

Mossman, Alan (2009) "There really is another way, if only he could stop ... for a moment and think of it"—Why isn't the UK construction industry going lean with gusto?. *Lean Construction Journal* 2009 pp 24 - 36

## Forum essay

*"There really is another way,  
if only he could stop ... for a moment and think of it"<sup>1</sup>—*

# Why isn't the UK construction industry going lean with gusto?

Alan Mossman<sup>2</sup>

## Summary

Even though there is now recognition that the Venice Arsenal (16C) and Henry Ford (Model T production line 1920s) were both precursors<sup>3</sup>, the idea of *lean production* didn't become popular until the publication of Womak & Jones' *The Machine that Changed the World* in 1990. Six years later the more general idea of *lean thinking* received considerable publicity. In 1998 the Egan committee commended the UK construction industry to study and learn from colleagues in other sectors who were already applying lean.

In parallel Lauri Koskela coined the term *lean construction* in 1992 and from 1993 the *International Group for Lean Construction* (IGLC) has met annually to discuss applications of lean to the end-to-end construction process (see [www.iglc.net](http://www.iglc.net)).

Following a brief review of the definition of lean construction, this essay explores some of the reasons why there has not been more implementation of lean in UK construction over the decade since Egan and includes reference to experience elsewhere.

Drawing extensively on anecdote and hearsay, this essay—it is not a research paper—is the start of a research process that I'd love others with the time & the resources to complete to pick up. It concludes with a preliminary hypothesis and suggestions for rigorous research.

## Introduction

I had a call one morning in March 2007 from a fellow consultant in London. A client of his, a significant regional contractor, had received a Pre-Qualification Questionnaire-PQQ asking *inter alia* about lean and the company's lean journey. Where, my caller wanted to know, could he find out about lean construction so that he could help his client get up to speed.

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<sup>1</sup> AA Milne, Winnie-the-pooh, 1926

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<sup>3</sup> for more see <http://www.lean.org/WhatsLean/Timeline.cfm> 26 Jan 09

But why, I asked myself, did it take a client to spur this contractor into action. Why, I had wondered a week or two before, when a client of mine asked their architects to use nD CAD, did the architect say *yes* so reluctantly—until another, much larger client, BAA, insisted on it. Why did they not want to go that way anyway? Surely it's a *no brainer*.

Well clearly it isn't.

This essay has grown out of a number of recent conversations, particularly an hour-long discussion with Prof David Seymour and Steven McCabe about why lean is not more used in construction.

The idea of lean *production* didn't become popular until the publication of *The Machine that Changed the World* in 1990. Six years later the more general idea of *lean thinking* received considerable publicity. In 1998 the Egan committee commended the UK construction industry to study and learn from colleagues in other sectors who were already applying lean: "*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. Indeed, we have found that lean thinking is already beginning to be applied with success by some construction companies in the USA. We recommend that the UK construction industry should also adopt lean thinking as a means of sustaining performance improvement.*"

In parallel Lauri Koskela coined the term *lean construction* in 1992 and from 1993 the *International Group for Lean Construction* (IGLC) has met annually to discuss applications of lean to the end-to-end construction process (*see* [www.iglc.net](http://www.iglc.net)).

The intention of this essay is to suggest and explore some reasons why lean construction hasn't established a bigger foothold in UK in the last decade. There will be discussion of experience elsewhere *en passant*.

The essay is necessarily based on anecdote and concludes with suggestions for further and more rigorous research that I would be happy for others to pick up and run with.

## What is lean construction?

Attempts to answer this question are inevitably controversial—there is no agreed definition, even within the IGLC & Lean Construction Institute (LCI) communities.

The picture of *lean production* in *The Machine that Changed the World* (Womack *et al* 1990) is sketchy. Two years later Koskela writes about *lean production ideas in construction* (1992) and subsequently coins the phrase *lean construction*.

In 1996 in *Lean Thinking* Womack and Jones detailed five operational principles of general applicability and offered *inter alia* case studies of applications in Tesco (logistics) and in a US construction company. In *Lean Thinking* the concept of lean is summed up:

*In short, lean thinking is lean because it provides a way to do more and more with less and less - less human effort, less equipment, less time and less space - while coming closer and closer to providing customers with exactly what they want.*

In *Rethinking Construction* (Egan 1998) the term *lean construction* is not used except to refer to the Lean Construction Institute. *Lean Thinking* is defined in terms of Womack and Jones' (1996) 5 principles—value, value stream, flow, pull and pursuit of perfection (Jones was a member of Egan's Commission).

It is not until Jeffrey Liker's *The Toyota Way* (2004) that there is a popular book outlining the strategic *organisation* level principles that guide behaviour in Toyota, but even this does not define lean. He defines a *lean enterprise* as "the end result of applying the Toyota Production System to all areas of your business" (p.7). Liker then goes on to define something more than the TPS, *The Toyota Way*.

In 2005, in the context of a competition for the design of affordable homes, English Partnerships, a UK Government Agency, asked competitors to demonstrate *lean construction* (LC) as part of their entries and offered a definition:

*... the continuous process of eliminating waste, meeting or exceeding all customer requirements, focusing on the entire value stream and the pursuit of perfection in the execution of a constructed project. Lean construction philosophy requires a continuous improvement focused on a value stream which responds directly to the needs of the customer. Improvement is, in part, accomplished by eliminating waste in the process. Lean construction can therefore apply right across design, procurement and production processes. (Design for Manufacture Competition 2005)*

Also in 2005, Tariq Abdelhamid wrote:

*".... From varied experiences related to Lean Construction (LC) (in IGLC, LCI, LCJ, industry, research, teaching, practice, etc.) it seems to me that we all have a different notion of what is LC. I believe the danger of not having the same notion of LC will inevitably lead to disparate implementation efforts/methods/techniques. .... There are also many definitions suggested in the literature and in cyberspace.*

*".... ...we need to agree on the end we seek but we should definitely allow ourselves to disagree on how to seek this end, which ... will allow for creativity and new discoveries. ... at some point in the future the understanding we have of LC could/will change when we find a mismatch between the principles and practice. This will signal the need for a new paradigm shift. But right now, we need to establish what LC is"<sup>4</sup>.*

We are still without that agreed definition—and that may not be a problem. Even though we may not be able to say with any certainty what Lean Construction *is*, it is much easier to say what it is *not* and to recognise its absence. The competing definitions give an indication of the boundary between what is generally accepted as lean and what is not. [For me what is missing from all of the above definitions is the transformation in thinking that I believe is a prerequisite for lean - I plan to say more about that in another paper.]

## The benefits of lean in construction

With that distinction in mind it is possible to define benefits that flow from construction operations and construction enterprise management arrangements that may be fairly safely labelled *lean*. The following benefits are claimed (and there are others):

- More satisfied clients
- Productivity gains
- Greater predictability

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<sup>4</sup> find more discussion at [http://www.msu.edu/user/tariq/Learn\\_Lean.html](http://www.msu.edu/user/tariq/Learn_Lean.html) and wikipedia (2007) email to IGLC2005 list Sun, 12 Jun 2005 15:01:38 -0400 Subject: RE: Should we answer the question "What is lean construction?" ?

- Shorter construction periods
- Operatives able to make better money
- Sub-contractors able to make better money
- Improved design
- Reduced costs, less waste
- Improved safety and health
- Improved quality, fewer defects

With carrots like these why are not more companies *going lean* than is currently the case? It is not as though the claims are not backed by adequate evidence—see past IGLC papers ([www.iglc.net](http://www.iglc.net)) and CLIP (<http://www.bre.co.uk/service.jsp?id=355>) for example. There is not space to review that literature here.

As Eric Johansen has pointed out<sup>5</sup>, a strong link can be made between lean and the sustainable construction agenda—increasing value *and* reducing waste. Eric believes that construction “*customers will be defining value to them in broader, more sustainable, terms in the future so if we are truly lean then we will ... be taking account of these issues anyway*”

## Discussion

This first part of this discussion is organised around some of the following ideas about why lean has not taken off:

- Fragmentation
- Low-tech, long-term, soft-skill
- It's just too big
- All Risk and No crisis
- No time to think
- Not invented here
- New thinking vs old habits
- Squeezing Middle Management
- All head and no heart
- Procurement and contracts
- Individual remuneration
- Low level literacy and computer literacy
- Giving lean a bad name
- Over enthusiastic champions
- Lean education, competing consultants
- There's nowt so practical as a good theory
- Fear

This is followed by a brief look at some of the conditions that seem to favour lean implementation.

## Fragmentation

Lean has had a significant effect in other sectors such as automotive and aerospace. Fragmentation and sub-contracting in construction means that there is little incentive for project teams to learn together—it is highly unlikely that they will work together again. Some clients have attempted to create opportunities for that to happen through partnering agreements, but these generally only involve the major players

There are signs of consolidation in UK construction. In the decade to 2005 the number of construction companies registered with DTI fell by 6% while the number of people employed in registered companies increased 26% (constat 2006). But the rate of consolidation is not fast enough to make a significant difference in the short-term.

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<sup>5</sup> private communication about this essay

*Accelerating Change* (Egan 2002) called for the formation of *integrated project teams* (IPTs). Design-Build and PFI procurement and requirements for government projects to consider *whole life value* make the formation of at least virtual IPTs more likely. Progress is slow but, if and when they form, IPTs will create conditions that could support lean in both design and construction and in the end-to-end process.

At least one major constructor has a strategy to focus its activity on negotiating projects where they have an involvement in design. This makes it easier for them to keep teams together, to do more work off-site and to make significant other savings because they have the opportunity to optimise the end-to-end *design* and construction process.

This company and a significant number of other larger constructors have significantly reduced the number of companies in their supply chain often to single figures for each trade. This means that significant parts of teams are more likely to work together on successive projects and that there are opportunities to explore on-site customer-supplier relationships between trades as part of general supply chain development discussions.

### Low-tech, long-term, soft-skill

Applying lean thinking to built environment processes is low-tech long-term and requires soft skills. Soft skills are much harder for most people to do well than so called “hard” or techie skills. At the same time there is far less money behind low-tech soft skills—securing patents and other IP protection is notoriously difficult.

Long-term change and development is unattractive to many managers on a fast track to the top—they want results within 12 months so that they can get their next promotion. The big consultancies are similar—they want quick and positive results for their next assignment.

Despite the evidence that short-termism of this sort is not in the long-term interests of most businesses, it is alive and well in our organisations.

### It is just too big

While the industry is fragmented, the implications of lean for a business are huge and the duration of a lean transformation—at least six years, going on sixteen—significant<sup>6</sup>. Going lean in project-based organisations like construction is likely to take longer than in manufacturing—where it often takes three to five years just to embed a continual improvement culture. An effective lean transformation will involve a constructors’ supply chain just as in manufacturing and will require “*consistency of purpose*” and consistency of leadership over a considerable period.

It is possible, even desirable (see Arbulu & Zabelle 2006, Henrich *et al* 2006), to start small and gain experience gradually. How well are these incremental pathways understood? Do lean interventions generally pay for themselves within 12 months as some claim?

### All Risk and No crisis?

Whether, like Tiger Woods, you invest in changing your swing, or you decide to change the way people think in your organisation, there may be a short-term dip in performance while new behaviours bed in. Even at the top of his game, Tiger Woods clearly thought the long-term benefits would be worth it—not once but twice. Many

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<sup>6</sup> in 2005 DPR Construction gave itself 20 years to become to construction what Toyota is to manufacturing. After 70 years Toyota reckon that they still spend 20% of their time creating waste (Kennedy 2003, 9)

UK construction managers love to play golf. What stops them from following Tiger's example back in the boardroom?

*If it ain't broke don't fix it* is a commonplace. Most in construction are making profits (averaging around 2%—unless you are in housing where it was higher). So in the housing sector the argument was “we are doing really well, why risk it by trying something new?”. For the rest of the industry the excuse is often “our margins are so tight we cannot afford to make changes where there is a risk it might put us into the red”<sup>7</sup>.

The title of W Edwards Deming's *Out of the Crisis* (1982) refers to the fact that it is often only in crisis that companies make efforts to change (and then is often too late). Until very recently there has been no crisis in UK construction since Egan encouraged the industry to go lean. Will the crunch bring lean on? There are some signs that it might be.

### No time to think

Recession, like a heart attack, is a great incentive to people to do something different. Recession can also provide something that is all too often missing in a growing market—time to think, time to reflect.

With everyone working flat out in the boom time and the shortages in both trade and professional staff, time was at a premium. If there is no time to think then there will be no time to learn new skills, new ways of thinking, that new golf swing.

Will companies use the crunch to make space to think, to learn and to transform in preparation for the upswing?

### Not invented here

As Koskela and others have noted—construction is a different form of production than manufacturing, it is one-off project-based. An easy out is “this works in automotive, but construction is different”. That isn't a reason to reject it altogether, but some people [unlike colleagues in Brazil (*see e.g. Pereira 2004, 2006, Kemmer et al 2006*)] treat it as if it was.

Of potentially greater relevance to construction is Morgan & Liker's *The Toyota Product Development System* (TPDS) (2006) and the principles and methods outlined by May (2007), Ward (2007) and Kennedy (2003, 2008). Like construction, TPDS is project-based production.

### Squeezing Middle Management: New thinking vs old habits

The benefits for operatives at the workforce are clear—lean enables them to make money faster; the benefits for top management are also pretty clear—greater productivity, shorter timeframes, less disruption from accidents. For middle managers the benefits are not so clear and their training has not prepared them for the changes in thinking and culture let alone the new roles and responsibilities (Odgaard 2005). As Boldt's Paul Reisser noted in a presentation (Reiser & Gupta 2005) lean leadership requires people who are both facilitative and authoritative, skills that contrast sharply with those of the predominant *command and control fire-fighters*. These individuals, like those who promote them, are rewarded for their fire-fighting skills.

One of the underlying assumptions in lean was brilliantly summarised in this final slide of a presentation by Abdel Azzouzi & Steve Toele of Todd Shipyards (2005).

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<sup>7</sup> one manager has been heard to report that his company had to be lean—they were only making a 1% profit!



One consequence of acknowledging that operatives have brains and know a thing or two about improving the way construction is done is giving them authority—and that means middle management have to give up some of theirs.

Lean systems like Last Planner (LPS) only survive in a learning culture. Blame, fear (see more below) and command and control will kill LPS. As a *fire prevention* tool LPS is a threat to middle managers—they don't know how to be *improvement* and *learning* managers. In a growing construction market, with skill shortages at all levels, companies cannot afford to replace these individuals with those who think differently (e.g. *making work ready*, planning better operations and logistics so that work *flows* and supporting continual improvement to create further improvements), even if they could find them.

Looking at why construction companies are reluctant to adopt new ideas, Henrich *et al* (2006) concluded "... *innovation should be coupled with ... understanding the circumstances within which it is used, when it is used, and why.*" Like a fish out of water, lean processes and lean tools struggle when they are not supported by *lean* thinking—as John Seddon, a British lean service consultant, so eloquently points out in his essay "*Watch out for the toolheads! Everything you need to know about lean manufacturing tools and why they won't work in service organisations*" (2005). The argument applies equally to construction.

### Procurement and contracts

Procurement processes and contracts seem to presuppose an adversarial process, so even if stakeholders want to, it is difficult to collaborate & operate in a lean way. As Penny Cullen *et al* (2005) from the Warwick University *Warwick Manufacturing Group* conclude:

- Contract forms that allow one party to impose power over another create adversarial relations
- Adversarial relations create transaction costs
- Transaction costs = waste and are therefore contrary to the lean philosophy
- Traditional contract forms undermine the application of lean principles.

Recent contracts such as PPC2000, Be, NEC3 and the new JCT-Constructing Excellence Contract are moving in the right direction. How much further could they go? You only have to look at Will Lichtig's *Integrated Form of Agreement* or the BAA T5 *Agreement* to get an idea of the answer.

### All head and no heart

All the arguments for lean seem to be made on a logical and rational basis with facts and data. What is missing is the personal-emotional message, the passion that makes the difference. For me that is why Al Gore's movie *An Inconvenient Truth* is so powerful—it combines stories from the reality of his personal experience with the data. Data don't connect with people, people do, heart to heart. The Egan Report (1998) didn't do that, nor did *Accelerating Change* (Egan 2002). Lean case studies

produced by CLIP and Constructing Excellence<sup>8</sup> don't do it either passionate speakers at Lean Construction Institute UK (LCI-uk) events can and do.

### Individual remuneration

I noted earlier that lean enables operatives to *make better money*. This is particularly true where operatives are paid by the piece. This may appear to be a great reason why lean should be adopted. Problems arise though when a working trade foreman who is paid on piece rates is not compensated for loss of earnings to engage in lean related activities such as LPS, improvement groups, etc. Many trade foremen, once they have experience of lean ways of working, are keen to support it for the reasons outlined in Figure 1 below and because they and their team earn more (they are more productive)—first they have to have the experience.

### Literacy and computer literacy

For years many teachers and careers advisors have seen UK construction as a dumping ground for *no-hopers*. This means that among operatives, particularly those in the biblical trades, levels of literacy and computer literacy are low and sometimes non-existent and so, for example, otherwise great trade foremen are unable to make written proposals for the work they will do next week in LPS Production Planning Meetings. Recently a different problem has emerged—the influx of workers from Eastern Europe means that for some the problem is language skills rather than literacy.

The image of construction is changing slowly and CITB-ConstructionSkills, an industry training organisation, is working on both the literacy and language issues—but the industry is still a long way from being seen as a knowledge-based people business in our schools.

Brazilian readers might laugh at this. In Brazil, as Pereira (2004, 2006) and Kemmer *et al* (2006) have reported, lean is implemented using simple *visual management* and, in at least one instance, has resulted in a productivity improvement of ~100%!

### Badge engineering: giving lean a bad name

As with many innovations, practitioners have been keen to label what they previously did as *lean* so that they and their organisation appear in the forefront of the industry—and sometimes, of course, that is true. Lean offers enormous benefits and who wouldn't want to be seen to be going after them. This is common practice with fads and flavours of the month and, to those who did not understand lean thinking, lean must have seemed just like that.

So it is not surprising that one researcher looking at “lean implementation” (without defining what he meant by lean), picked up a lot of negativity about what was done in the name of lean, whether it was lean or not. Whether or not that research had any impact outside the academic community, the stories about what was done in the name of lean will have done damage to the idea and may have affected take up.

Have consultants too been guilty of re-badging as *lean* what they did before? There are short-term commercial reasons why they might.

### Over enthusiastic champions

Over-enthusiastic lean champions within companies can get lean a bad name too. Possibly because they have “no time to stop and think” they build resistance to innovation by rushing into lean interventions ignoring the significant literature on

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<sup>8</sup> <http://www.bre.co.uk/service.jsp?id=355> & <http://www.constructingexcellence.org.uk>



organisation development and change management and the lessons described by Arbulu & Zabelle (2006) for example.

Change management is a soft skill and not well understood. Construction is a people process—projects are completed through a network of commitments that flow from conversations that are themselves dependent on personal relationships—yet how much of our training in universities and colleges is geared to enabling those entering the industry to build relationships and make reliable promises, let alone manage change effectively?

### Lean education

There is little lean thinking and lean construction taught in UK HE and FE to construction related students at either undergraduate or postgraduate levels. There are a number of consultants who offer an *introduction to lean construction* workshop, but not all are based around lean thinking and the Toyota experience. A number of consultants are offering training in LPS.

### Competing consultants

The UK consultants offering lean services and training to construction have not collaborated or sought to align their activities. By and large each is convinced that it is preaching the *one true lean* and knows *the one right way* to deliver lean training/consultancy. This must be intensely confusing to constructors and does nothing to help consultants develop their market.

There are though a number of consultants with good theoretical understanding of lean in construction and in other sectors who have been using *lean thinking* to improve the end-to-end construction process. There is little collaboration between even these consultants.

LCI-uk will bring consultants and academics together to share their learning and understandings so that we can produce an operational definition of at least the boundaries of lean

### There's nowt so practical as a good theory

As Lauri Koskela has noted, *Lean thinking* is low on theory. Theories of lean construction are only now starting to emerge. As Henrich *et al* (2006) suggest, could the very *absence* of theory affect uptake by the very practically oriented UK construction industry?

### Fear

One reviewer commented that he witnessed fear as a motivator over 25+ years in construction. It was not specific to a lean conversion but rather the *modus operandi* (and hence part of the culture) of many construction companies. Fear is a great way to *kill* learning – when people are afraid their focus is on how they can protect themselves and their reputations (CYA) rather than on admitting and learning from mistakes (for more on this see Deming 1986, 59ff; Ryan & Oestreich 1998) – without learning there is no improvement and without improvement no lean.

### When lean seems to work

There are construction companies applying lean thinking—and there do seem to be patterns.

Those companies that have chosen to go down the lean path have done so because **they want to**—not because they driven to do so by an internal or external crisis. Like Tiger Woods they have courage, determination and a long-term view.

Crisis time is too late—This is particularly true for those who wait for the crisis of a construction industry downturn or recession. Perhaps though, the imminent crisis is one of *skills* rather than recession. A crisis based on skills shortage requires us to work smarter rather than harder. Learning to work smarter takes time—time that's in short supply precisely because of the skills crisis. Waiting risks losing out to those that have already begun. As Toyota is aware, everyone else is playing catch-up. Toyota shares its *modus operandi* knowing it is well nigh impossible for others to catch-up; such is the pace of change at Toyota that they will have moved on well beyond where competitors last set their sights.

### Middle sized, closely held

Many of the companies that have taken the lean pathway are middle sized and privately owned. They may be in the top 1% of companies by size in the UK but that is not difficult—any construction company with more than 115 employees fits that description. Is it the size or the form of ownership that is causal here? I suspect it's the latter as that enables the directors to take a longer view—they are not subject to the short-termism of stock exchange and shareholder reporting. (That they are still privately owned may also be a function of size.) Laing O'Rourke is an exception to the size criterion, but it is privately owned and appears to be driving down the lean road. Early adopters in the US are regional and sub-regional companies. I don't know their ownership structures.

### Senior level champion

All the early adopters appear to have a senior level champion—Bill Munn in Thomas Vale, Mark Reynolds in Mace, Mel Knight at Castleoak. The champion role is important—in at least one company where the champion was diverted by other issues lean implementations fell. In the US figures like Dean Read (DPR Construction) and Paul Reiser (Boldt) stand out.

In Denmark construction *unions* are championing lean alongside the owners of the major construction companies for the reasons indicated in Figure 1.

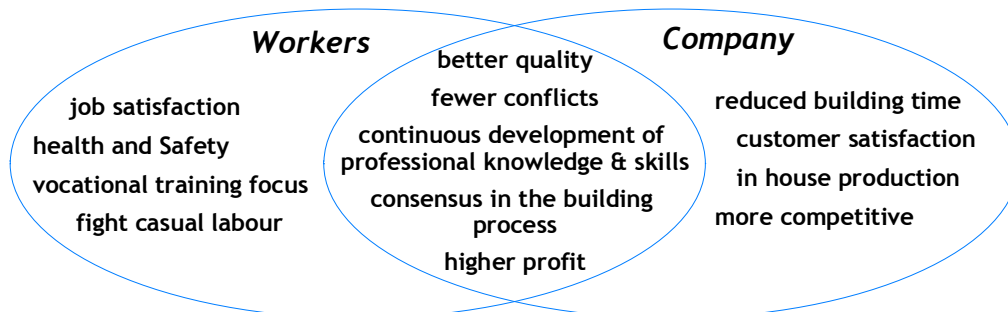


Figure 1: overlapping interests in lean of workers and employers.  
source BAT-kartelet in Odgaard (2005).

### Only ever part of the company?

So far as I am aware, no company has gone lean by *fiat*—that would be *command & control* thinking. Early adopters have allowed good results to *infect* the rest of the company. In Mace, for example, lean is slowly moving out from the Airports division that Mark Reynolds once led. Denmark's largest constructor MT Højgaard began using LPS in 1999 but even now not all projects use the system despite excellent results. In the US Boldt is similar. This may be Arbulu & Zabelle's (2006) "*Narrow and Deep, Bottom Up Implementation*".

## Client push—what happens when it stops?

In UK one client in particular, BAA, has led the way, encouraging its extensive supply chain to adopt lean practices on airport projects. More recently Waitrose, an up-market supermarket chain, have insisted on its contractors using LPS at least. In the couple of years Constructing Excellence worked with a number of organisations and consortia in the public sector helping them secure lean construction processes within EU procurement rules. It was as a result of one of those that I had the call mentioned in the introduction.

Heinrich *et al* (2006) suggest that client push—a form of extrinsic motivation—is less effective than intrinsically motivated *pull*. This makes sense as there may be no reason to continue when that client is no longer on the scene.

## Conclusion

Lean is happening in construction in the UK; it is piecemeal and haphazard. There are a number of circumstances that militate against successful lean implementation but none of them on their own are sufficient to block it.

Gathering together and exploring the disparate reasons and excuses for the slow adoption of lean in UK construction has raised a number of questions for further research:

- How prevalent are lean ideas, lean thinking and lean tools in the UK industry
- To what extent are lean principles, lean thinking and/or lean tools included in FE and HE courses for those aspiring to work in the industry.
- How can we measure the impact of lean teaching in HE, FE and elsewhere?
- How (if at all) are lean principles, lean thinking and lean tools perceived by those employed in design and construction
- How has lean thinking and lean tools diffused in design and construction and compare it to the diffusion of other ideas in construction and other sectors
- What have been the key reasons for companies choosing to go lean
- What is the understanding of change and change management within the design and construction community
- How to sell ideas like lean effectively in the sector
- How does ownership structure affect a company's willingness to innovate?
- What are the similarities and differences of lean dissemination in different cultures and in different countries; how might this knowledge affect further diffusion of lean within the EU and elsewhere?
- What is the impact of lean on productivity?
- How can the industry raise the literacy standards of existing operatives and what is it worth to both operatives and their employers to do so?
- What might convince equity markets that lean construction is worth investing in?

My hypothesis is:

*Implementation is most likely to succeed long-term where it is a conscious and consistent strategy voluntarily arrived at and systematically deployed by a senior level champion with the time and resources to manage and support over a number of years a bottom up "infection" of the organisation using sound organisation development/change management principles.*

So perhaps consultants and promotional organisations should, after all, pay attention to the stated intention of the founders of LCI (as reported by Eric Johansen in a personal email) “*LCI were not bothered about changing the US construction industry - they just wanted to help their [LCI] members to be the best.*” They, Greg Howell and Glenn Ballard, wanted to be pulled, not to push.

## References

- Arbulu, Roberto & Todd Zabelle (2006) “Implementing Lean in Construction: How to Succeed” In proceedings of the 14th Conference of the International Group for Lean Construction, Santiago, Chile
- Azzouzi, Abdel & Steve Toebe (2005) *Managing Ship Repair with Last Planner*. PowerPoint presentation to 7<sup>th</sup> Lean Construction Institute Annual Congress, San Francisco  
[http://www.leanconstruction.org/files/LCI\\_Seminars\\_and\\_Annual\\_Conferences/7thAnnualCongress/10-ShipRepair/10.Azzouzi-Toebe\\_Todd\\_Last\\_Planner.pdf](http://www.leanconstruction.org/files/LCI_Seminars_and_Annual_Conferences/7thAnnualCongress/10-ShipRepair/10.Azzouzi-Toebe_Todd_Last_Planner.pdf) 10 mar 07
- Constat (2006) *Construction Statistics Annual Report* Department of Trade and Industry HMSO UK <http://www.dti.gov.uk/files/file34487.pdf> 10 mar 07
- Cullen, Penny-Anne, Bob Butcher, Richard Hickman, John Keast & Miguel Valadez (2005) The application of lean principles to in-service support: a comparison between construction and the aerospace and defence sectors *Lean Construction Journal* 2 (1)
- Deming, W Edwards (1982, 1986) *Out of the Crisis* MIT Press
- Design for Manufacture Competition (2005) *Q&A1 answer 51* at [www.designformanufacture.info/page.aspx?pointerid=307FE1A776AD4E8D8AC46662DF7FDA56#q51](http://www.designformanufacture.info/page.aspx?pointerid=307FE1A776AD4E8D8AC46662DF7FDA56#q51) 10 Mar 07
- Egan, Sir John (1998) *Rethinking construction: the report of the Construction Task Force*. [The Egan Report] Department of Environment, Transport and Regions and HMSO, London, UK
- Egan, Sir John (2002) *Accelerating Change: A report by the Strategic Forum for Construction* [http://www.strategicforum.org.uk/pdf/report\\_sept02.pdf](http://www.strategicforum.org.uk/pdf/report_sept02.pdf) 10 mar 07
- Henrich, Gil, Carl Abbott & Lauri Koskela (2006) Drivers for innovation in Production Management. In proceedings of the 14<sup>th</sup> Conference of the International Group for Lean Construction, Santiago, Chile
- Howell, Greg (1999) “What Is Lean Construction” *Proceedings of the 7th Conference of the International Group for Lean Construction*, Berkeley, California, USA, 26-28 July
- Kemmer, Sérgio L, Martina A. Saraiva, Luiz F. M. Heineck, Ana Valéria. L. Pacheco, Marcos de V. Novaes, Carlos A. M. A. Mourão and Luiz C. R. Moreira (2006) “The Use of Andon in High Rise Building” In proceedings of the 14<sup>th</sup> Conference of the International Group for Lean Construction, Santiago, Chile  
<http://www.iglc2006.cl/papers.html#103> 13 mar 07
- Kennedy, Michael N (2003) *Product Development for the Lean Enterprise: Why Toyota’s system is four times more productive and how you can implement it*. Oaklea Press, Richmond, VA
- Kennedy, Michael N, Kent Harmon & Ed Minnock (2008) *Ready, Set, Dominate - implementing Toyota’s set based Learning for Developing Products ... and nobody can catch you* Oaklea Press, Richmond, VA
- Koskela, Lauri (1992) *Application of the new production philosophy to construction*. Stanford University. 75p. CIFE Technical Report TR72.  
[www.leanconstruction.org/pdf/Koskela-TR72.pdf](http://www.leanconstruction.org/pdf/Koskela-TR72.pdf)
- Liker, Jeffrey K (2004) *The Toyota Way: 14 Management Principles from the World’s Greatest Manufacturer* McGraw-Hill Education
- May, Matthew E (2007) *The Elegant Solution: Toyota’s Formula for Mastering innovation* Simon & Schuster

- Morgan, James M & Jeffrey K Liker (2006) *The Toyota Product Development System: Integrating People, Process and Technology* Productivity Press
- Odgaard, Gunde (2005) *Why Danish trade unions promote the ideas of Lean Construction* paper to Lean Construction Institute Labour Symposium May  
[http://www.leanconstruction.org/files/LCI\\_Symposium/Labor\\_Symposium-10May05/Labor\\_presentations/1\\_OdgaardDanishtWoodworker.pdf](http://www.leanconstruction.org/files/LCI_Symposium/Labor_Symposium-10May05/Labor_presentations/1_OdgaardDanishtWoodworker.pdf) 10 mar 07.
- Pereira, Pedro Eduardo (2004) *Just in Time and Autonomation: Applying TPS in Vertical Housing* presentation to the 6th Annual Lean Construction Congress,  
[www.leanconstruction.org/files/LCI\\_Seminars\\_and\\_Annual\\_Conferences/LCI\\_Annual\\_Conference\\_15Sep04/10\\_PereiraTPSHousing.ppt](http://www.leanconstruction.org/files/LCI_Seminars_and_Annual_Conferences/LCI_Annual_Conference_15Sep04/10_PereiraTPSHousing.ppt) 11 mar 07
- Pereira, Pedro Eduardo (2006) *Takt Time and Autonomation: Keys to Success* presentation to the 8th Annual Lean Construction Congress, San Francisco, CA.  
[http://www.leanconstruction.org/files/LCI\\_Seminars\\_and\\_Annual\\_Conferences/2006\\_Congress/Presentations/12\\_PereiraTaktTimeAutonomation.pdf](http://www.leanconstruction.org/files/LCI_Seminars_and_Annual_Conferences/2006_Congress/Presentations/12_PereiraTaktTimeAutonomation.pdf) 11 mar 07
- Reiser, Paul & Venu J Gupta (2005) *The LEAN Revolution in Construction is here! Is the Government ready?* Powerpoint presentation to the APWA International Public Works Congress 13 Sept.  
[www.apwa.net/documents/meetings/congress/2005/handouts/1330.pdf](http://www.apwa.net/documents/meetings/congress/2005/handouts/1330.pdf) 10 mar 07
- Ryan, Kathleen D & Daniel K Oestreich (1998) *Driving fear out of the workplace: creating the high-trust, high-performance organization*. 2e. Jossey-Bass Publishers, San Francisco
- Seddon, John (2005) "Watch out for the toolheads! Everything you need to know about lean manufacturing tools and why they won't work in service organizations" <http://www.lean-service.com/6-23.asp> 10 mar 07
- Ward, Allen (2007) *Lean Product and Process Development* Lean Enterprise Institute
- Wheeler, Donald J (1993) *Understanding Variation: the key to managing chaos* SPC Press, Knoxville TN
- Wikipedia (2007) *Lean Construction Definitions Potpourri*  
[http://en.wikipedia.org/wiki/Lean\\_Construction](http://en.wikipedia.org/wiki/Lean_Construction) 18 mar 07
- Womak, James P & Daniel T Jones (2003, 1966) *Lean Thinking: Banish waste and create wealth in your corporation* Simon and Schuster
- Womak, James P, Daniel T Jones & Daniel Roos (1990) *The machine that changed the world*. Rawson Associates, New York