

# LEAN – EXAMPLES IN CONSTRUCTION

Members' Report E3135

**Report of a workshop organised by the Construction Productivity Network on the 23<sup>rd</sup> September 2003 at *The Orange Studio*, Caxton House, Cannon Street, Birmingham, B2 5EP.**

<b>Speakers</b>	Martin Watson Adrian Blumenthal	<i>Construction Best Practice (CBP)</i> <i>Carillion</i>
<b>Chairman</b>	Ali Mafi	<i>Rethinking Constructing</i>

## INTRODUCTION

Applying Lean thinking has transformed many industries and its implementation in construction has now started to show the potential benefits. The lean approach is the only way that improvements in time, cost and quality can be made simultaneously without trade off. Lean construction focuses on delivering precisely what the client and end-user want. Its application requires a fresh approach in thinking about the complete process from design through to construction in order to remove waste, to create 'continuous flow' and to radically enhance value to the customer.

Rethinking Construction identified Lean as one of the key approaches that could lead to great improvements in quality and efficiency. The main principles of Lean are:

- specify value from the end customer's perspective,
- clearly identify the process that delivers customer values and eliminate all non value adding steps,
- make the remaining value adding steps flow without interruption,
- let the customer pull - don't make anything until it is needed, then make it quickly,
- pursue perfection by continuous improvement.

These principles are now being applied to construction in terms that are easily understood. Impressive benefits being demonstrated by the early practitioners have led to an increasing demand for information on what is involved and how to proceed.

The workshop heard presentations from leading practitioners giving an overview of the Lean process, the way these principles are being applied to construction and the experience gained, highlighting some of the lessons learned.

## LEARNING POINTS

- 1) Lean is a philosophy, not a set of tools and techniques. Lean merely provides ideas and principles for organisations to improve operations by using any number of different and innovative tools and techniques.
- 2) Initiatives and terminology can be intimidating, but it is a simple philosophy that can be clouded by tools and techniques.
- 3) Lean involves simple common-sense principles, which can be implemented from the most basic level of operations across the entire organisation.
- 4) Lean thinking can deliver dramatic improvements, particularly attractive to clients.
- 5) In Lean thinking, it should be noted that cost is targeted for reduction, not profit. This needs to be understood by the supply-chain for the principles to be embraced.
- 6) Relationships of trust between client and suppliers are very important for providing these dramatic savings.
- 7) Focus on Cost, Time and Quality – measure these and know where it is you are trying to get to.

## **CHAIRMAN'S INTRODUCTION**

The chairman briefly introduced the area under discussion by defining Lean Construction, outlining the general principles of Lean thinking and the potential benefits this has to construction projects.

## **LEAN CONSTRUCTION**

Sir John Egan defines it in this way, "Lean construction presents a coherent synthesis of the most effective techniques for eliminating waste & delivering significant sustained improvement". The philosophy of Lean is an umbrella that covers a multitude of tools and techniques commonly used within the industry.

### **What is Lean Construction?**

- A way to do more & more with less & less – less effort, less equipment, less time & less space - whilst providing customers with exactly what they want. (Dan Jones)
- Improving cost, time, quality and safety simultaneously without trade-off
- Lean construction principles basically involve,
  - The elimination of waste, especially within the process, in a strategic and considered manner, and
  - By creating continuous flow

### **Lean Construction**

- A 'lean' system/ process/ organisation is one that is waste free
- Lean is not about size or number of people employed. A reduction in employees may cut costs, and eliminate the waste of those employees, but does not decrease the proportion of waste to value adding within the organisation or process
- Most waste is through products waiting to be worked on by succeeding activities

### **Types of waste**

Waste can take on many forms within the building process. Below are some common examples:

- Building ahead of demand/time
- Waiting (people, material, information, for the next operation)
- Unnecessary transport (double handling)
- Inappropriate processing (larger machines, unnecessary steps, machines not quality capable, over design)
- Material stocks (early deliveries, storage space, deterioration)
- Unnecessary motions (ergonomics, bending, reaching)
- Building defective parts/sections
- Waste of untapped human potential

### **The impact of Lean**

Lean thinking changes the process of product delivery and therefore should give revolutionary improvements. It has been described as delivering "more-for-less". Value Engineering, on the other hand, provides savings through changes to the actual product and not necessarily the process. VE has therefore been described as delivering "less-for-less".

### **Value adding activities**

An example of the amount of value adding activities that are attained in various sectors is provided by the Cardiff Business School (Lean Profit Potential), which shows comparatively higher amounts of waste within construction,

#### **In a Construction Environment**

- 40% value adding activity or support activity
- 60% waste

#### **In an Information Environment**

- 51% value adding activity or support activity
- 49% waste

## **The FIVE principles of Lean**

---

©CIRIA, 2003, for the Construction Productivity Network. Entitled recipients may duplicate this Workshop Report for internal company use only. Opinions expressed in articles or editorial comments are not necessarily those of CIRIA or the Construction Productivity Network.

In order to attain radical improvement, one needs to understand how all the different initiatives within the industry fit together. This can be visualised as a puzzle, with each initiative comprising one piece. Initiatives (or pieces) in the puzzle will not work unless the 4 main principles of Lean are present. These Lean principles can be thought of as the corners of puzzle. The fifth principle of Lean, namely perfection, is one that flows from the establishment of the previous four. These are briefly listed below:

- Value** - Establish the expected value from the end users standpoint
- Value Chain** - Map out the value chain and eliminate non-value adding activities.
- Flow** - Aim for one piece continuous flow & synchronise all activities
- Pull** - Don't make anything upstream until needed
- Perfection** - Increase rate of flow & compete against perfection

### MARTIN WATSON – CONSTRUCTION BEST PRACTICE

- *Martin is the Programme Manager for the Construction Lean Improvement Programme (CLIP), which brings to construction businesses a practical approach to the successful application of lean principles to their work, enabling dramatic improvements to costs, delivery times and quality. CLIP is part of Construction Excellence.*
- *Martin has worked in the support of business, management and technology improvements for over 25 years in many industry sectors, including offshore, marine, process plant, oil and gas transport, aerospace, medical, automotive and electronics.*
- *For the last seven years he has worked exclusively in the construction sector and believes strongly that construction organisations that embrace lean will benefit as much as those in other sectors of the UK industry.*

Martin Watson provided case studies from the CLIP (Construction Lean Improvement Programme) initiative as examples of how lean principles can be successfully implemented in construction. CLIP is a movement (supported by the DTI) that seeks to take Lean principles into the construction industry.

### CONSTRUCTION LEAN IMPROVEMENT PROGRAMME (CLIP) – PRACTICAL EXPERIENCE OF APPLYING LEAN THINKING TO CONSTRUCTION PROJECTS

The radical improvements that Lean thinking can give the construction industry were communicated within Rethinking Construction: The Report of the Construction Task Force (1998). The following quotation offers some indication of the impact that Lean can have on the industry.

*"We are impressed by the dramatic success being achieved by leading companies that are implementing the principles of 'lean thinking' and we believe that the concept holds much promise for construction as well"*

#### What is CLIP's approach to Lean?

- It's not about trimming everything to the bone and squeezing more out of what's left
- It's not about wholesale restructuring of the industry
- It **IS** about the rigorous application of the fundamentals of lean philosophy to:
  - Focus on the details in small areas of operations
  - working with small teams (typically 10-15 people)
  - and emphasising the need for measurement of performance

#### How can this be done?

- By understanding **processes**
  - a process **transforms** the form, fit and function of the material or information to meet the **customers** requirements
  - it is made up of steps that we can list (**map**) in an agreed order, and do many times
  - it is what the customer **pays** us for
  - it has associated **costs**
- Eliminating **waste**
  - Waste consists of those parts of the process that do not contribute or add any value
  - One way of viewing waste is through the 7 Wastes (Muda), which never add any value, such as: Motion; Waiting; Defects; Transport; Overproduction; Unnecessary inventory; Inappropriate work or processing

- Making the value **flow**
  - It is only Value if the customer **cares** that it is being done
  - Anything else is waste

### **Based on these principles, what is Efficiency?**

Efficiency therefore is the ratio of value creating to wasted time. The primary components that make-up an activity and which need to be understood and measured can be summarised as follows:

- Waste (contributes no value)
  - Sorting, Copying, Rework, Batching, In/out-trays, Work in progress, Authorisation, Filing, Imaging
- Value creating
  - Raw Process Time
  - What the customer wants and is willing to pay for
- Sustaining
  - Essential QA time imposed by Regulator or Customer, which to them may be seen as adding value

The presentation then moved onto demonstrating what CLIP was set-up to do and demonstrate some of the benefits that Lean has had in the organisations implementing the philosophy.

### **Benefits in organisations that adopted Lean within the CLIP programme**

The massive benefits that these projects observed were identified as tangible and intangible. Some of these are listed below in order to provide an appreciation of what is possible:

- Tangible benefits
  - Productivity ↑ 16 – 40 %
  - Refurb lead time ↓ 25%
  - Pre-construction lead time (time between client approval and start of works on-site) ↓ 48%
- Intangible benefits
  - Best practice set-up, methods introduced, operation & organisation improvements, waste reduction, delays & disruptions reduced, snags reduced, communications improved, Team dynamics improved, partnering benefits, skills transfer in the industry

### **How do CLIP Masterclasses work?**

CLIP Masterclasses facilitate the appreciation and implementation of Lean in construction organisations and projects. A “lean” expert works with the team to make practical improvements and to train them by example – it is not learning in the class room, so results are immediate, tangible and directly relate to need. The Masterclass approach can be applied to any process in construction – specification, design, procurement or site operations (in the pilot tests we demonstrated that it works well even on the minute-to-minute detail of site operations). The Masterclasses activities basically consist of Diagnostic, Improvement Activity workshop and Follow-up stages, which together last approximately 3 months. The two fundamental stages, diagnostic and activity, are briefly discussed below.

#### **Diagnostic Stage**

- Objectives of the Diagnostic stage
  - To understand the current situation
  - To place a “stake in the ground” – calculate relevant Quality, Cost and Delivery measures
  - To gain a focus for the Improvement Activity
- Diagnostic Tools
  - Direct observation of work
    - Team members trained to observe methods, times, effectiveness and waste
  - Ask “why” five times
  - Non conformance reporting
  - Cause and effect analysis (fishbone diagram)
  - Flow mapping of processes or materials
    - Paper or video recording
    - “chunked” into individual process stages
    - Who, what, where, when, why, how?

## Improvement Activity

The Improvement activity (common approach) toolkit which seeks to implement Lean and eliminate the inefficiencies (waste) basically consists of the following tools and techniques, although any number of these, or others, could be used.

- The 5Cs – clear out, configure, clean and check, conformity, custom and practice
- The 7 Wastes (stated earlier)
- Visual control
- Standardisation of operations
- Improvement activity to sustain and to cascade knowledge
- Value chain mapping and process optimisation
- Focus on adding value and satisfying customer need
- Its common sense - but unfortunately its not all that common

## Barriers to Process Improvement and Achieving Lean

Change is not as easy to achieve as we'd like because we are dealing with changing real peoples' behaviour. We need to understand the issues.

### Primary Barriers to Change

The following three areas are seen as the main barriers to change and the implementation of Lean

- Organisational resistance
- Inadequate executive sponsorship
- Unrealistic expectations

These three principle barriers are discussed in detail below.

### Organisational resistance to change

Organisational resistance to change appears to go through a cycle over time which affects the workforce's effectiveness, confidence and morale.

- The usual cycle of Organisational resistance is: shock → denial → frustration → anger/confusion → acceptance → experimentation → understanding
- General solutions to organisational resistance
  - Develop a clear case for change
  - Involve people from different business areas
  - Train people
  - Devolve power
  - Lead by example
  - Feedback and encouragement
  - Highlight success

### Inadequate executive sponsorship

- Resources
  - Executives have conflicting priorities
  - Overstretched staff lack time for new initiatives
- Supporting behaviour
  - Preoccupation with traditional measures
    - *ask for quality but measure productivity*
  - Mixed messages
    - *Do what we say, not what we do*
    - *Only take an interest when things go wrong*
    - *Must reduce costs – won't invest to make improvements*
- General solutions
  - Select and develop team to lead the change
  - Adequate resources provided centrally (not project based)
  - Develop effective measures that encourage new behaviour
  - Pursue value, not reduced costs

### Unrealistic expectations

- Timescales
  - Transformation expected instantly
  - Initiative abandoned if no quick major improvement

- Levels of improvement
  - Expect major change with small effort
  - Belief that improvement is a one-off job
- Ability to change
  - Assumption that staff have all needed skills and commitment
  - Failure to stabilise existing business processes
- General solutions
  - Decide on scale of effort
  - Decide your ability to change
  - Set adequate timescale
  - Resource carefully
  - Be prepared to see things through – constancy of purpose
  - Don't con yourself

### **Summary**

In order to ensure the success of any changes within an organisation, particularly regarding the introduction of Lean principles, always remember the following:

- Lead by example
- Communicate
- Involve relevant staff
- Be realistic in your expectations

### **ADRIAN BLUMENTHAL – CARILLION**

- *Adrian is the Performance Manager for Carillion - Crown House Engineering*
- *He is presently on secondment to Constructing Excellence as Development Director*

Adrian Blumenthal presented a contractor's perspective on implementing Lean in construction. He emphasised the human factors in applying lean to businesses. The presentation was based on the current Old City Hospital project in Birmingham.

### **APPLYING LEAN PRINCIPLES TO OUR BUSINESS - CARILLION AND CROWN HOUSE ENGINEERING**

#### **What do modern construction clients' want from the industry?**

The presentation was opened by emphasis of what the modern construction client demanded of the industry's suppliers. They require overall satisfaction through improved time, cost, quality and whole-life/operating cost performance. In addition, they demand that this take place within an innovative, flexible and safe environment. However, these performance improvements also need to be achieved without compromising the supplier's own corporate objectives, which include financial performance, improved market capitalisation and penetration into new sectors.

It is argued that this can only be achieved by applying Lean Principles to construction.

In order to achieve the targets for improvement set within the Egan report, one needs to improve the process through waste elimination. This can only be realized by measuring value-adding and non value-adding activities. Measurement drives performance.

## Crown House and Carillion Route Map for Success

Carillion have mapped out their route to achieving these targets, which are summarised in the table below.

Route map for success	Process	People	Organizational structure
<b>Visions and Values</b> (e.g. market share)	KPI's and benchmarks	360 Surveys	Strategic plan
<b>Policy Deployment</b> (getting the message across, e.g. war-on-waste)	PD Matrix	Gemba	Balanced scorecard/EFQM
<b>Value stream management/VSM</b>	Process activity Map	Team building	Co- location/ integrated teams
<b>Continuous Improvement</b>	Last Planner Kaizen	H and S Tools	Product family teams
<b>Supply Development</b>	Client perception analysis/Kanban	360 survey and RFT	Relationship assessments
<b>Integration</b> (resources in or out of the company to maximize benefit)	Target Costing/risk and reward	Multi-skilling	DFMAMXXX
<b>Synchronization</b> (matching production cycle of the site to supply-chain production cycle)	Work flow and production planning	Multi-skilling and CFT	Extranets
<b>KM</b>	Best and worst practice capture and dissemination	Learn by doing SOPs	Corporate university LW

### What Carillion saw they needed to do to make 10% savings

In order to try and achieve an improvement of 10% on what Carillion do, they looked at the following:

- Find out how much Quality costs us (one of the organisation's KPI's)
- Improve the performance of our staff (ownership of issues, skills transfer etc.)
- Improve production control (improved planning)
- Facilitate improvement with our operatives
  - observation of object through the process, not measuring individuals
  - check which steps are value-adding
- Help the supply chain to improve its performance
  - Workshops, demonstrate performance improvement possibilities
- Balance of non confrontation, and commercial astuteness or edge
- Total employee involvement with:
  - Simple, visual communication (drawings on-site, method statements etc.)
  - Recognition, reward and celebration
- Continuous improvement culture with:
  - Bias for action
  - Right first time mentality

### Benchmarks for world-class performance improvement - what gets measured gets managed

The following improvement targets have been set by Carillion

- Quality improvement at 50% per annum
- Productivity improvement at 2% per month
- Sub-contract improvement at 1% per month
- Materials supply improvement at 1% per month
- Waiting time is less than 10 times the value adding time in the process

### CHE Policy Deployment Matrix - Stating how we are going to Implement Lean construction!

CHE have developed a Policy Deployment Matrix which outlines how Lean principles are going to be implemented into the organisation. In summary these are:

- **Financial Benefits:** Increase profit to 10%; reduce cost of quality by 50%; increase productivity,
- **Objectives:** Develop CI model for Crown House develop CI model for Crown House; eliminate waste on process; develop CI model for Crown House,
- **Selected projects:** Map value in design and construction process; train people in Lean thinking; create productivity teams,
- **Improvement targets (through improvement teams):** VSM team; work with supplier to adopt lean; create benchmarks for company; introduce critical chain scheduling; form value stream team site; form VSM supply chain; form value stream team design; form 5S team; visual management; Kanban logistics; Kaizan; Kaikaku event,

The Production Improvement Plans of Carillion involve 4 main areas, namely; production control; value stream management; workplace organisation; KPI's. Some of these are briefly discussed below.

### **Production Control**

- Introduce *Takt time* concept – e.g. building divided into 4 zones, through which teams move and ensure that the process continues to flow without interruption,
- Use *Last Planner*, monitor weekly work plan and non-completions. Availability of the construction plan is roughly 6 weeks, so planning needs to work on this constraint.
- *CCS* – Critical Constraint Scheduling. Take float out of the programme, so that construction plan is reduced significantly. Then add a buffer to the activities.

### **Workplace organisation (5S or CANDO)**

5S principles involve improvement to processes generally through good house keeping and sensible workplace organisation. These 5 principles are basically:

- Cleanliness
  - General tidying up
  - Removing from the landscape all items that are not in use, not required by the current activity
  - This means inventory - only that which is needed for that activity no more than a days worth
  - Improve, and keep rigorous paperwork
- Arranging
  - Determine a place for everything to be kept
  - Material to be arranged to minimise waste on motions- double handling
  - Shadow boards for tools
  - Visual Management
- Neatness
  - Everything in its place and ready to go
  - Visual management seeing where everything is
  - 5 minute cleanups on the hour
  - Plans, schedules, risk assessments, Takt time all displayed
  - Responsibilities for neatness assigned
- Discipline
  - Don't Do it-stop the line!
  - One thing at a time latest start earliest finish
  - Establish routines
  - Conduct regular audits
- Ongoing Improvement
  - Maintaining the tempo of every thing we do
  - Getting to the root cause of the problems
  - Stretching to reach the targets
  - Learning to see waste and improve our performance
  - Challenge what has gone before

### **How does VSM work?**

- Measure and visualise "waste" in the process - Material flow and information flow
- Provide a clear statistical picture of the process in terms of time and distance
- Understand the causes of the waste
- Work to reduce the waste in the process

### **Definitions/Review**

In order to consolidate some concepts a review of the main concepts of Lean is re-stated here.

- *Value Adding Activity*
  1. The customer cares
  2. It has to be done right first time
  3. It transforms or shapes the raw material or information to meet the customer's requirements



4. Adds to the security of their business. E.g. Consolidation centres, as set up at Heathrow (T5), are not essentially value-adding, however it adds security to their business and so does add value for them,
  - *Non-Value Adding Activity*
    1. Any activity that does not meet the above criteria and consumes time, space, resources

### Process Evaluation

Process evaluation Data is divided into 4 categories for measurement. All activities can be categorised into these basic categories. Only the first adds actual value.

- Operation, Value adding step
- Inspection
- Transport
- Delay

Examples of studies are provided below for pre-fabricated steelwork and a concrete pour, demonstrating the vast potential for waste elimination in the construction process.

Process Evaluation	Steelwork	Concrete	Total for all processes mapped
Transport	84.6%	78%	80.79%
Inspection	0%	7%	3.81%
Delay	15.1%	7%	10.75%
Operation	0.3%	8%	4.65%
Total number of steps	216	168	-
Number of people	5	7	-
Time taken	456	159	-
Distance travelled	1942m	511	-

DEVELOPING A WORKING CULTURE IN WHICH **PEOPLE** COME TO WORK EACH DAY WANTING TO **CHANGE THINGS** FOR THE BETTER.....AND PROACTIVELY **DO IT**

### DISCUSSION

- Q: What happens to the issue of improved efficiency ultimately meaning less money for operatives?
- If a change results in contractors/operatives earning less weekly pay then the initiative is bound to fail,
  - Ultimately the appeal must be to peoples desire for more money, that is convincing them that there is more money through Lean, not less,
  - It is necessary to have the Unions on-board with any of these initiatives, so as to ensure that there is buy-in,
- Q: If Lean is so obvious, why is it not being taken-up?
- Lean encourages one to view operations on-site more critically and start to question why things are done as they are – very common-sense approaches to issues,
  - Attitudinal problems are the main barriers to the implementation of Lean on-site,
  - The problem is often that organisations/projects do not view the big picture of what they are trying to achieve – instead they implement different tools and techniques in isolation and become disappointed when they do not return the expected results,
  - Most businesses buy 70% of what they sell (materials and services) – organisations that don't manage their supply-chains are therefore 'passing-over' the opportunity to influence 70% of what they pass onto their customer,
- Q: How does one deal with the human aspects of implementing Lean principles?
- It is one of the most difficult aspects of Lean,
  - It is important to function within a no-blame culture,
  - Allow the team to be radical – although risks involved, all sign an agreement that a project is used to find out what the problems are – without attributing blame. Highlight the problems and pass them back into the organisation as case histories for use as lessons learnt - e.g. on one project there were pipe installation problems on site – found that the building onto which these were being fixed was 100mm out from the drawings. No blame attributed, learnt lessons and moved on.

---

©CIRIA, 2003, for the Construction Productivity Network. Entitled recipients may duplicate this Workshop Report for internal company use only. Opinions expressed in articles or editorial comments are not necessarily those of CIRIA or the Construction Productivity Network.

- Important to do the diagnostic measurements so that one can pass that information over in a non-emotive way – ‘this has cost us this much, how can we improve...’
- Concentrate on facts – focus on what is happening to a product over time, particularly directed on waste in the process. People can’t hide from the figures.
- Implementation of these principles is hard work, but significant rewards are possible,
- Lean construction is not an instant, easy formula – but takes hard work, although the principles are simple,

Q: What is the client’s role in Lean?

- There is a misconception in the industry that clients do not want suppliers to change their practices - it is unfounded. Client’s are not the hindrance to implementing Lean construction,
- Larger public sector clients have recently become more attuned to these possibilities and are going begin demanding the year-on-year improvements that Egan suggested,
- Lean philosophy is seen as the only way of achieving these targets,
  - E.g. rigorous analyses show that some activities are only 4% value-adding, indicating that the potential for improvement is enormous,
  - World-class organisations, like Toyota achieve in the order of 12% value-adding activities in their whole supply chain, although this level of efficiency has taken 16 years to achieve,

Q: Lean seems appropriate for large organisations, but what about SMEs?

- The larger organisations like Carillion use their weekly meetings to discuss performance and Lean principles with their suppliers, but they also give their suppliers the skills through workshops so that they understand the principles themselves. These suppliers are often SMEs,
- The exact problem of SMEs adopting this philosophy was evident in the car industry, but it is resolved through active involvement by the ‘client’ to teach and implement Lean within their supply-chain,
- A key in any implementation is to identify the key people within value-adding activities and influence them,
- Suppliers need to be helped to do what is required in terms of performance, however this does not mean that they need to be approached in a soft or overly-compromising manner,
- When considering Lean, it is helpful to think of oneself as both a customer and a supplier within the supply-chain,

Q: Do you need increased resources to implement Lean thinking within the organisation?

- More resources are not necessary to implement Lean. Initially small process improvements and savings will free-up resources to tackle larger processes in the organisation,
- The change should be undertaken in small bits, and does not necessarily involve an instant organisational change that tackles all aspects of the organisation’s processes simultaneously,
- However it is advised that the first area to be addressed with Lean principles should be significant enough to deliver good savings,
- The savings that Lean provides usually results in the opposite problem of redundant resources, which need to be dealt with. The savings expected, and resultant redundant resources, need to be counteracted by initiatives such as business expansion, so that these resources can be absorbed,

Q: How does this work within unique businesses?

- The way in which Lean will work in each organisation will be unique,
- Lean is a philosophy and not a ‘recipe book’. The tools and techniques often spoken about are simply methods of implementation,
- Any implementation must start with identifying what the organisation wants to achieve,
- This must be done in the context of most smaller businesses who don’t have the capacity to dedicate resources solely to these initiatives, however they do have more flexibility than larger organisations and can change more easily once the avenues for improvement have been identified,

- In implementing Lean, organisations must be realistic in what they can achieve within given timescales. Small organisations have less to dedicate to thinking through the possible changes, and therefore these need to be done in small bits, but concentrating on areas that can yield the greatest benefits,

Q: Are suppliers left to themselves to meet the client's demands for better performance?

- Within the car industry, the client (car manufacturer) would make demands, but would also undertake to teach and assist their suppliers in these new work philosophies so that mutual benefit was achieved,
- Reductions in suppliers within the car industry were mainly to reduce interfaces and improve interaction between organisations,
- Price consists of cost + margin – using Lean principles, prices are reduced **not** by cutting margins but by deleting waste within the cost element of the price,

In order to bring about change, one needs to go through a 2-stage process:

- Everything is created twice, once in the mind, and once physically,
- Lean thinking facilitates people to think through all processes and imagine how they could be done if their processes were Lean. It involves trying to imagine a product in constant flow through the process, without any waiting or delays,

Q: How is information captured in a Lean way?

- Weekly production reports, KM systems on the intranet with posted articles,
- Workshops to increase awareness using interactive sessions,
- Demonstrate tools so that people can see the potential benefits for themselves,

Q: Is there a danger of initiative overload?

- No, change is undertaken at a very practical level. Try different things on-site and see the actual results. Involves a cycle of issuing a challenge and returning regularly to report on the progress,
- Change must be applied at the practical level - at the 'coal-face'. This application at the practical level facilitates the understanding of the underlying theory, which thereafter allows people to apply it to other operations they undertake,