites across NZ and this case study was carried out at one of these sites (Site A). The 20 Keys programme was implemented only at Site A and was initiated in 2005. The programme ran for approximately two years before being put on hold indefinitely due to financial hardship from a downturn in demand. Two key informant interviews and a site tour were done at this organisation. The key informants were the operations manager (OM) and one of the shop floor team leaders (TL). The OM was in-charge of overseeing all manufacturing operations and staff. The TL was in-charge of implementing Key 5 (quick changeover technology) across the manufacturing operations and had been involved with the 20 Keys programme from the outset.

### **3.9.2 Description of organisation**

Company B is a large shareholder company with over 800 employees and have been operating for 37 years. They have multiple manufacturing sites in NZ and distribution sites in Australia. Site A has 80 full-time employees and manufacture products for domestic and international markets. Company B had traded under their original owners for 32 years before being taken over by the current shareholders in 2004. The company had experienced strong growth for some years and the new shareholders undertook cost-cutting measures in 2005 to further improve the financial status of the company. Employee redundancies and the 20 Keys programme were initiated simultaneously in the bid to further boost productivity. Company B continued to perform well until the end of 2006 when the demand for their products dropped significantly. They started to struggle financially not long after the market slowed down. The shareholders initiated more cost-cutting activities through further staff redundancies and put the 20 Keys initiative on hold. These redundancies included the SMT including the lean champion. Many of the staff trained with 20 Keys was also made redundant. All resources were taken away from the 20 Keys initiative as the organisation focused on surviving the economic downturn. The OM stated that the shareholders had made *'drastic cuts to staffing levels because it was the main cost to the business. The remaining staff were working long hours just to make sure they got*

*through the economic crisis*'. They had no plans to revive the 20 Keys until the organisation was financially secure again which was unlikely to happen in the near future.

### **3.9.3 Lean education and background**

The shop floor staff had not been exposed to lean manufacturing prior to the NZTE engagement. Company B did not have any mechanism for internal or external staff training and the formal lean training ceased after the consultant's engagement. The TL had been working at the company for 25 years and had no understanding of lean prior to the 20 Keys programme. The OM had a tertiary qualification in engineering but lean was not covered in his studies. He had been working at Company B for five months and had wide spread experience in manufacturing both in NZ and overseas. He had experienced implementing six sigma and lean manufacturing with former employers. The OM was working at an NZTE *Aichi 2* members (Company G) prior to joining Company B. Company G had ceased operations in 2009 and was one of two companies that could not participate in this study. They had implemented the 20 Keys programme with the NZTE consultant in 2006 and the OM had been actively involved with this initiative. Company G was in the business of making luxury items and the global economic recession had led to a dramatic downturn in sales over the last two years. Company G had undertaken lean as a last gasp attempt to survive the downturn. They had only focused on Key 1 to improve manufacturing operations. Key 1 delivered good short-term gains but had merely delayed the inevitability of liquidation for the company. The market for their products had simply ceased to exist.

### **3.9.4 The decision to go lean**

Company B had experienced a period of strong growth and was selected as a high-growth potential company by NZTE. They did not have any internal or external pressure to change and the new shareholders undertook the 20 Keys programme to reduce manufacturing costs. Based on the impressions of the key informants it can be inferred that the NZTE funding was the main driver for undertaking the 20 Keys programme. They saw the subsidised NZTE programme as a low-risk venture and it was well aligned with their goal of cost-cutting.

### **3.9.5 Strategy for change**

The organisation did not have a strategy for lean as both informants were not aware of ever having an action plan for change. The informants could not articulate the current organisation strategy either. The SMT had appointed the previous OM as the lean champion but they relied on the consultant to drive the initiative during his engagement with the company. The consultant was charged with assessing each department and formulating action plans for change. 20 different employees were give responsibility of implementing each of the 20 Keys on the shop floor. Their initial focus was on implementing Key 1 across the manufacturing operations.

### **3.9.6 Implementation steps**

The consultant carried out monthly trainings with the key leaders and the SMT. These sessions covered the basic concepts of the 20 Keys methodology and the key leaders were responsible for imparting this knowledge onto the shop floor staff. The SMT actively participated in training and implementation showing good commitment to the initiative. The consultant had no further engagement with the organisation after the first 12 months. The lean champion drove the initiative for a further 12 months until the economic set-back. During the two years they implemented lean their main focus was on implementing Key 1 and they achieved little else with the other keys. The TL stated that the biggest roadblock they faced during the implementation of the Keys was the cost of making changes. The organisation was not prepared to commit resources to make major changes and only focused on the relatively cost-effective Key 1. They had established an auditing regime for shop floor improvements however audits were hardly ever done since the postponement of the 20 Keys initiative. The SMT took all focus away from the 20 Keys and staff lost motivation to continue to change. The economic downturn led to many of the key leaders and the lean champion being made redundant. The remaining staff had to focus entirely on meeting production deadlines. The TL mentioned that 20 Keys had not been mentioned in the workplace for sometime. The site tour did not reveal any signs of lean improvements and they had failed to complete Key 1.



### **3.9.7 Staff engagement and behavioural changes towards lean**

The SMT did experience significant resistance from the shop floor staff when they first initiated the 20 Keys programme. Staff felt that 20 Keys was just another management fad creating more work for them. The resistance decreased through the key leaders constantly discussing and educating the staff. Once the staff understood the basic concepts of the 20 Keys and after seeing the improvements from making changes most of them bought-into lean. The shop floor staff did not feel that redundancies were a result of the 20 Keys programme as they were aware of the economic situation and company's financial difficulties.

### **3.9.8 Adding value to the end-product**

The consultant did process mapping within individual departments but he did not create any organisation-wide value stream maps. The training was compartmentalised to individual departments with each key and team leader having his or her action plans. There was no link between the customers and the improvements on the shop floor focused simply on short-term improvements. Company B failed to visualise their processes as a value-adding stream because they saw lean merely as a tool for the manufacturing sector.

### **3.9.9 Changes from implementing lean**

The biggest change from the 20 Keys initiative had been improved housekeeping. They had made some changes to machinery to reduce changeover time but major changes could not be carried out due to financial difficulties. They had implemented an auditing system to monitor improvements but the system had not been maintained over the years and was defunct. They still carried out Key 1 audits but it happened in an ad hoc manner when they had downtime.

### **3.9.10 Sustaining the lean momentum**

On viewing the Iceberg Model the OM stated they had only looked at '*above the waterline*' aspects of lean. He was correct in his evaluation of their efforts to date as Company B had simply focused on Key 1 over the two years they pursued 20 Keys. The economic downturn had had taken all focus away from then improvement projects. The 20 Keys programme was put on hold indefinitely in 2006 and there are no signs of it being revived in the near future. Company B did not see lean as an

investment but merely as a cost to their bottom-line. They failed to embed a culture of continuous improvement and the reasons for this failure are discussed next.

### **High-staff turnover**

The lean champion and many of the employees trained in lean were made redundant due to the economic downturn. This led to a major loss of lean knowledge and they did not have any ongoing training to replace the lost knowledge as training was perceived as a cost. Some individuals were motivated to continue with the improvements after the deferment of the 20 Keys programme but progress was greatly impeded by the low level of lean understanding within the organisation.

### **Erroneous understanding of lean**

Company B had no experience with lean manufacturing prior to the NZTE engagement. They viewed lean as a 'standard' tool for boosting productivity by removing waste. Their implementation of lean manufacturing reflected their understanding as lean was seen merely as a tool to improve the manufacturing part of the business. The OM stated that for him '*lean was a production-oriented system*'. They perceived lean as an add-on tool to their current operations which they could drop when financial situation became bleak.

### **Lack of change strategy**

The implementation of the 20 Keys programme was done in isolation without any link to an organisation-wide strategy. They failed to develop a holistic action plan and improvements were made in pockets. Company B had not done any work on understanding the voice of their customers and they did not identify the root-cause of their problems. Their focus had always been on short-term productivity growth through cost-cutting and their approach to lean reflected this.

### **Subsidised funding 'pushing' change**

Company B did not have the resource capabilities to make the radical changes they had planned. They were financially constrained and were not prepared to fully commit to lean until funding was made available. They had some capabilities with lean but it was working in a fragmented way. When funding came along they made a 'push' for full lean implementation. They failed to identify any strong external or internal factors

to 'pull' the change initiative. The consultant used a standard 'recipe' to 'push' lean with a focus on one commonly used lean tool. This resulted in the mere attachment of a popular tool onto the existing organisational procedures and culture. This 'recipe' served to oversimplify the complexity and scope of such a change process and the effort required to successfully implement it. The lean initiative stalled once the funding dried up. It is likely that they would not have undertaken lean if it was not funded.

## **Chapter 4: Cross-Case Analysis**

### **4.1 Introduction**

The within-case studies raised some common problems experienced by the case-study organisations in sustaining their lean transformations. The within-case studies revealed that eight out of the nine case study organisations had either not sustained or looked highly unlikely to continue to sustain their lean transformations. This section will highlight the common problems faced by these organisations and seek to establish the root-cause(s) behind these problems. The findings will be compared and contrasted with earlier studies in sustaining lean and other CI methodologies with the aim of establishing whether the findings from this study are unique to the nine case studies or generalisable across NZ and SME's universally.

This section will also highlight the findings of the CI focus group discussion conducted during a postgraduate quality management contact course at Massey University (refer to Section 2.5.6.1 for further details on the CI focus group). The focus group was used to triangulate the preliminary findings from the case studies. The group included 12 industry-based students from various private and public sector organisations that were knowledgeable and/or interested in CI. The participants had different levels of involvement with CI with most being aware of the common methodologies for implementing CI although not all had experience in implementing the methodologies. The group was asked to relate the key lessons for staying lean from the Iceberg Model and from this study to their organisations.

### **4.2 Within-case study summary**

Table 17 presents a summary of the within-case study findings from this study and the problems experienced by the case study organisations in embedding a CI culture. All organisations were privately owned with the owners either being involved in the daily running of the business as the CEO or being part of the shareholder's group. A brief summary of each case study and common problems experienced by these companies follow Table 17. Appendix 8 contains a list of key informant quotes related to the common problems faced by the case study organisations in sustaining their lean transformations. These quotes highlight the magnitude of the problem NZ organisations face in sustaining their lean transformations.

Table 17: Summary of within-case study findings.

	Case Study A	Case Study B	Case Study C	Case Study D	Case Study E	Case Study F	Case Study G	Case Study H	Case Study I	Case Study J & K
<b>Organisation description</b>	SME	Large	Large	SME	SME	SME	Large	SME	Large	N/A
<b>Number of full time employees</b>	46	50 (one site only)	160	43	60	32	112	30	80 (one site only)	N/A
<b>Years in operation</b>	47	14	50	21	35	32	62	55	32	N/A
<b>Ownership structure</b>	Private shareholders <i>Direct</i>	Private shareholders	Private shareholders <i>Direct</i>	Private shareholders	Private shareholders <i>Direct</i>	Family business	Private shareholders	Owner-operator	Private shareholders	N/A
<b>Lean approach</b>		20 Keys (one site only)		20 Keys		20 Keys	20 Keys	20 Keys	20 Keys (one site only)	J – 20 Keys K – <i>Direct</i>
<b>Implementation year</b>	2007	2006	2008	2005	2007	2007	2005	2007	2005	J – 2006 K – 2007
<b>Have embedded or will embed CI culture</b>	No	No	Maybe	No	No	No	No	No	No	No (gone into receivership)
<b>Key problems faced in sustaining lean</b>	<ul style="list-style-type: none"> <li>▪ Compartment -alisation of lean</li> <li>▪ Lack of change strategy</li> <li>▪ Lack of SMT commitment</li> <li>▪ Not developing the lean champion's capabilities</li> <li>▪ Subsidised funding pushing change</li> </ul>	<ul style="list-style-type: none"> <li>▪ Erroneous understanding of lean</li> <li>▪ Lack of change strategy</li> <li>▪ Lack of SMT commitment</li> <li>▪ Employee resistance</li> <li>▪ High-staff turnover</li> </ul>	<ul style="list-style-type: none"> <li>▪ Not developing the lean champion's capabilities</li> <li>▪ Poorly aligned with customer demands</li> </ul>	<ul style="list-style-type: none"> <li>▪ Erroneous understanding of lean</li> <li>▪ Lack of change strategy</li> <li>▪ Lack of SMT commitment</li> <li>▪ Employee resistance</li> <li>▪ High-staff turnover</li> </ul>	<ul style="list-style-type: none"> <li>▪ Erroneous understanding of lean</li> <li>▪ Lack of change strategy</li> <li>▪ Lack of SMT commitment</li> <li>▪ Not developing the lean champion's capabilities</li> <li>▪ Employee resistance</li> </ul>	<ul style="list-style-type: none"> <li>▪ Erroneous understanding of lean</li> <li>▪ Lack of change strategy</li> <li>▪ Lack of SMT commitment</li> <li>▪ Not developing the lean champion's capabilities</li> <li>▪ Employee resistance</li> </ul>	<ul style="list-style-type: none"> <li>▪ Erroneous understanding of lean</li> <li>▪ Lack of change strategy</li> <li>▪ Lack of SMT commitment</li> <li>▪ Not developing the lean champion's capabilities</li> <li>▪ Employee resistance</li> </ul>	<ul style="list-style-type: none"> <li>▪ Erroneous understanding of lean</li> <li>▪ Lack of change strategy</li> <li>▪ Lack of SMT commitment</li> <li>▪ High-staff turnover</li> </ul>	<ul style="list-style-type: none"> <li>▪ Erroneous understanding of lean</li> <li>▪ Lack of change strategy</li> <li>▪ Subsidised funding pushing change</li> <li>▪ High-staff turnover</li> </ul>	

### 4.3 Case study summaries

#### *Case study A*

Company O is a NZ SME that initiated lean in 2007 as one of the *Direct* funded members. They focused on implementing 5S's into their core manufacturing process during the 12 months NZTE provided financial assistance. Company O compartmentalised lean into a tool for the manufacturing department and they failed to develop a holistic organisation-wide change strategy. The driver behind the lean implementation was the NZTE subsidy. The SMT were not fully committed to the initiative and failed to develop a champion to drive the CI process after the consultant's departure. Their lean transformation stalled after the initial 12 months.

#### *Case study B*

Company E is a large NZ company with three manufacturing sites across the country. The organisation was close to fiscal crisis in 2006 and the owner-operator turned to the 20 Keys programme as a last-ditched attempt to revive the business. The 20 Keys programme was initiated in 2006 however the programme did not result in the radical changes the owner-operator was seeking. The organisation underwent re-structuring during 20 Keys programme and the lean initiative was abandoned as a result. A new Operations Manager with lean implementation experience was hired during the restructure to oversee the day-to-day running of the main manufacturing site. The Operations Manager had initiated several low-key 'embryo' projects in 2008 to renew their lean drive.

#### *Case study C*

Company V is a large NZ company that initiated lean as one of the *Direct* funded members in 2008. The CEO implemented lean as a methodology to implement a CI culture and Company V seemed on track to achieving this cultural transformation. The CEO demonstrated strong commitment to change and had invested significant time and money into ongoing staff training. However, Company V still needed to gain a better understanding and alignment to their customer demands and place greater emphasis on developing internal lean leaders to ensure their lean journey led to a CI culture.

#### *Case study D*

Company C is a small job-shop that implemented 20 Keys in 2005 as a last resort to avoid financial failure. They had averted crisis but it was unclear as to what role lean had played in survival as the market conditions had changed and the company had downsized since 2005. They had implemented the 20 Keys as a tool to improve the manufacturing operations for five years. After five years of implementing lean as a tool the SMT had realised that their existing approach was not sustainable and that they needed to take a holistic culture-change approach to implementing lean if they were to sustain improvements in the long-term. The SMT was formulating strategies to embed a CI culture at the time of this case study.

#### *Case study E*

Company T is a small job-shop that undertook lean as a *Direct* funded member in 2007. The NZTE subsidy had convinced the SMT to commit to lean but the SMT showed no commitment to change and relied on the consultant to drive the programme. The consultant drove the initiative for 12 months with little success. The organisation did not have a strategy for change, they placed little emphasis on developing the lean champion's capabilities to drive changes and their overall focus on staff training was poor. They also found it difficult to adapt lean into their job-shop environment due to their poor understanding of lean. Overall their progress with lean was inconsequential.

#### *Case study F*

Company J is a small job-shop that implemented the 20 Keys in 2007. Although the SMT was committed to the initiative, their understanding of lean was purely tools based. This lack of understanding together with a poor change strategy, high staff resistance and lack of implementation know-how on the shop floor meant that they had not sustained their lean transformation. They also struggled to apply the concepts of the 20 Keys to their job-shop environment.

#### *Case study G*

Company D is a large NZ company that implemented the 20 Keys programme in 2005. They made little progress over the five years they attempted lean and have primarily focused on 'cleaning and organising' of the manufacturing operations. The

NZTE funding was the main driver behind their decision to undertake lean and the SMT were never committed to leading the changes. They had a tools based understanding of lean, lacked a champion to implement changes and they failed to develop a strategy for change. The combination of these factors meant that they failed to make any significant gains with the 20 Keys programme.

#### *Case study H*

Company K is a small job-shop that implemented the 20 Keys programme in 2007. They focused on ‘cleaning and organising’ the manufacturing department and staff development which resulted in considerable short-term gains in productivity. Their understanding of lean was tools based and this erroneous understanding of lean together with a lack of SMT commitment, a poor change strategy and high staff turnover meant that they were unlikely to sustain lean.

#### *Case study I*

Company B is a large NZ company with several manufacturing sites across the country. They implemented 20 Keys at one of these sites in 2005. The NZTE funding had convinced the SMT to undertake the 20 Keys programme which they saw as a cost-cutting tool. They primarily focused on ‘cleaning and organising’ the manufacturing operations for two years before abandoning their lean transformation indefinitely due to financial stress.

#### *Case studies J & K*

Company G and P had gone into receivership as a result of the economic downturn some months before the data collection phase of this study. Company G undertook the 20 Keys programme in 2006 and Company P undertook the *Direct* approach in 2007 and neither succeeded in embedding a CI culture.

### **4.4 Common cross-case problems in sustaining lean**

Evidence from the case studies supports Hines *et al.* (2008) findings that in general companies merely focus ‘*above the waterline*’ on tools and processes and place little or no emphasis on ‘*below the waterline*’ aspects of lean. This problem is not unique to the case study organisations as the CI focus group discussions revealed that participants who were actively implementing CI were also generally focused ‘*above*



*the waterline*’ with little or no emphasis *‘below the waterline*’. Evidence from the case studies showed that this lack of focus on *‘below the waterline*’ aspects of lean does inhibit lean sustainability.

Table 17 shows that an erroneous understanding of lean and the lack of a clear strategy for change were the two most common problems experienced across the case study organisations. The lack of SMT commitment and the lean champion’s poor implementation know-how was a problem in over half of the case study companies. The subsidised funding ‘pushing’ change, high staff resistance and high staff turnover were major problems in about half of the case study organisations. These problems are not unique to the case-study organisations. The focus group members indicated that a poor understanding of CI methodologies, a lack of strategy for change and weak SMT commitment is or would potentially be major inhibitors to sustaining CI within their organisations. The focus group discussions revealed that CI methodologies were seen as a tool for short-term revenue growth by most organisations. A comparison with literature (Section 1.8.1) shows that these problems are not unique to NZ either and are commonly linked to CI failures overseas. The common problems experienced by the case study organisations are expanded in the following sections and compared and contrasted with literature.

#### **4.4.1 Lack of change strategy**

In general, the organisations failed to develop a holistic action plan for change and improvements were made in pockets. Evidence shows that most of the SMT did not understand the importance of organisational strategic planning. The organisations were not engaged with what they needed to do, what the end point was, and what actions needed to be taken if they were to go off track. Poor strategy development and deployment of improvement initiatives is one of the most common problems with CI transformations universally (Emiliani and Stec 2005; Kallage 2006; Shin *et al.* 1998). Case study data shows that the implementation approach adopted by the organisations did not address the real problems that persisted within the businesses as the companies had not understood the ‘voice of their customers’. Little or no focus or awareness of customer value is a common problem with organisations implementing lean or TQM initiatives across the globe (Dale 1997; Emiliani and Stec 2005; Shin *et al.* 1998). Not

being engaged with their customers also meant that they did not have any external pressure to change.

The organisations also did not have an entry or exit plan for the consultant involvement. In the majority of cases the SMT desired ‘quick-wins’ from manufacturing improvements and selected lean tools were implemented to deliver these ‘quick-wins’. The consultant’s role was generally compartmentalised into the driver for delivering ‘quick-wins’ within manufacturing operations. Evidence clearly shows that organisations had taken just the tools aspect of the 20 Keys philosophy but that could be against what the consultant recommended. Evidence suggests that the common lean tools were simply customised into packages to deliver ‘quick-wins’ and this resulted in the mere attachment of popular tools onto the existing organisational procedures and culture. Iwao Kobayashi, the creator the 20 Keys programme states that the implementation of the 20 Keys needs to be part of a wider improvement philosophy and there needs to be a readiness, strategy and alignment with customer demand and all these aspects need to occur in a synergistic approach to sustain CI. Only Company V looked-for a culture change and their lean transformation process was designed to embed a CI culture.

The organisations did not have a robust system for measuring improvements and they relied on anecdotal evidence to measure change. The lack of auditing meant that it was easy for the staff to slide back to their old ways. Companies were evaluating productivity on a regular basis but this did not give a clear indication of how the improvement projects were progressing. Production took precedence and lean improvements were generally attempted during slack-time.

#### **4.4.2 Erroneous understanding of lean**

Wilson *et al.* (2008) state that the resident level of knowledge and experience of lean in NZ is minimal to non-existent at both managerial and operational levels. Evidence from this study not only supports their findings it also shows that the understanding of lean within the NZ manufacturing sector is largely erroneous. The erroneous understanding of the principles and philosophies of lean was a major problem faced by many of the case study organisations. Lean was prescribed as a step-by-step, logical and linear programme rather than a flexible evolutionary process that could

allow for changes in the internal and external environment to be incorporated. As such, the companies in general viewed lean as a 'standard' prescriptive tool for short-term productivity gains and not as a long-term holistic methodology for embedding a CI culture. This approach served to oversimplify the complexity and scope of such a change process and the effort required to successfully implement it. Change rarely happens in a linear, logical and incremental process and is influenced by environmental and contextual factors. Change is continuous and does not move through in a series of distinct, identifiable phases in a direct and linear way (Todd 1995). Organisations failed to account for the continuous, evolutionary stance needed to implement the lean philosophy.

The lack of ongoing training contributed to the narrow understanding of lean on the shop floor. The job-shops in particular struggled to implement this 'standard' manufacturing tool to their 'non-standard' operations. Several organisations did make short-term gains from implementing lean tools, mostly with improved factory cleanliness and tidiness, but they failed to sustain the improvements. The experience of the case study organisations is comparable with overseas experience which shows that short-term improvements or 'quick-wins' are a good way to demonstrate improvements and get staff buy-in to change but they generally do not lead to long-term sustainability of lean (Hines *et al.* 2008).

Three of the key informants from the case studies had extensive experience in implementing and leading lean transformations overseas and they all mentioned that the level of knowledge and understanding of lean within the NZ manufacturing sector was '*very poor*'. The CI focus group also validated that the erroneous understanding of lean was a common problem in NZ. Organisations that were on their CI journeys were, by and large, implementing popular improvement tools onto their existing systems. This tool based understanding and approach to implementing lean is a common problem experienced by many organisations across the globe. Shin *et al.* (1998), Emiliani and Stec (2005), Bhasin and Burcher (2006), Kallage (2006), and Worley and Doolen (2006) discovered that organisations do not understand lean or TQM to be a comprehensive management system that will remove waste in every business process rather than just operations.

#### **4.4.3 Subsidised funding ‘pushing’ change**

It is commonly stated in literature (Barker 1998, Emiliani and Stec 2005, Venkateswarlu and Nilakant 2005, and Kallage 2006) that successful CI transformations depend on strong external ‘pull’ or internal ‘push’ factors. Literature states that organisations either require a strong external factor or crisis to ‘pull’ change or a strong internal factor in the form of a champion to ‘push’ changes. The case study companies in general failed to identify strong external ‘pull’ or internal ‘push’ factors to drive change. Several case-study organisations only implemented lean due to the subsidy provided by NZTE. This supports the findings of Wilson *et al* (2008) who state that for the firms supported by NZTE, the co-funding played a critical role in their decision to adopt lean.

Two case study organisations did experience fiscal crisis but they failed to convert their positions into a strong ‘pull’ for change choosing to focus on ‘quick-wins’ instead. Company V and G were the only companies with strong internal ‘push’ agents but Organisation G’s lean progress was inhibited by the change agents tools based understanding of lean. The other organisations based their decision to implement lean largely on the basis of receiving NZTE funds and this failed to generate a strong drive for change. The NZTE funds served as a low-risk investment and the organisations relied on the consultant to provide the impetus for change. Once the funding had dried up and the consultant departed, many of improvement initiatives were put on the ‘*back-burner*’ as changes were considered to be a cost not an investment. It is likely that many of the organisations would not have undertaken lean if it was not funded. One of the CI focus group members mentioned that his organisation was not undertaking improvements ‘*because it was costly to make changes*’ and another respondent stated that unless her organisation experienced ‘*immediate gains they were not interested in making changes*’ suggesting that the short-term ‘quick-wins’ approach to organisational improvements is a key problem.

#### **4.4.4 Staff resistance to change**

Many of the organisations faced strong resistance from the staff at the start of the lean initiative. This does not concur with the findings of Wilson *et al*. (2008) who mention that the initial fears of major staff resistance within the NZTE sponsored organisations were not realised during the implementations. They state that the ‘buy-in’ of staff had

been a revelation to managers and business owners. There was also no evidence to support their findings that unskilled and semi-skilled workers tended to adopt lean more readily, whilst skilled workers and trades people tended to be more resistant, although not obstructive. It is likely that the differences in findings between the two studies is a result of Wilson *et al.* (2008) having a single key informant from the senior management level as opposed to this study where two key informants from two levels (SMT and middle-management) were used to gain a more thorough and accurate understanding of each firm's lean experience.

There were several sources to staff resistance within the organisations. Redundancies, remuneration issues, a lack of SMT commitment, poor lean understanding and poor lean implementation skills were some of the major issues behind staff resisting change. The poor lean understanding on the shop floor meant that staff viewed lean as more work and as just another management fad which served as further sources of resistance. The focus group members agreed that staff resistance to change was a serious issue for their organisations with one respondent stating that '*people simply hate change*'. Staff resistance to change is not only a national problem but a common problem globally in organisations attempting CI transformations. Dale (1997), Emiliani and Stec (2005), Kallage (2006) and Sim and Rogers (2009) argue that staff resistance is mostly due to employees being poorly trained to undertake improvement initiatives. However, this study did show that staff resistance had declined gradually through the years in many of the organisations as staff began understanding the benefits of the improvements they were making.

#### **4.4.5 Lack of SMT commitment to change**

Lack of SMT commitment to change is a universal problem with CI initiatives (Emiliani and Stec 2005; Soltani, Lai *et al.* 2005; Venkateswarlu and Nilakant 2005; Sim and Rogers 2009). A lack of SMT was also a commonly mentioned problem in the focus group with one member stating that his managers were '*merely paying lip service to staff and they had put no effort into empowering the CI team members to implement changes*'. Emiliani and Stec (2005) mention that many organisations have poor leaders who commonly exhibit wasteful behaviours while trying to eliminate waste and they do not directly participate in improvement activities. The case-study organisations experienced similar problems with many of the SMT not participating

directly in the improvement activities and only a handful of managers showing commitment to the change initiative. The SMT failure to actively drive improvements had greatly inhibited the progress of the lean initiative and their ability to get full staff buy-in. Most of the managers were either not engaged with their role in the lean transformation, had a poor understanding of lean, and/or lacked leadership skills. Poor leadership has often been found to be the reason for poor sustainability of change initiatives with many organisations possessing good managers but not necessarily good leaders (Hines *et al.* 2006) and this is no different in NZ. Most of the leaders from the case studies tended to rely on the consultant or the shop-floor staff to drive the changes. The organisations that had SMT commitment were let down by their poor understanding of lean.

#### **4.4.6 Lean champion's capabilities**

Literature (Lasa *et al.* 2008; Sohal 1999; Venkateswarlu and Nilakant 2005) commonly states that not having a champion with appropriate background, knowledge and experience inhibits the chances of successfully implementing CI initiatives. Most of the case-study organisations did appoint a champion to oversee the initiative but they either did not engage the consultant to develop the champion's capabilities to lead the changes into the future or the training did not satisfactorily prepare the champion with the skills that she/he needed to lead the changes. The low levels of lean knowledge within the organisations, including the SMT exacerbated this problem as the lean champion had no one for assistance in the absence of the consultant. The lean champions generally took a participatory role during the NZTE programme and relied on the consultant to provide the necessary leadership.

#### **4.4.7 High-staff turnover**

Several of the case study organisations had high staff turnover rates from redundancies due to economic downturn and from managers seeing lean as a way to reduce labour costs. Staff were seen as cost and redundancies were common when market conditions got tough. The redundancies from downsizing led to resistance to change from the shop floor as staff feared further job losses. Staff resistance to change due to fear of job losses is a universal problem as change initiatives are generally seen as a way to reduce labour costs, typically through layoffs (Emiliani and Stec 2005; Kallage 2006; Redman and Grievies 1999; Sim and Rogers 2009). Liker (2004) argues

that lean is a system designed to provide the tools for people to continually improve their work and lean means more dependence on people, not less. The high staff turnover rates also led to a loss of lean knowledge within several case study organisations. The effect of this loss of knowledge on the lean momentum was exacerbated by the fact that many of the organisations did not see the value in ongoing staff training and development. Staff training was seen as an expense as the organisation measured how well they performed merely by looking at productivity markers and this meant that there was little emphasis on the ongoing development or nurturing of staff.

#### **4.5 Common themes underlying the general problems**

A cause-effect analysis (Figure 8) was completed to extract the common themes underlying the aforementioned general problems. The analysis demonstrates that all the themes and problems are interdependent and cannot be considered in isolation. However, looking at the cause-effect arrows to and from each theme reveals that there are three key themes underlying the common problems experienced by the case study organisations in sustaining lean. Each key theme is either directly or indirectly linked to one or many problems. The three key themes underlying the common case study problems are:

1. Lack of focus on nurturing people to continuously improve.
2. Lean manufacturing being implemented as a prescriptive tool for ‘quick-wins’ and not a CI methodology.
3. Focus on short-term productivity gains.

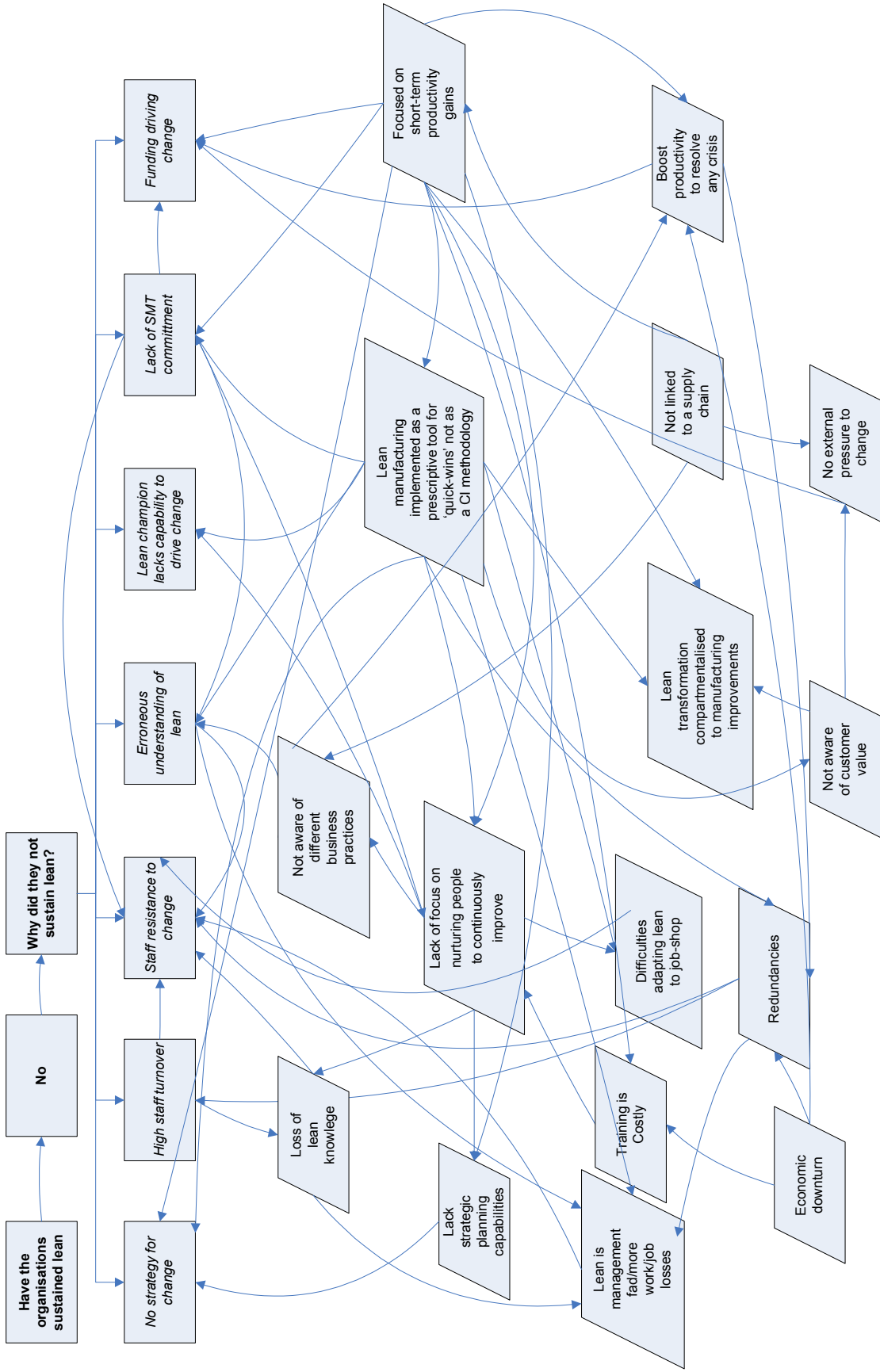


Figure 8: Cause-effect analysis to determine underlying themes of the common sustainability problems



#### 4.6 Root-cause of the common problems

A closer look at the themes and cause-effect arrows within Figure 8 shows that the source of the common problems experienced by the case study organisations was their focus on *short-term productivity gains*. A separate root-cause analysis (Figure 9) of each problem also showed that the root-cause of the common sustainability problems was once again the *focus on short-term productivity gains*. Both forms of analysis show that the common problems faced by the case-study companies can be traced back to their short-term productivity focus. This *focus on short-term productivity gains* also gave rise to the two key sub-themes of *lack of focus on nurturing people to continuously improve* and *lean manufacturing being implemented as a prescriptive tool for 'quick-wins' and not a CI methodology*. This analysis validates evidence from the case-studies that most organisations were simply focused on 'quick-wins' for short-term productivity gains. Eight out of the nine case study companies simply focused on implementing lean as a tool to boost short-term productivity and this led them being unable to sustain lean.

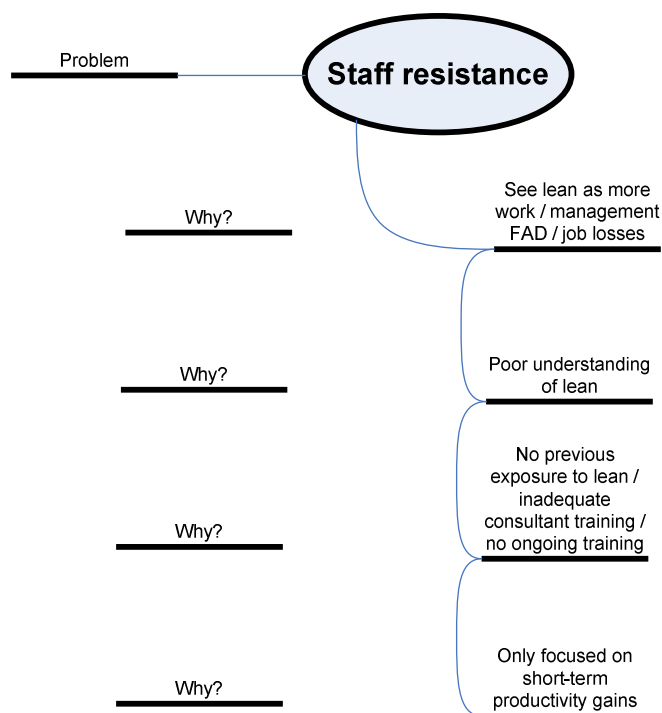


Figure 9: Example of a root-cause analysis.

## **Chapter 5: Discussion**

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### **5.1 Introduction**

This section will investigate the background to the problem of short-term productivity focus within the NZ manufacturing sector. The role of the public, private and tertiary sectors in helping solve this problem is also discussed. Furthermore, a theoretical model for embedding a CI culture in NZ is presented.

### **5.2 The problem of short-term productivity focus in NZ**

BusinessNZ (2009) highlights that organisational investment in physical and human capital is generally low in NZ and there has been an over-reliance on boosting production through longer hours and the use of relatively cheap labour over the years. This suggests that there is an inherent culture of short-term thinking within NZ businesses. Case study evidence and the root-cause analysis strongly supports the concept that the NZ manufacturing culture revolves around short-term thinking and as aforementioned CI is an evolutionary process that takes a long-time and a short-term push on 'quick-wins' simply will not result in sustained improvements. All the studies on sustaining CI methodologies presently point towards the need to have a long-term focus for sustainable improvements with the leading scholars (Liker 2004, Emiliani 1998, Womack and Jones 1996) of lean agreeing that for an organisation to sustain lean they need to focus on long-term culture change. This focus on short-term productivity seems typical for NZ organisations attempting to implement lean and CI initiatives in general. The CI focus group members who had been actively implementing CI methodologies felt that their main problem with improvement initiatives was that the SMT were focused on short-term profits and if a project was not delivering immediate gains it was not pursued.

The focus on short-term gains is not limited to NZ either. Emiliani (1998) argues that globally the early process oriented mass production methods have largely degenerated into results-oriented, output-focused, production systems that rigidly control most manufacturing businesses today. He states that it is likely that production systems were 'improved' over time by aggressive and undisciplined results-oriented managers seeking to raise production efficiency to meet both explicit and, more importantly, implicit company or personal goals. Such behaviour, practiced over decades, has

resulted in the solidification of corporate cultures with debilitating inward focus, and where the voice of the customer and other stakeholders are no longer heard.

A closer look at the problem of short-term productivity focus within the NZ manufacturing sector suggests that there are two distinct issues underlying this phenomenon. The two issues being ‘short-term thinking’ and ‘a focus on productivity gains’. The fixation on productivity gains for improvements can be traced back to how the economic and business performance is measured by the NZ Government. The NZ Government and national organisations incessantly talk about productivity when they discuss economic improvements. The NZ Government have historically used productivity as the key measure for assessing economic performance and have pushed the productivity agenda to boost economic performance. The frequent productivity push by the Government has seen the NZ manufacturing sector adopt productivity as the key measure to assess business performance and improvements over the years and evidence from the case studies supports this as all organisations were using productivity figures to measure performance and their primary focus was to boost productivity to improve performance.

Having already established the root-cause of the fixation on productivity within the manufacturing sector leaves the question of:

*Why do NZ manufacturers have a culture of short-term thinking?*

Based on what Government departments such as NZTE and the DOL and other leading national organisations such as BusinessNZ are advocating (Refer to Section 1.2 for Government agency and national body policies) about productivity gains, the Government and national bodies cannot be held responsible for this short-term thinking. It appears that there is an obvious disconnection between what the Government is advocating about productivity growth and what NZ businesses are practicing. Looking at the key strategies for economic and business productivity growth in NZ, it is clear that the Government agencies and national bodies are focused on long-term improvements based on CI and ongoing education to boost economic and business productivity growth. Evidence from the case studies clearly shows that NZ organisations have so far failed to achieve this. The Government’s

focus on productivity gains therefore cannot necessarily be considered as an inhibitor to sustaining CI until it is incorporated with short-term thinking.

The Government cannot force organisations to change, they are simply encouraging companies to consider a new approach to doing business using the temptation of a subsidy. We cannot blame the short-term focus on the lean consultant either as we cannot categorically say that the consultant told the organisation's to focus on 'quick-wins'. How the case study organisations chose to utilise the NZTE funds and consultancy resources came down to the managerial goals. Evidence shows that the companies dictated what the consultant did. If we compare Organisation A and C for example, it is clear that the consultant simply fashioned 'lean programmes' to suit the managerial goals. Therefore, the disconnection between what is being promoted by the Government i.e. long-term thinking and what is being implemented by the organisations i.e. short-term gains, suggests that the short-term culture within the NZ manufacturing sector stems from poor organisational leadership.

Kennedy's (2008) study of leadership in NZ states that in the organisational context NZ managers show an excessive focus on short-term goals supporting the notion that the short-term focus within the NZ manufacturing sector is directly linked to poor organisational leadership. The study by Wilson, Heyl *et al.* (2008) of all organisations attempting lean under the NZTE banner revealed that some owners saw the effort to implement lean as too onerous as their expectations were only built around current standard of living (such as the 'Auckland 3 B's – The Bach, Boat and BMW' (Wilson *et al.* 2008)). Their findings once again reinforced the concept that the real problem behind the failure to sustain lean was poor top level leadership. They state that professional executives (i.e. those without an equity stake) were more easily convinced to implement lean. The professional managers' goals were generally focused on business improvement, whereas convincing the owners was more problematic. Evidence from this study does agree with these findings as many of the case study organisations were run simply to support the owner's 'Bach-Boat-BMW' lifestyle. The SMT in general only looked at 'quick-wins' and paid little attention to the people side of CI. However, all organisational leaders saw the value in training and developing people but most were not prepared to invest the time and money into nurturing people. Therefore it can be generalised that the problem of short-term

thinking within the NZ manufacturing sector is linked to the owner-operator mentality where the owners are directly involved in the running of the businesses and they cannot look past quick returns on their investments towards long-term business process improvements.

### **5.3 Organisational leadership characteristics in NZ**

The majority of NZ SME's have evolved from small owner-operator or family type enterprises (Kennedy 2008). Small business owners generally exhibit management behaviours that are very different from large publicly owned businesses because they have different life experiences and are accountable to different stakeholders (Emiliani 2000). For example, the management style in NZ has tended to be top-down, with the owner making most of the decisions (Kennedy 2008). Case study evidence suggests that the NZ owner-operators have generally tended to be innovative individuals with great ideas but with limited leadership skills. These owner-operators generally have had a limited amount of formal education and fail to recognise the shortcomings of their fundamental production processes or procurement practices that have remained largely unchanged since the manufacturing process was first fashioned. From the point of view of many of these owners, they are successful, and are hesitant to listen to the new breed of managers and consider new methodologies for running their organisations. But like any successful businessperson, the owners of small businesses in NZ have blind spots that can make it difficult to respond to changes in business conditions. They often find it difficult to delegate work to others, preferring instead to be directly involved in all activities. The owner may be so busy that they lose touch with what is happening in the marketplace. In other words, NZ owner-operators possess a debilitating inward focus.

### **5.4 Developing good organisational leaders in NZ**

Organisational leaders have a strong influence in moulding an organisations culture. If we look back at what the Iceberg Model recommends the role of the leader is seen as a crucial aspect in embedding a CI culture. Emiliani (2000) emphasises that it is the organisational leaders' responsibility to transform themselves and their organisation into learning enterprises in order to sustain improvements. The experiences of organisations like Toyota who have embedded a CI culture also show that the organisational leader or *sensei* has a very important role to play in nurturing people

for CI. Evidence suggests that the failure to sustain lean in NZ manufacturing organisations essentially relates to a difference in the leadership culture between NZ and Japan. Toyota's leaders have simply concentrated on developing Toyota into an 'outward focused learning organisation' through investing in their people and case study data shows that NZ manufacturers do not carry this notion of long-term learning.

Evidence suggests for lean to work in NZ organisational leaders need to shift from their short-term profit driven thinking to a long-term learning driven philosophy where people are nurtured to continuously improve the business processes. NZ leaders need to shift from running an inward focused profit driven enterprise to an outward focused learning enterprise. Lean transformations are not about imitating the tools used by Toyota in a particular manufacturing process; lean is about leaders developing principles that are right for an organisation and diligently practicing them to achieve high performance that continues to add value to customers and society (Liker 2004). Understanding Toyota's success and quality improvement systems does not automatically mean one can transform a company with a different culture and context.

Currently, NZ leaders are not committed to the long-term transformation of their companies into learning organisations and are simply picking and choosing from the multitude of CI tools and programmes, making 'quick-wins' and waiting for the next fad to appear. Data suggests that there is some merit in NZ leaders adopting a 'quick-wins' tools focused approach to implementing CI methodologies such as lean. Implementing the common lean tools will deliver 'quick-wins' and likely boost productivity in the short-term as some of the case-study organisations experienced. However, as mentioned previously, sustained improvements are not realised through implementing lean tools for 'quick wins', it results from having a long-term philosophy of CI through ongoing learning.

The NZ manufacturing organisations and the sector in general will continue to perform poorly and struggle to be competitive without the leaders buy-in to a long-term culture change to CI. One avenue to get NZ leaders to commit to this change is exposure to new business ideas and its benefits through education and learning.

Giving organisational leaders tangible incentives is another plausible option to getting them to commit to organisational change. One viable way of achieving this would be for the Government to offer tax breaks to companies who invest a certain level of profit back into their enterprises towards developing their people, processes and technologies.

NZ leaders need to accept that moving from short-term fixes to long-term improvements is an ongoing process. For this to happen leaders not only require long-term thinking but they need to demonstrate continuity in leadership. Leaders need to embrace the fact that it may take decades to lay foundations for radically transforming the organisation's culture and they need to be ready to make significant long-term investments in educating and changing the thinking of their employees. It is therefore critical that these leaders invest into life-long learning for long-term organisational growth.

Most, if not all the common problems experienced by the case study organisations could be solved with a greater emphasis on ongoing learning. The problems of lack of ability to strategise, staff resistance to change, weak management commitment, erroneous understanding of lean, weak drivers for change and poorly trained lean champions could be overcome through ongoing education. High staff turnover could also potentially be reduced with the professional development of staff. Factors such as an economic downturn are out of the organisation's control but a company that has a learning culture would be much better equipped to handle such changes in the external environment.

The owners of small businesses in NZ need access to affordable, high quality instruction on the philosophy and practice of CI. The substantial differences between batch-and-queue mass production and methodologies such as lean manufacturing must be made very clear, including the implications for leadership and human resource management. The successful and sustained application of CI tools and techniques will need leaders to have a deeper business philosophy based on the ability to understand people and human motivations. Leaders need to be personally involved in the change process and constantly go to the *Gemba* to facilitate and participate in change activities. Knowledgeable third parties can be important resources to facilitate

implementation in an unbiased and less threatening manner. It is not just the role of outside teachers to impart knowledge. The owners have a responsibility to read some of the books and articles published to date to gain added depth of understanding, teach their employees, and reinforce their leadership role.

NZ leaders also need to bear in mind the fundamental differences between the Japanese and the NZ culture if they are attempting a lean transformation. It is important that the NZ leaders acknowledge and understand the uniqueness of the NZ culture and incorporate these traits into their organisational culture. They need to focus on changing the culture by aligning objectives, measurements, and visual systems to reinforce the appropriate behaviours every day. They need to develop an organisational culture that will encourage new employees to change their ways or leave. A strong organisational culture may help the company negotiate factors that are beyond the leaders control such as a downturn in demand. Leaders also need to work on creating effective supply-chain networks to share resources and experiences. If a company has committed, knowledgeable and long-term thinkers at the highest level, they are well on their way to becoming a learning organisation. Leadership development is the key to embedding and sustaining a culture of CI in NZ. Further research needs to be carried out to determine exactly how NZ can develop such organisational leaders.

### **5.5 The NZTE *Aichi* and *Direct Lean* Programmes**

NZTE's current lean approach has done little to boost long-term productivity growth rates for the NZ manufacturing sector. NZTE advocating lean through their lean programmes has proved to be a good model for promoting lean in NZ but funding consultants to implement lean changes has proved to be a very poor format for sustaining improvements. There was a clear disconnection between NZTE's lean strategy and how lean was implemented through the manufacturing sector. The funding was seen as an opportunity for 'quick-gains' and the organisations used the funding for this purpose. Organisations failed to engage in learning and implementing the 'front-end' aspects of change such as developing a robust strategy for change, understanding customer value, getting staff commitment to change, etc. which are crucial in sustaining improvements.



Wilson *et al.* (2008) argue that continued NZTE co-funding through the *Aichi* format is crucial for firms to sustain the lean momentum. They state that in terms of practical implementations, the *Aichi* format should become the main vehicle for sponsored lean implementations in the future. In their judgement, the elements that worked best were the co-funding for the first 12 months, the on-going interactions in forums and cluster meetings, and the visits to the exemplar firms. Wilson *et al.* (2008) also recommend that efforts to sustain lean should be focused on setting in place periodic external checks, not on dictating compliance through any disciplinary measures, but rather to encourage compliance through accountability for progress. This study does not concur with these findings and recommendations. Evidence clearly shows that co-funding was not an effective driver for sustainability and that organisations need to focus on nurturing people through ongoing learning for embedding a CI culture and not rely on embedding CI through accountability. Case study evidence also suggests that the cluster meetings have been ineffective to date due to poor administration. For these clusters to be effective NZTE needs to ensure that the meetings are properly structured with a defined focus on lean sustainability.

### **5.6 The role of NZTE in promoting life-long learning**

NZTE needs to focus on establishing a coordinated national approach to lifting productivity improvements for the future by building the capabilities of the manufacturing sector through investing in life-long learning infrastructures. There is no doubting the ability of methodologies such as lean to boost productivity, but for the NZ manufacturing sector to prosper in the long-term it cannot continue with short-term thinking. NZ companies have a debilitating inward focus and are programmed to follow the 'status-quo'. This trend will not be broken without exposure to new and different business practices through ongoing learning. NZTE needs to promote and help organisations develop a route for education progression. Ongoing learning and education needs to be part of every organisation's business strategy.

A key issue in NZ is the need for a coordinated approach between the public and the tertiary sector to expand life-long learning within the NZ manufacturing sector. NZTE ought to facilitate companies to link to an education network such as the Competitive Manufacturing Initiative and adopt such progression paths. The tertiary sector also needs to align their activities to provide a clear education progression path for

companies. Organisational leaders should be encouraged to do not only lean courses but general business degrees, leadership training, etc. Education will bring the ability to solve problems, give individuals a different view on business practices, equip them with the ability to find new information, expose them to other business practices and processes and widen their scope to help them create learning organisations. Companies need to be encouraged to bring education into the company if they don't have time to get educated, for example through undergraduate and postgraduate student placements.

It is therefore strongly recommended that NZTE invest the co-funding into uplifting the education level within the manufacturing sector. NZ manufacturing organisations will achieve better productivity growth rates if NZTE subsidised workplace training and education so that companies can attend courses to lift internal education levels. The NZ organisations have been receptive of NZTE promoting lean and NZTE should continue promoting lean but expand their manufacturing improvement strategy to include learning. NZTE ought to promote lean as one of the key methodologies for embedding a learning culture with NZ businesses. NZTE needs to spread the message of using knowledge as the main source of competitive advantage.

### **5.7 Consultants facilitating change**

Using consultants to facilitate change and embed a CI culture has not been successful in NZ to date. Evidence from the study suggests that NZTE used the wrong category of consultants to implement CI. They would have been better served to use management or change consultants to improve organisational leadership skills, strategy skills, etc followed by the introduction of lean experts or consultants to implement lean tools. Overseas experience shows that a more appropriate way of establishing culture change is to have a high-level of internal change stimuli through having a high-level of CI knowledge within the organisations. Each organisation is unique and it needs to define and develop its own path to CI and it is only through nurturing people within the organisation that such changes can be sustained. Educating employees is a critical element in nurturing people. Education can provide a high-level of stimulus for change through having a large pool of internal CI knowledge. Culture change takes a long time and having the right people constantly driving changes from within the organisation is crucial in embedding a culture of CI.

### **5.8 A coordinated approach to life-long learning in NZ**

Wilson *et al.* (2008) recommend that lean thinking and systems be adopted as a national strategy for lifting productivity in NZ. They suggest that this will best be achieved through a New Zealand Centre of Excellence for Lean Thinking. The focus of such a centre would be to provide practical support for firms engaging with lean and facilitating and promoting lean education and up-skilling of the NZ workforce at all levels. The findings from this research supports their recommendation that a centre be established to help manufacturers but such a centre needs to focus on life-long learning and not simply on lean. The problems faced by NZ manufacturers will not be solved with a specific focus on lean; rather the emphasis needs to be on establishing a centre that promotes and coordinates national learning. NZ needs a mechanism for coordinated, ongoing and widespread dissemination of not only lean but good business practice knowledge in general.

### **5.9 The NZ tertiary sector**

The tertiary education sector plays a crucial role in advancing organisational learning. The tertiary sector needs to coordinate its efforts and resources for the betterment of the private sector. A closer look at the current education resources shows that there is a wide variety of education and training courses, programmes, degrees, etc available in NZ through numerous providers. There are a lot of competitive packages available in the market place for manufacturers to choose from. A better approach would be to coordinate the learning resources into a nationally accredited package right from the shop floor level to senior leadership. Current educators should form a partnership to broaden the reach of their learning curriculums. This would provide improved communication between the tertiary sector and the private sector and make it easier for organisations to see how they can progress through the education curriculum. The organisational training resources could also be accredited to professional bodies.

### **5.10 Theoretical development from research findings**

The lessons learnt in sustaining lean within the NZ manufacturing sector adds support to the Iceberg Model in that sustaining lean requires organisations to not only place emphasis on '*above the waterline*' aspects of lean but place equal if not greater emphasis on '*below the waterline*' aspects. Looking back at the CI implementation,

CI sustainability and benchmarking models analysed in Chapter 1, the Iceberg Model was selected for this study as it was the most comprehensive, it aligned well with what the other models were advocating, it was the most recently published model and focused solely on lean. However, looking at what has transpired in NZ with organisations failing to focus on ongoing learning, the 4P model (Liker 2004) would have been more appropriate for assessing improvement sustainability in the NZ context. The Iceberg Model simply provided a broad guide to the common enablers and inhibitors to implementing lean principles. The 4P model on the other hand is a hierarchical model that uses Toyota's principles as a guide to becoming a learning organisation (Liker 2004), and as shown in this study organisations need to focus on learning if they are to sustain improvements.

### **5.11 A theoretical model for developing learning organisations in NZ**

There is no 'right' or 'wrong' way to become a learning organisation. Using Toyota's philosophies or lean is just one of many ways of becoming a learning organisation. Based on the findings of this study it is proposed that Liker's 4P model be modified into the 5P model (figure 10) and used as a guide to establishing learning organisations in NZ. The 5P encompasses the original 4Ps advocated by Liker and the additional P of Preparedness. The 5P's therefore are Preparedness, Philosophy, Process, People and Partners and Problem Solving. The 5P model aims to address the key problems behind poor improvement sustainability in the NZ manufacturing sector. The 5P model is designed to lead an organisation from the preparedness for change phase through to embedding a culture of CI. The 5P model is hierarchical with higher levels building on lower levels. The higher levels build on lower levels, for example without a long-term philosophy a company will simply not do all the things the other P's imply. Organisations first establish their strengths and weaknesses through a period of Preparedness. The next step is to establish a long-term Philosophy to enable the successful roll-out of the other P's. Process improvements provide the setting in which to challenge and develop people, which is necessary to achieve a true learning organisation focused on CI through Problem Solving. The principles behind each P are described next.

**1<sup>st</sup> P - Preparedness:** NZ companies are not only bad at focusing on learning they are also poor at developing a platform that will lead to sustainable improvements. As shown in this research, companies are poor at developing strategies for change, understanding their customer demands and getting staff and management committed to change. The general failure to develop a solid platform for sustained improvements within the NZ manufacturing sector leads to the suggestion that before organisations embark on change transformations they undergo a period of change preparedness. The first step in a change transformation should be to determine with some precision where the organisation stands in relation to strengths and weaknesses for a successful transformation especially in regards to leadership commitment and abilities. Once an organisation recognises its current position, the leaders are better able to devise short, medium and long-term plans for making improvements and reaching goals. Further research needs to be carried out in NZ looking specifically at how NZ manufacturers' can develop a platform for sustained improvements through a period of preparedness. This research needs to establish a model or system for identifying the strengths and weaknesses of a typical NZ organisation to enable successful change to occur. The issues unearthed from the preparedness phase will show the path a typical NZ organisation needs to take for life-long learning.

Some of the issues that need to be considered during preparedness for change period are listed below:

1. Leadership commitment to change and understanding of CI.
2. Leadership abilities.
3. Organisational understanding of CI.
4. Level of employee resistance.
5. Understanding of customer value.
6. Motivators for change.
7. Existing organisational goals and strategies.
8. Resource and time requirements for change.

**2<sup>nd</sup> P - Philosophy:** Base management decisions on long-term philosophy, even at the expense of short-term financial goals. The company philosophy sets the foundation for the other principles.

**3<sup>rd</sup> P - Process:** Follow the right processes to get the right results. It is important to balance immediate gains with long-term investments.

**4<sup>th</sup> P - People and Partners:** Add value to your organisation by challenging your people and partners to grow. Use lean tools to raise problems to the surface, creating challenging environments that force people to think and grow.

**5<sup>th</sup> P - Problem Solving:** Continuously solve root problems to drive organisational learning. View problems as opportunities to learn. This study has shown that NZ organisations are very poor when it comes to ongoing learning. Further research needs to be done on developing a learning framework for NZ organisations. A framework for learning could possibly make the transition to becoming a learning organisation smoother for many NZ companies. The issues of life-long learning and preparedness for change are complimentary and both need to be addressed in the NZ context to help NZ organisations sustain improvements.

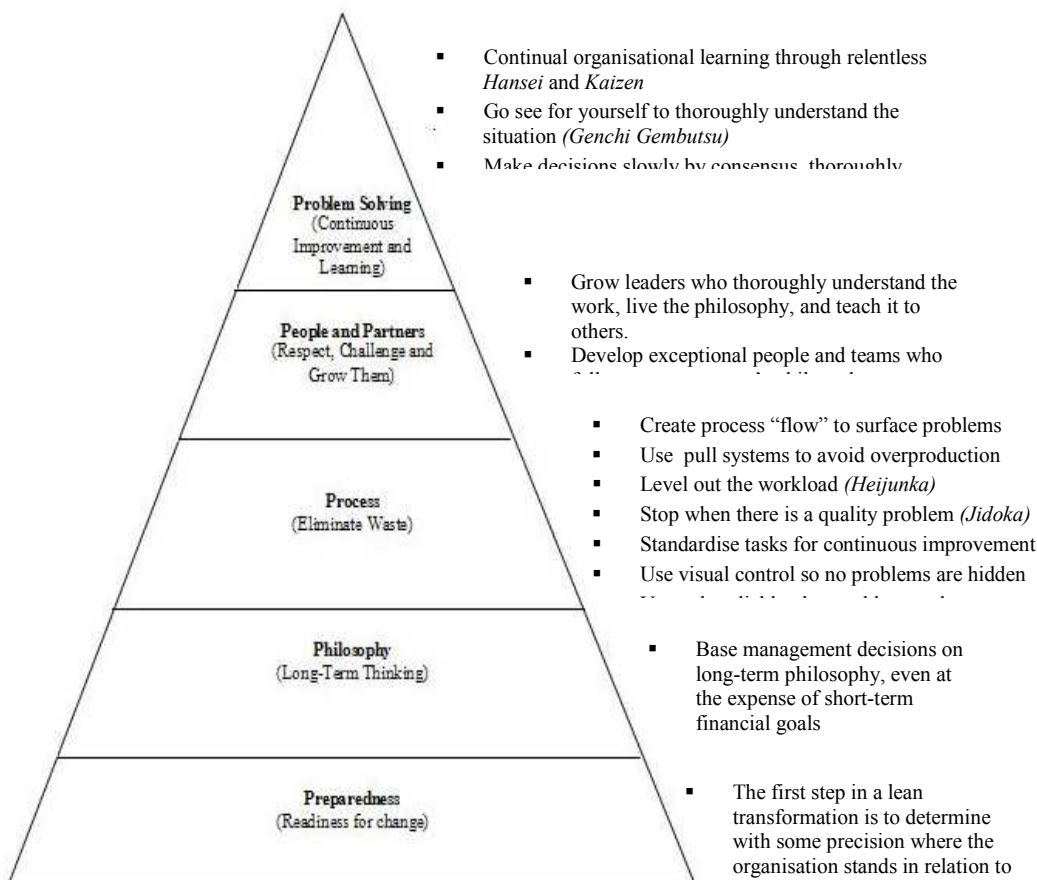


Figure 10: The 5P model

### **5.12 Research variables**

The two key variables for this study were timeline (number of years they had been implementing lean) and approach (20 Keys vs. *Direct*). Overall, the cross-case analysis of the nine organisations showed that these variables did not have a measurable impact on the organisation's ability to sustain lean. Evidence from the case study shows that none of the organisations that had implemented the 20 Keys programme had sustained lean and only Company V which had taken the *Direct* approach looked likely to sustain lean. However, the two other organisations that had undertaken the *Direct* approach did not seem likely to sustain lean. There was insufficient evidence to suggest that one approach was markedly better or worse than the other for sustaining lean.

As abovementioned, only Company V looked likely to sustain lean and they were barely 12 months into their lean implementation. Other organisations that had been attempting lean for much longer periods than Company V had either not sustained or looked highly unlikely to continue to sustain lean. A longer period of implementation did not necessarily lead to lean sustainability. Building a culture does take time but this varies between organisations and time cannot necessarily be used as a measure of CI sustainability. In addition, the organisation's size had no marked impact on their ability to sustain lean. Evidence does show that each organisation is unique with its own culture and own set of problems and their ability to sustain lean comes down to their ability to identify these problems and embed a culture of CI to solve these problems.

## **Chapter 6.0 Conclusions**

The original aims and objectives of this study are reiterated below prior to the conclusions. This is to enable a direct comparison between the aims and objectives and the conclusions.

### **6.1 Research aim**

- To study the experiences of NZ manufacturers in sustaining lean transformations.

### **6.2 Research objectives**

- To review current literature on lean sustainability in NZ and globally.
- Identify a good representative sample and a robust methodology to extract data from this sample.
- Determine the commonalities and differences within the sample.
- Suggest recommendations to sustain lean.

### **6.3 Conclusions**

In general, lean improvements were not sustained across NZ manufacturing organisations. Only one case study organisation looked likely to sustain improvements.

There were several common problems experienced by the organisations. These problems were:

- Erroneous understanding of lean.
- Poor change strategy.
- Poor SMT commitment.
- NZTE funding ‘pushing’ change.
- High staff turnover.
- High staff resistance.
- Failure to develop the lean champion’s capabilities.

Overall, there was nothing new about the problems experienced by the NZ manufacturers in sustaining lean. These problems were comparable and were also consistent with problems experienced overseas. However, some of the forces behind



the problems were stronger in NZ such as the abundance of small owner-operator enterprises, limited supply-chain involvement and a low level of lean understanding.

The root-cause of the common problems in sustaining lean was poor organisational leadership. The majority of leaders chose to attempt lean simply as a tool for short-term gains. Many organisations experienced good initial gains from implementing lean tools but majority failed to sustain these improvements. The poor sustainability of improvements was a result of the organisational leaders placing little or no emphasis on ongoing learning. Most organisations had poor learning infrastructures at all levels of the company and the leaders in particular had little awareness and understanding of not only lean but also good business practices in general.

In addition to a lack of focus on life-long learning NZ organisations are poor at the ‘front-end’ aspects of change such as establishing a strategy for change, understanding customer value and getting staff and management commitment to change.

The length of time organisations had been attempting lean and the two different lean implementation systems had no bearing on their ability to sustain improvements.

NZTE’s *Aichi* and *Direct* lean models were successful in promoting lean but proved poor in sustaining improvements. Funding consultants was a poor mechanism for engaging leaders into long-term thinking. It is likely that future lean implementations in NZ using this approach will lead to similar failures.

Based on the research findings it would have been more appropriate to use the 4P model to assess improvement sustainability in NZ instead of the Iceberg Model. The Iceberg model is relevant to lean but the 4P model is more relevant to establishing a learning organisation.

## **Chapter 7.0 Recommendations**

It is strongly recommended that the following actions be taken to enable NZ manufacturing organisations to sustain Lean improvements.

### **7.1 Implementing Lean as a holistic therapy rather than a tools-and-techniques ‘pill’**

Overall the findings from this study are in line with other Lean studies such as Hines et al. (2008) and Liker (2004) that you need to simultaneously focus on aspects such as strategy, culture and leadership, in conjunction with the tools and techniques of Lean to sustain improvements.

The findings from this study clearly show that most Lean implementations currently focus on the tools and techniques, which generally tends to be 5S or good housekeeping. Due to this focus it seems that NZ companies are struggling to develop a solid platform for sustained improvements within their organisations. It is suggested that before organisations embark on change transformations they undergo a period of change preparedness; to ensure that they are building strong foundations so that the ‘below the waterline’ aspects develop. The first step in a change transformation should be to determine with some precision where the organisation stands in relation to strengths and weaknesses for a successful transformation especially in regards to leadership commitment and abilities. Once an organisation recognises its current position, the leaders are better able to devise short, medium and long-term strategic plans for making improvements and reaching goals.

Some of the general issues that need to be considered in a readiness phase are listed below:

1. Leadership commitment to change and understanding of CI
2. Leadership abilities
3. Organisational understanding of CI
4. Level of employee resistance
5. Understanding of customer value
6. Motivators for change

7. Organisational goals and strategies
8. Effective change management strategy

## **7.2 Development of stronger leadership capability**

It is quite clear that many organisations do not have sufficient capability within their management teams of providing the leadership to create a sustainable Lean initiative aligned with a clear strategy. Leading Lean and CI researchers (Emiliani 2003, Hines et al. 2006) advocate that success with embedding a CI culture (i.e. sustaining Lean) depends on the leader's ability to create a learning environment where individual, team and organisational learning is facilitated. They also endorse that good leaders develop an environment where change is the norm; nurture people; inspire trust and constantly challenge the status quo. Importantly they must be fully immersed with the *Gemba* not just by words but with deeds and actions thus encouraging everyone to get involved in delivering changes. As proven by Toyota the key to sustained improvements lies with an organisation's ability to become a learning organisation that nurtures its employees to continuously improve business processes. This study strongly supports the need for ongoing learning as this is a key foundation stone for continuous improvement and recommends the following to help support this initiative:

### **7.2.1 Creating learning organisations by adopting the 5P model**

It is strongly recommended that the 5P model (Figure 10 – Section 5.11) be used as a guide to establishing a learning organisation in NZ. The 5P's are Preparedness, Philosophy, Process, People and Partners and Problem Solving. The 5P model is designed to lead an organisation from the preparedness for change phase through to embedding a culture of CI. The 5P model aims to address the key problems behind poor improvement sustainability in the NZ manufacturing sector. The 5P model is designed to lead an organisation from the preparedness for change phase through to embedding a culture of CI.

### **7.2.2 Creation of a New Zealand Centre of Excellence for Lean**

This study supports Wilson et al. (2008) recommendation that a New Zealand Centre of Excellence of Lean be established to both coordinate the funding and implementation assistance and to facilitate and promote Lean education and research in organisations and tertiary institutions. In relation to education and research it is strongly recommended that current educators should form a Partnership whose aim is to significantly broaden the reach of Lean curriculum and provide communication between Universities, Institutes of Technology and Polytechnics, Wānanga, Industry Training Organisations and Private Training Establishments, as well as linkages to the other key stakeholders. It should help facilitate the operation of curriculum development and its deployment around New Zealand, so that Lean education becomes accessible to manufacturers right across the country.

Organisational leaders should be encouraged to do not only Lean courses but general business degrees, leadership training, etc. Education will bring the ability to solve problems, give individuals a different view on business practices, equip them with the ability to find new information, expose them to other business practices and processes and widen their scope to help them create learning organisations. Therefore, the Partnership should work together on making it easy for manufacturers to see how they can progress through the academic channels. As educators the Partnership should encourage Life Long Learning and establish clear routes for students to gain qualifications; from Certificates, through to Diplomas, Degrees and Postgraduate Degrees.

### **7.2.3 Government support for industry education**

Whilst this study supports Wilson et al. (2008) suggestion in that the Aichi format should become the main vehicle for sponsored Lean implementations in the future it is encouraged that government bodies take a wider view (not just in Lean) of supporting education in the workplace. Using consultants to facilitate change and embed a CI culture has not been successful in NZ to date. A more appropriate way of establishing culture change would be to develop a high-level of internal change stimuli through having a high-level of CI knowledge within the organisations.

It is recommended that bodies, such as NZTE and the Tertiary Education Commission (TEC), look very closely at how they are encouraging industry and tertiary education organisations to align and support NZs economic development. In these times of economic strife countries, such as the United Kingdom (UK), are realigning their education strategies to ensure their education sector (universities in particular) build new partnerships with business and industry. For example, the UK' Department for Business Innovation & Skills (BIS 2009) is giving priority to programmes that meet the need for high level skills, especially for key industry sectors, which means enhanced support for the 'STEM' subjects – degrees in the sciences, technology, engineering and mathematics. They also advocate the use of funding to support the development of links between business and education institutions; equivalent funding in NZ would be TEC's Encouraging & Supporting Innovation Fund (ESI). The ESI fund began in 2007 with a focus on collaboration, but subsequently no funding was distributed in 2009 and current indicators suggest that future funding seems significantly restrained.

The UK are also changing their higher education progression model from that where predominantly school leavers progressed to study conventional three year degree programmes, to that where they are widening participation through the expansion of the number of adults at university by promoting a broader range of programme models alongside the three year degree. Tertiary education institutions in NZ should be considering these alternative education models.

Although the recommendations have been targeted at both government and education it is equally important that NZ businesses need to be active and engage with the Tertiary education sector. Businesses must begin to commit to education and continuing professional development. Organisations need to allocate time and resources to educating their staff; especially the managerial levels.

### **7.3 Provision of focused research to support Lean development in NZ**

Further research needs to be done on developing NZ's capabilities in specific areas through answering questions such as:

1. How do we get NZ organisations ready for change transformations and establish a long-term philosophy?
2. How do we fix the national problem of poor organisational leadership?
3. How can NZ organisations become learning organisations?
4. How do we encourage industry leaders, practitioners, managers and other key stakeholders to engage in on-going continuing education and professional development?

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## **Chapter 9.0 Appendices**

### **Appendix 1 – Found *et al* (2006), Sustainability Framework**

<b>Step No.</b>	<b>Description</b>	<b>Tool or Technique</b>
1	Recognize the need for change	Environmental sensing
2	Understand the customer requirements and develop strategy for change	Hoshin Kanri
3	Clearly communicate the need and strategy for change	Effective communication
4	Monitor employee perceptions and understanding	Perception questionnaires
5a	Understand current process capability and identify waste	Value Stream Mapping and Four Fields Mapping
5b	Understand current culture and employee behaviours	Employee interviews and surveys
6	Develop a model of current organizational climate and capability. Match to customer requirement	Synthesis of current state maps and current behaviours. Four fields mapping of process
7a	Remove the waste from in current system to create early wins and visible results that increases motivation and involvement	5S, Problem Solving to involve whole workforce to motivate and gain commitment
7b	Knowledge transfer and training	Training programmes
8	Make choices regarding process, technology options. Make choices regarding HR policies, employee structure, incentive schemes etc.	Senior Management approval and agreement
9	Develop Future State	Future / Ideal State Mapping
10	Embed Future	Implement the plans, set KPIs, monitor progress and set review timetables.

## **Appendix 2: Project Ethical Issues Discussion and Analysis**

The ethical analysis of the project has been discussed during two separate meetings. The discussions and outcomes from the meetings are as follows:

### **Meeting One: 21/08/08**

*Participants:* Primary Supervisor and researcher

*Key Discussion Points:*

- New Zealand Trade and Enterprise (NZTE) will be funding this project.
- NZTE has contacted the participating companies via email and have got permission for us to interview individuals from the research companies. The companies have been informed by NZTE of the research goals of this project. All companies have voluntarily agreed to participate and they understand what their participation involves.
- No sensitive information will be collected e.g. profits, gross margins, etc.

### **Meeting Two: 15/10/08**

*Participants:* Primary Supervisor , researcher and social scientist

The social scientist is a qualitative researcher with many years of experience in conducting research with human participants.

*Key Discussion Points:*

- No sensitive information will be collected e.g. profits, gross margins, etc.
- Company names, product descriptions, etc won't be published.
- The Consent Form will ask the companies their view on being identified as an Aichi member. If a company refuses to be identified as an Aichi member then we will simply refer to them as "A Group of NZ Manufacturers" in our publications.
- Consensus that this research is one in which the nature of the harm is minimal hence this is a low risk research.

### **Appendix 3 - Case Study Protocol**

The contents of Appendix 3 are listed below.

- Case-Study Information Sheet Sample
- Company Information Sheet
- Consent Form
- Interview Questionnaire – Original
- Interview Questionnaire - Final

## Case-Study Information Sheet Sample

### Company Information:

Name:

Address:

Description, history, etc:

Key products/services, markets, etc:

Location:

### Visit details:

*Key Contact*

*Interviewee One*

*Interviewee Two*

Name:

Name:

Name:

Phone:

Phone:

Phone:

Email:

Email:

Email:

Role:

Role:

Role:

Visit date:

Visit time:

### Lean Initiative Details

NZTE cluster:

Implementation period:

Implementation method and consultant:

Other/Remarks:

## Lean in New Zealand’s Medium to Large Sized Manufacturers

### Participant Consent Form

**This consent form will be held for a period of five (5) years**

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I agree/do not agree to the interview being recorded.

I wish/do not wish to have recordings of my interview returned to me.

I agree/do not agree to being identified as an *Aichi* member.

I agree to participate in this study under the conditions set out in the Information Sheet.

**Signature:** ..... **Date:** .....

**Full Name - printed** .....



## Lean in New Zealand's Medium to Large Sized Manufacturers

### Information Sheet

**Researcher:** Yashwant Murti, Masters in Technology, Massey University, Palmerston North.

**Project Description:** This project is sponsored by NZTE and seeks to study the experiences of several NZ companies in sustaining the Lean Manufacturing initiative. This study has a direct focus on shop floor implementation of Lean. We will attempt to design a 'Sustainable Lean' system for wider use in NZ from the research findings. All participating companies will have access to these findings. On behalf of NZTE and Massey University, I would like to invite you to participate in this study.

#### Site Visits:

Firstly, I would like to have a brief (15-20min) tour of your facility. I then wish to conduct an informal interview with a senior manager and a production team leader who has been directly involved with the Lean initiative. Each interview will last 60-90mins. The interviews will be recorded on a Dictaphone. Interview information will be transcribed by the researcher and only be accessed by the researcher and the project supervisors.

#### Identification of Company:

While you will not be identified as an individual company, should you agree to be identified as an Aichi member, this may mean you could be indirectly identified.

#### Participant's Rights:

You are under no obligation to accept this invitation. If you decide to participate, you have the right to:

- decline to answer any particular question;
- withdraw from the study (before April 2009);
- ask any questions about the study at any time during participation;
- be given access to a summary of the project findings when it is concluded.
- ask for the recorder to be turned off at any time during the interview.

#### Project Contacts:

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*Please feel free to contact the researcher and/or supervisor(s) if you have any questions about the project.*

#### Low Risk Notification:

*This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher named above is responsible for the ethical conduct of this research.*

*If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher(s), please contact Professor Sylvia Rumball, Assistant to the Vice-Chancellor (Research Ethics), telephone 06 350 5249, email [humanethics@massey.ac.nz](mailto:humanethics@massey.ac.nz).*

## Original Interview Protocol

### Part A: Demographics

Years in business	
Type of Industry	
Number of Full Time Employees	
Years of average service	
Staff turnover	
Company structure:	
<i>Senior Managers</i>	
<i>Middle Managers</i>	
<i>Lower Management – team leaders</i>	
<i>Operations</i>	
<i>Others</i>	

### Part B: Lean Background

1. Why is your company embarking on the lean journey?
2. What does Lean mean to you?
3. Can you tell me about how Lean was implemented in your business?

### Part C: Strategy and Alignment

4. Does your organisation have a vision?

Yes – please elaborate

Prompts:

- Long-term view

5. How is this vision shared with everyone in the organisation?

Prompts:

- Everyone looking in the same direction (alignment)
- Mechanisms to engage the people
- Visual Aids
- Self-Managing Lean team

### Part D: Leadership

6. How do you inspire people to engage in Lean?

Prompts:

- Good communication
- Trust
- Leading by example
- Respect
- People development
- Develop Lean teams

### **Part E: Behaviour and Engagement**

7. What changes have you seen in the behaviour of your employees as a result of this Lean programme?

Prompts:

- Teamwork
- Employees challenge ‘status quo’
- Waste elimination and continuous improvements
- Adding or creating value
- Employees are engaged with customer values
- Roadblocks
- Open to Lean training

### **Part F: Processes**

Organising around key business processes and engaging in process improvements are the cornerstones of a Lean enterprise. Two things are important when looking at business processes:

- Choose processes that are key to the core business.
- Design and optimise key processes to deliver value to the customer, business or value stream.

8. Which business processes have you focused on to add value to your key customer?

Prompts:

- Value stream mapping
- Alignment to strategy
- How did they identify what improvements are to be made
- Visual Aids

### **Part G: Technology, tools and techniques**

9. How do you improve and sustain these key business processes?

Prompts:

- Improvement projects
- Lean tools and techniques
- How do they determine what tools to use

### **Part G: Reflection**

10. What contribution will Lean make in enabling you to get to your vision?

11. Describe the significant change in your organisation from how you were before lean to how you are now?

12. Have you been able to sustain the changes you made?

13. What do you think will enable you to keep going on the Lean track?

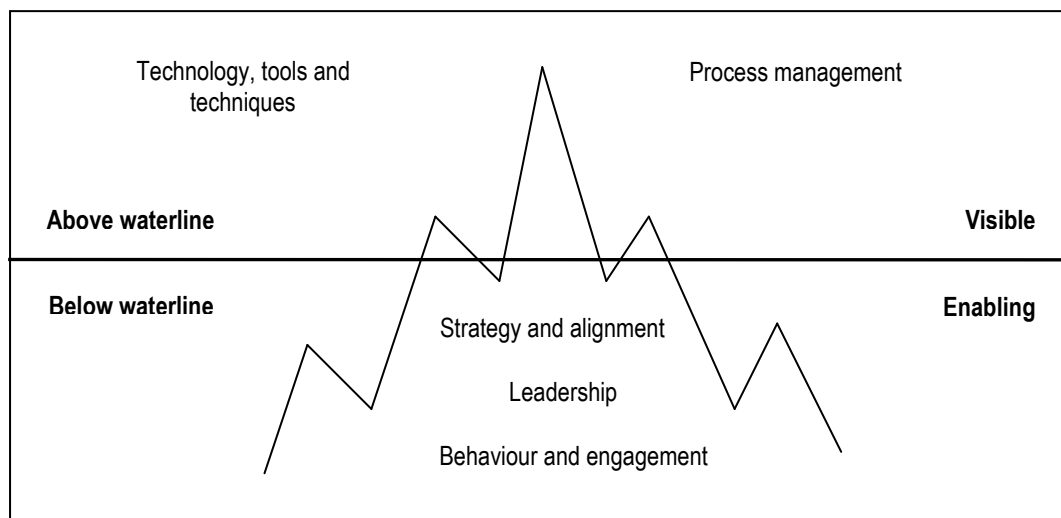
14. What do you think will be the key inhibitors to sustaining Lean?

15. Is there any other point you would like to make?

16. These questions were based on the ‘Sustainable Lean Iceberg Model’ from the *Staying Lean* publication by Cardiff University. How does this model (show model) apply to your situation?

- Developed after a 5 year study on sustaining lean transformation
- Latest publication in this area
- Leading research in Europe
- We are interested in seeing how this applies to the NZ manufacturers.

## The Sustainable Lean Iceberg Model



The sustainable Lean thinker needs to learn to see and act below the waterline as well as above it.

The items below the waterline are:

1. Strategy and alignment
2. Leadership
3. Behaviour and engagement

The items above the waterline are:

1. Technology, tools and techniques
2. Process management

To establish a sustainable Lean organisation you need to address each of the five elements illustrated in the iceberg. This needs to be achieved at all levels of the organisation not just on the shop-floor

## Final Interview Protocol

### Part A: Demographics

Years in business	
Type of Industry	
Number of Full Time Employees	
Years of average service	
Staff turnover	
Company structure:	
<i>Senior Managers</i>	
<i>Middle Managers</i>	
<i>Lower Management – team leaders</i>	
<i>Operations</i>	
<i>Others</i>	

### Part B: Lean Background

2. What level of education is in the company?

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3. What does Lean mean to you?

4. Why is your company embarking on the lean journey? Motivation behind undertaking this Lean initiative?

5. Is there any pressure from your supply-chain or customers to change/improve? Would it help if you did?

6. Did you see any potential negatives before implementing Lean – examples? Why did you see this?

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7. Can you tell me about how Lean was implemented in your business?

8. What is your perception of the consultant? What do you think his role is?

9. Are you managing to get that knowledge off him to allow you to stand on your own feet after he leaves?

10. What are your impressions on having someone from outside doing regular health-checks?

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### Part C: Strategy and Alignment

10. Does your organisation have a vision?

Yes – please elaborate

Prompts:

- Long-term view

11. How is this vision shared with everyone in the organisation?

Prompts:

- Everyone looking in the same direction (alignment)
- Mechanisms to engage the people
- Visual Aids
- Self-Managing Lean team

#### **Part D: Leadership**

12. How do you inspire people to engage in Lean?

Prompts:

- Good communication
- Trust
- Leading by example
- Respect
- People development
- Develop Lean teams

13. Have you managed to get SMT commitment to lean? Do you think a 2-day training course on Lean is sufficient? How do you get strong SMT commitment?

14. Do you see the need to have a lean expert in the organisation? What are your thoughts on getting that knowledge into the organisation? How are you achieving this or going to achieve this? How are they getting people to take up the role of the lean champion?

#### **Part E: Behaviour and Engagement**

15. Did you notice any difference to lean with skilled vs. unskilled staff?

16. What changes have you seen in the behaviour of your employees as a result of this Lean programme?

Prompts:

- Teamwork
- Employees challenge 'status quo'
- Waste elimination and continuous improvements
- Adding or creating value
- Employees are engaged with customer values
- Roadblocks
- Open to Lean training

#### **Part F: Processes**

Organising around key business processes and engaging in process improvements are the cornerstones of a Lean enterprise. Two things are important when looking at business processes:

- Choose processes that are key to the core business.
- Design and optimise key processes to deliver value to the customer, business or value stream.

17. Which business processes have you focused on to add value to your key customer?

Prompts:

- Value stream mapping
- Alignment to strategy
- How did they identify what improvements are to be made
- Visual Aids

18. What does customer value mean to you?

**Part G: Technology, tools and techniques**

19. How do you improve and sustain these key business processes?

Prompts:

- Improvement projects
- Lean tools and techniques
- How do they determine what tools to use

**Part G: Reflection**

20. What contribution will Lean make in enabling you to get to your vision?

21. Have you noticed any significant or impressive changes as a result of Lean and are you managing to sustain the rate of change or are you starting to slide? If so, why?

22. What does sustaining the lean initiative mean to you – how do you see sustainability?

23. What are your thoughts on the industry forums and cluster run by NZTE to promote sustainability? Did they help in sustaining the lean initiative?

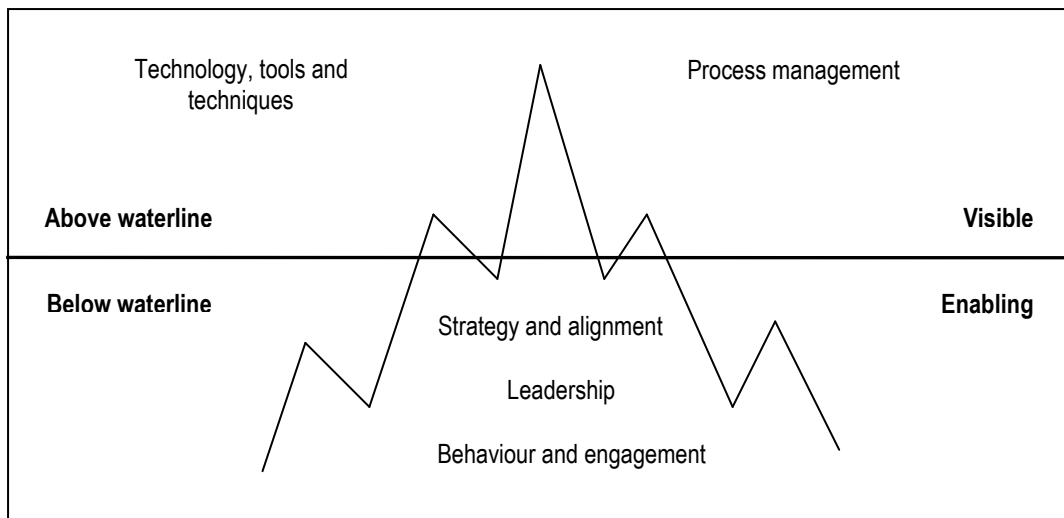
24. What do you think will enable you to keep going on the Lean track?

25. What do you think will be the key inhibitors to sustaining Lean?

26. These questions were based on the ‘Sustainable Lean Iceberg Model’ (next page) from the *Staying Lean* publication by Cardiff University. How does this model (show model) apply to your situation?

- Developed after a 5 year study on sustaining lean transformation
- Latest publication in this area
- Leading research in Europe
- We are interested in seeing how this applies to the NZ manufacturers.

## The Sustainable Lean Iceberg Model



The sustainable lean thinker needs to learn to see and act below the waterline as well as above it.

The items below the waterline are:

4. Strategy and alignment
5. Leadership
6. Behaviour and engagement

The items above the waterline are:

3. Technology, tools and techniques
4. Process management

To establish a sustainable lean organisation you need to address each of the five elements illustrated in the iceberg. This needs to be achieved at all levels of the organisation not just on the shop-floor



## **Appendix 4 – CI Focus Group Protocol**

The contents of Appendix 4 are listed below.

- Case-Study Information Sheet Sample
- Participant Consent Form
- CI Focus Group Questionnaire (Part 1)
- CI Focus Group Questionnaire (Part 2)

## Sustaining Continuous Improvement in NZ SME's.

### Information Sheet

**Researcher:** Yashwant Murti, Masters in Technology, Massey University, Palmerston North.

**Project Description:** This project looked at the experiences of several NZ companies in sustaining their continuous improvement initiatives. This study has a direct focus on shop floor implementation of lean manufacturing as a method for implementing continuous improvement. We will attempt to design a 'Sustainable Continuous Improvement System' for wider use in NZ from the research findings.

#### **This workshop:**

There will be a 15-20min presentation on continuous improvement and its application in NZ. I then wish to have a discussion with you on the findings of this study and finally, I would like you to complete a brief survey on issues that might impact continuous improvement sustainability within your organisation.

#### **Identification of Participants:**

No reference will be made to you or your organisation in any of the publications and the information you provide will only be used to support or contradict the research findings.

#### **Participant's Rights:**

You have the right to:

- decline to answer any particular question;
- withdraw from the study;
- ask any questions about the study at any time during participation;
- the discussions will be recorded on a Dictaphone. You may ask for the recorder to be turned off at any time during the discussion.

#### **Project Contacts:**

*Researcher:* Yashwant Murti,  
School of Engineering and Advanced Technology, Massey University, Palmerston North.  
Phone: 027 338 2438, Email: [y.murti@massey.ac.nz](mailto:y.murti@massey.ac.nz)

*1<sup>st</sup> Supervisor:* Dr Jane Goodyer,  
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*2<sup>nd</sup> Supervisor:* Dr Nigel Grigg,  
School of Engineering and Advanced Technology, Massey University, Palmerston North.  
Phone: +64 6 350 5799 ext 7399, Fax: +64 6 350 5604, Email: [N.Grigg@massey.ac.nz](mailto:N.Grigg@massey.ac.nz)

*Please feel free to contact the researcher and/or supervisor(s) if you have any questions about the project.*

#### **Low Risk Notification:**

*This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher named above is responsible for the ethical conduct of this research.*

*If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher(s), please contact Professor Sylvia Rumball, Assistant to the Vice-Chancellor (Research Ethics), telephone 06 350 5249, email [humanethics@massey.ac.nz](mailto:humanethics@massey.ac.nz).*

## **Sustaining Continuous Improvement in NZ SME's.**

### **Participant Consent Form**

**This consent form will be held for a period of five (5) years**

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I agree/do not agree to the discussion being recorded.

I agree to participate in this workshop under the conditions set out in the Information Sheet.

**Signature:**

**Date:**

**Full Name - printed**

## CI Focus Group Questionnaire (Part 1)

### How to sustain CI initiatives – Iceberg Model key lessons.

Q1: Do these qualities exist in your organisation? (Select Yes or No)

Key Qualities	Yes	No
1. Tool selection is driven by the needs of the customer, the business and the people within the business.		
2. Tools are part of policy deployment process. Employees understand why they are using it and how it will help.		
3. Early application of the basic tool and techniques emphasise on self-sustaining systems of management.		
4. Have visible and up-to-date information at the point of operation. Visualise problems and use the PDCA method in improvement projects. Monitor all improvement projects with KPIs.		
5. Use mapping tools to identify disruption in flow (waste). Mapping determines the baseline so improvements can be measured and monitored.		
6. Senior management select strategic key value streams that receive sustained improvement focus.		
7. Continuously apply customer value analysis to inform and improve all other key business processes.		
8. All employees understand the 'Voice of Customer' before attempting waste reduction.		
9. Have leadership structures based on the value stream requirements.		
10. Clear and stretching action plans have been developed and deployed throughout the organisation and people know what the business plans are and their contribution to making them happen.		
11. Use Visual Management Systems at all levels of the organisation to deploy vision, action plans, KPIs, etc.		
12. Individuals and teams can self-manage the business cockpits at all levels.		
13. KPIs are used to monitor improvement performance. KPIs measured and monitored regularly.		

**P.T.O**

14. Strong decisive leadership with CI experience in present for the early phase of the programme.		
15. Leaders are prepared to review themselves and the process critically in order to push the business forward.		
16. Leaders continually developed at all levels, on all shifts and within all areas of the business and adopt a 'leading the lean lifestyle' programme.		
17. Leaders' set the direction and develop a vision for the future and inspire and align people to achieve this vision through continuous improvements.		
18. Leaders develop people by constantly moving them out of their comfort zones and stretching them a little.		
19. Leaders can create dedicated and fully resourced CI implementation teams that understand the vision and accepts their roles in the implementation of the strategy.		
20. To inject pace into the programme experienced, motivated and multi-disciplined people are used to form internal CI teams.		
21. Sharing and learning is encourage throughout the programme, every opportunity is taken to get people together to discuss continuous improvements.		
22. Have people who are both competent and capable of pushing themselves and their teams out of the comfort zone.		
23. The organisation has employees who can envisage link between them and their customers and challenge the status quo.		
24. 'Roadblocks' are negotiated early and motivated employees are encouraged.		

## CI Focus Group Questionnaire (Part 2)

### Why NZ organisations have not being able to embed a CI culture?

Q1: Do you see these themes as being an issue for your organisation? (Select Yes or No)

<b>Key Inhibitors</b>	<b>Yes</b>	<b>No</b>
a. Compartmentalised lean as a short-term tool for productivity gains and not as an organisation-wide CI methodology.		
b. Organisations failed to shift from their traditional profit-driven ethos to a customer-value oriented philosophy.		
c. The senior management team (SMT) lacks understanding of CI and rely on an the consultant to drive the initiative.		
d. The SMT do not have the necessary skills to lead a change initiative and they fail to work alongside the consultant to develop these skills.		
e. On the departure of the consultant the responsibility for driving improvement is pushed onto the shop floor staff.		
f. The improvement activities are ad hoc and disconnected from the organisational vision.		
g. KPIs are not established and there isn't a rigorous process to establish if you have improved and you rely on anecdotal evidence to measure change.		
h. You do not have an entry or exit plan for the consultant. Consultants are charged with delivering quick-wins and the company revert to their old ways on his departure.		
i. Adding value to the end product was seen as increasing profitability.		
j. The staff are unaware of customer demands and continue creating waste.		
k. Processes improvements are happening in pockets as the organisation is not seeing their processes as value adding streams.		

**P.T.O**

Q2: Rank the four factors according to the impact this will have on your organisation's ability to sustain continuous improvement. (Rank 1 to 4, with 1 representing the largest inhibitor).

<b>Factors</b>	<b>Rank</b>
Factor 1: Understanding the CI Philosophy	
Factor 2: Managements' ability to lead a change initiative	
Factor 3: Developing a clear strategy for change.	
Factor 4: Improvements are not aligned with customer value.	

Q3: Are there any other inhibitors you expect to see within your organisation to sustaining CI?

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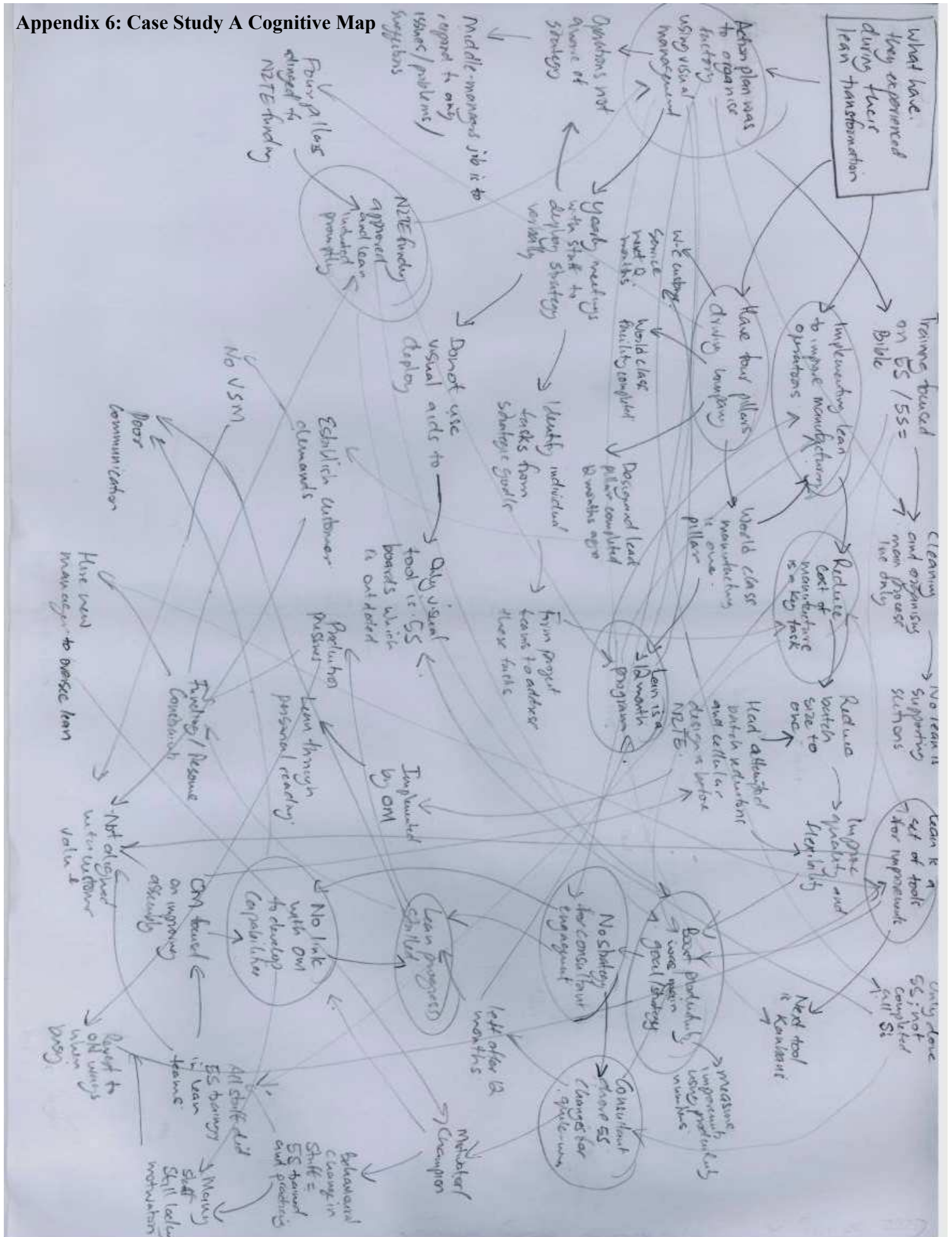
**Appendix 5: Key Lessons for Staying Lean from the Iceberg Model**

<b>Key Theme</b>	<b>Keys Lessons for Staying Lean</b>	<b>Key Skills</b>	<b>Key Tools / Techniques</b>
<i>Strategy and alignment</i>	<ul style="list-style-type: none"> <li>▪ Take time to define clear and stretching CSFs and build in a PDCA cycle to improve the deployment process.</li> <li>▪ Use Visual Management Systems (e.g. A3s) at all levels of the organisation to deploy and sustain the management process. A3s become the focus of regular review meetings to monitor progress and take corrective action.</li> <li>▪ Work to build up the capability of individuals and teams to self-manage the business cockpits at all levels.</li> <li>▪ Deploy words and numbers to ensure full ‘line of sight’ is achieved, so that people know the business plans and their contribution to making them happen. All employees should be engaged from the outset.</li> <li>▪ Use KPIs to monitor improvement performance. KPIs should be measured and monitored regularly.</li> </ul>		<ul style="list-style-type: none"> <li>▪ Policy deployment/ Hoshin Kanri</li> <li>▪ Catchball</li> <li>▪ PDCA</li> <li>▪ Visual Management (A3 planning and storyboards)</li> <li>▪ KPIs</li> <li>▪ Rewards system.</li> </ul>
<i>Leadership</i>	<ul style="list-style-type: none"> <li>▪ Strong decisive leadership with Lean experience is needed in the early phase of the programme.</li> <li>▪ Leaders must be prepared to review themselves and the process critically in order to push the business forward.</li> <li>▪ Continually develop Lean leaders at all levels, on all shifts and within all areas of the business and adopt a ‘leading the Lean lifestyle’ programme.</li> <li>▪ Leaders’ role is to set the direction and develop a vision for the future and inspire and align people to achieve this vision through continuous improvements.</li> <li>▪ Leaders are responsible for developing people by constantly moving them out of their comfort zones and stretching them a little.</li> <li>▪ Leaders create dedicated and fully resourced Lean implementation team that understands the vision and accepts their roles in the implementation of the strategy</li> </ul>	<ul style="list-style-type: none"> <li>▪ Good communicator.</li> <li>▪ Has a long-term perspective.</li> <li>▪ Respects employees.</li> <li>▪ Inspires change.</li> <li>▪ Trusting and trustworthy.</li> <li>▪ Able to monitor and evaluate outcome.</li> <li>▪ ‘Flow’ thinker.</li> <li>▪ Creates a learning environment.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Lean leaders programme</li> <li>▪ Level 5 leader</li> <li>▪ Gemba</li> </ul>

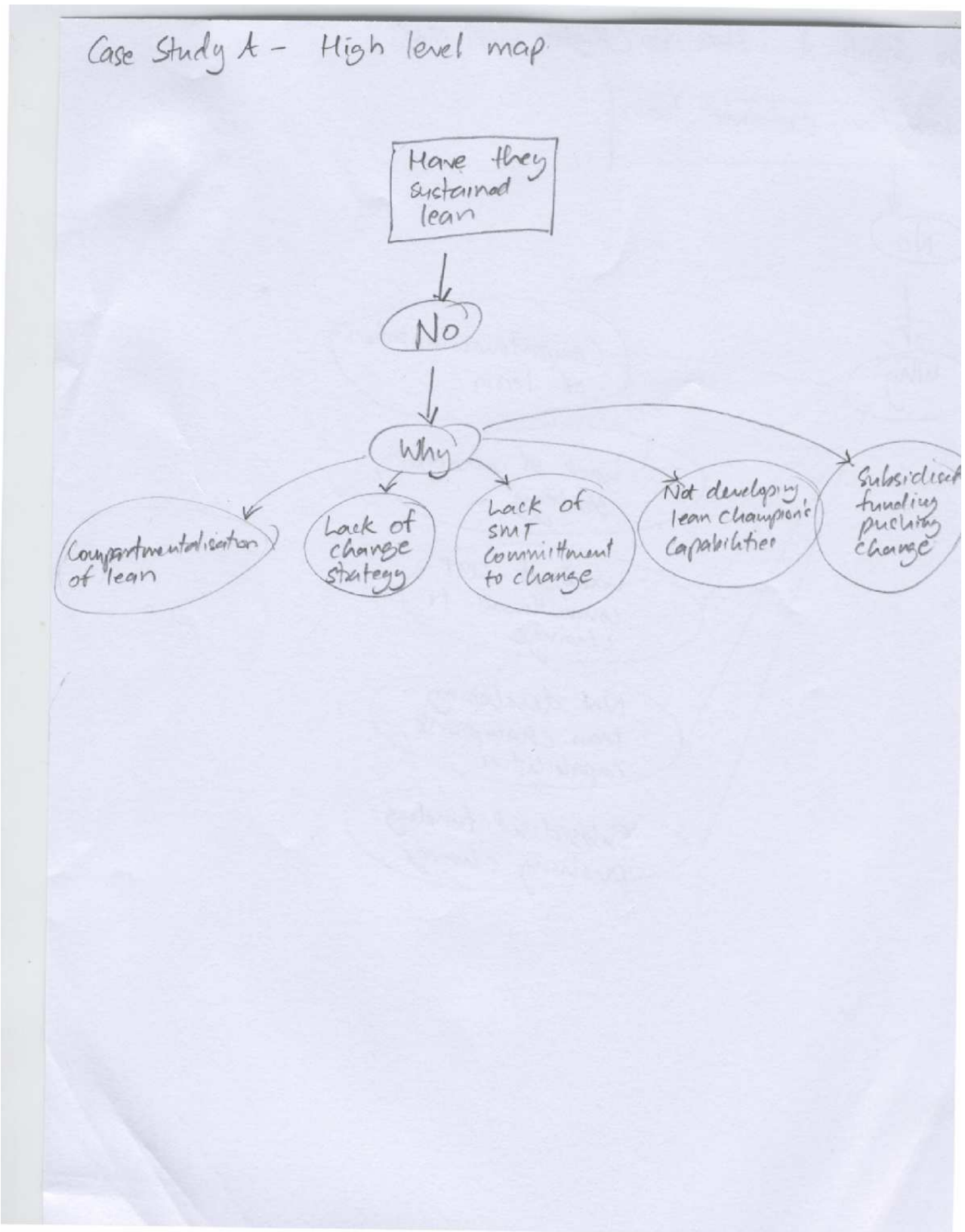
<p><i>Behaviour and engagement</i></p>	<ul style="list-style-type: none"> <li>▪ To inject pace into the programme take experienced, motivated and multi-disciplined people to form an internal Lean team.</li> <li>▪ Encourage sharing and learning throughout the programme, take every opportunity to get people together to discuss continuous improvements. Encourage teamwork.</li> <li>▪ Lean organisations need Lean people who are both competent and capable of pushing themselves and their teams out of the comfort zone and into the stretch zone.</li> <li>▪ Training, support and good communication with all employees encourage them to join Lean and create Lean behaviours. Open, democratic and honest work environment lead to engaged employees and environment where they can excel. Behaviour change and communication are key to engagement.</li> <li>▪ Create a ‘Lean Culture’ of waste elimination &amp; continuous improvement. Encourage ‘Lean Behaviour’ of adding or creating value.</li> <li>▪ Lean organisations have emotionally engaged employees who can envisage link between them and their customers. ‘Lean’ employees challenge the status quo.</li> <li>▪ ‘Roadblocks’ should be negotiated early and motivated employees are encouraged. Use appropriate and satisfactory rewards to keep employees motivated.</li> </ul>	<ul style="list-style-type: none"> <li>▪ 7 Lean skills</li> <li>▪ Team cultures</li> <li>▪ Lean coaches</li> <li>▪ Continuous improvement</li> <li>▪ <i>Kanban</i></li> <li>▪ Problem Solving</li> <li>▪ Catchball</li> <li>▪ Rewards system</li> </ul>
<p><i>Processes</i></p>	<ul style="list-style-type: none"> <li>▪ The application of value stream mapping tools needs to focus on longer-term management, not just mapping.</li> <li>▪ Use mapping tools to identify disruption in flow (waste). Gemba used to develop maps. Mapping determines the baseline so improvements can be measured and monitored. This helps sustain the effort and encourages people to improve continuously.</li> <li>▪ Senior management need to select strategic key value streams that need sustained improvement focus by addressing pillars and platforms.</li> <li>▪ Continuously apply customer value analysis to inform and improve all other key business processes. All employees need to understand the ‘Voice of Customer’ before attempting waste reduction.</li> <li>▪ Lean organisations have leadership structures based on the value stream requirements.</li> <li>▪ Use a combination of ‘Pillar’ and ‘Platform’ approach to improve processes; possibly starting with pillars for demonstration of improvement benefits and platforms to roll-out improvements across company.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Mapping tools</li> <li>▪ Pull systems</li> <li>▪ VOC insight tool</li> <li>▪ Pillar/Platform approach</li> <li>▪ Flow</li> </ul>

<p><i>Technology, tools and techniques</i></p>	<ul style="list-style-type: none"> <li>▪ Tool selection should be driven by the needs of the customer, the business and the people within the business; they should be pulled, not pushed. Tools need to be part of policy deployment process. Employees need to understand why they are using it and how it will help.</li> <li>▪ Early application of the basic tool and techniques needs an emphasis on self-sustaining systems of management.</li> <li>▪ Use appropriate ‘bundles’ and ‘combinations’ of Lean tools &amp; techniques to achieve the specific value stream goals and bottom-line improvements.</li> <li>▪ Use simple and proven technologies such as web cams and software to better manage and make the bridge between customer and supplier demand profiles.</li> <li>▪ Have visible and up-to-date information at the point of operation. Visualise problems and use the PDCA method in improvement projects. Monitor all improvement projects with KPIs.</li> </ul>	<ul style="list-style-type: none"> <li>▪ 5S</li> <li>▪ TPM</li> <li>▪ SMED</li> <li>▪ Standardised work</li> <li>▪ SOPs</li> <li>▪ Visual Management</li> <li>▪ PDCA</li> <li>▪ Mistake-proofing</li> </ul>
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Appendix 6: Case Study A Cognitive Map



Appendix 7 Case Study A - Higher-level map



## Appendix 8: Table of Quotes

Inhibitors to Sustaining Lean	Key Informant Quotes
<i>Lack of clear strategy for change</i>	<ul style="list-style-type: none"> <li>▪ <i>What is your company strategy?</i> I'm not sure of that.</li> <li>▪ I don't believe in having a vision; visions are blurry.</li> <li>▪ <i>Does your organisation have a strategy?</i> Probably, I am not aware of it</li> <li>▪ We have only focused on Key 1 for 12 months.</li> <li>▪ They are a bit disengaged down on the shop floor with the company strategy.</li> <li>▪ Our strategy has basically been to organise the factory using 5S.</li> <li>▪ <i>What's your company's vision?</i> Make some money, not too sure what it is. To survive the economic crisis in 2009 would be nice.</li> <li>▪ Our focus for the last 12 months has been on implementing Key 1.</li> <li>▪ <i>You are aware of the strategy?</i> Not at this stage.</li> <li>▪ We are now at a point where we are working on articulating a vision for the operations unit – won't bother with the broader business.</li> </ul>
<i>Erroneous understanding of lean</i>	<ul style="list-style-type: none"> <li>▪ Lean means clean to me</li> <li>▪ Lean is a set of cost-cutting tools for manufacturing</li> <li>▪ Lean means 20Keys essentially</li> <li>▪ Hardest thing to do when you are not busy is finding work for the guys; lean is a useful tool in that respect.</li> <li>▪ Lean has very much been driven as a tool for slack-time here.</li> </ul>
<i>Funding 'pushing' change</i>	<ul style="list-style-type: none"> <li>▪ More funding will enable us to sustain lean</li> <li>▪ We require assistance financially with external body to push lean forward</li> <li>▪ Funding was a big carrot for implementing lean</li> <li>▪ <i>What was your main reason for undertaking the lean programme?</i> Mostly because it was funded by government.</li> <li>▪ NZTE funding was probably the key behind our decision to undertake lean</li> </ul>
<i>Staff resistance to change</i>	<ul style="list-style-type: none"> <li>▪ Hard to keep them motivated and keep the morale up.</li> <li>▪ <i>What about the changes in the shop floor behaviour, engagement, resistance, etc?</i> Was a tough one to get through to them initially. We lost one staff member directly as a result of implementing lean – he didn't like it. We said we are changing if you don't want to fit into our window leave now, and one left straight away.</li> <li>▪ I have had some negativity when you start talking lean to them,</li> </ul>

	<p>but never seen the negativity when you involve them in the change process.</p> <ul style="list-style-type: none"> <li>▪ Hard to change old people. Got motivated people and hangers on. They are motivated by the benefits they get from the improvements.</li> <li>▪ People have trouble changing. Guys doing the same thing 40 - 50 years don't want to change their ways. There were 3-4 people disagreeing out of 20 that were doing things, that made it awkward for the rest.</li> <li>▪ Some people are more sceptical than others on what lean is going to deliver and how much it is going to cost.</li> <li>▪ <i>What are your inhibitors to sustaining lean?</i> Our biggest inhibitor is that people are negative towards it. Not wanting to buy-in towards it. Resistance to change.</li> <li>▪ Initially when we introduced lean, staff thought that more jobs were going down so that management want to get this thing done with less number of people with more efficiency. So it was a negative sort of frame of mind to start with.</li> <li>▪ Well at the moment the word lean means less staff, more work for those left</li> <li>▪ We had quite a bit on resistance, with lot of verbal disagreements going on. Those people have moved on. They saw it as threat because they were losing control.</li> <li>▪ Some people have pushed a bit against lean because SMT don't have a full understanding of it themselves and they are trying to promote it.</li> </ul>
<p><i>Lack of SMT commitment to change</i></p>	<ul style="list-style-type: none"> <li>▪ We had the consultant driving lean all the time last year. This year it has stagnated as I haven't had time to be able to push it along.</li> <li>▪ Managers need to make people more aware of what's happening and what can be happening in the future – keep people in the loop.</li> <li>▪ We need an external driver to keep focused</li> <li>▪ Problem is I don't have enough time. I need someone from outside who is the 'guru' of lean and assist by being the project expert in lean.</li> <li>▪ They didn't do anything with the 20 Keys because they were too busy being pushed by a numbers driven owner operator</li> <li>▪ Previous SMT went to all meetings, trainings but didn't get involved with lean. Nothing implemented at shop-floor level till new management took over.</li> <li>▪ The directors' participation in lean changes comes down to their will. As you know you can't teach someone that doesn't want to learn. I can't sack my business partners also, that's a very hard one to change.</li> <li>▪ Apart from one, the SMT haven't been involved. For me it's been</li> </ul>

	<p>a bit of a disappointment. I feel that they have left themselves out of the lean loop.</p> <ul style="list-style-type: none"> <li>▪ The main reason for lean taking a back-step has been lack of drive by management. When the top guys driving it left, the lean momentum fell off.</li> </ul>
<i>Lack of internal lean expertise</i>	<ul style="list-style-type: none"> <li>▪ We need external help, advice and support; we don't have enough people knowing enough about it internally to help us.</li> <li>▪ Our biggest inhibitor with lean is the lack of knowledge or expertise internally.</li> <li>▪ The problem was the consultant was here only once a month. The MD was not around as often as he should have been with other business interests. From the perspective of the company what they should have done was get a lean champion first before they embarked on embedding the lean initiative.</li> </ul>
<i>High staff turnover</i>	<ul style="list-style-type: none"> <li>▪ We didn't look after people too well. Awful people retention, literally a revolving door policy.</li> <li>▪ We lost a lot of lean knowledge with company restructures.</li> <li>▪ We had a committee of staff that was highly trained through the <i>Aichi</i> training. That committee slowly came apart because we lost 3 members during a point of resizing and adjusting our staffing level for the volume of work we were able to win at the time. So that slowed up our progress with lean on that basis.</li> <li>▪ Lost lot of staff, about 20 to redundancy, so that chopped what we were working on, and we had to continue with the Keys that were beneficial to us everyday, we were doing all the Keys to start off with, now we only doing selected Keys</li> <li>▪ Retaining staff is a major problem for us, about 6 to 8 people last year left this company and gone to Australia for better prospects.</li> <li>▪ The more staff we lose, the less we are able to focus on the Keys.</li> </ul>

Note: Some quotes have been paraphrased for ease of understanding. The original connotations of the informant responses remain unchanged.