

# Lean Thinking In An Uncertain Environment

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Mention of the concept of Lean Thinking to many in the UK defence environment is likely to lead to, at best, a highly negative reaction, with torrid stories recounted of the impact of 'being leaned', the consequential reductions in manpower and inventory holdings, and demands for efficiency savings that are said to flow in the wake of this latest management fad. And yet, the concept has unquestionably proven its worth in the commercial environment with innovators such as Toyota basing their world-beating performance on the precepts of Lean Thinking. From this one might reasonably argue that 'Lean' has its place as a concept that can deliver improved efficiency and effectiveness within the relatively stable environment of the manufacture of cars or similar commodities. Indeed, in this regard, some of the UK defence experience is certainly positive with the application of the Lean methodology in aircraft and vehicle repair being reported as making significant financial savings,<sup>1</sup> whilst simultaneously enhancing platform or equipment availability.

In principle, however, if one goes back to the underpinning philosophy behind Lean Thinking, there is absolutely no reason why the concept should not be taken out of its traditional environment and used to good effect in the markedly more volatile and risky area of support to deployed forces. To demonstrate this point, this article outlines the deliberate use of Lean to underpin the operation of a 2nd Line Repair and Overhaul organisation that was based in Iraq in 2005.

## Lean Thinking

Before explaining how this was undertaken, a brief overview of Lean Thinking will be offered. The concept is based on the Toyota Production System (TPS), the roots of which can be traced back at least as far as the advent of 'scientific management' in the early 20th Century. It has since been popularised through the work of James P. Womack, Daniel

T. Jones and Daniel Roos in their book entitled *The Machine That Changed the World*,<sup>2</sup> but as the understanding of the Lean model has become more widely known, so too has the breadth of areas to which the technique has been applied. These include not just the production of commodities from carbonated drinks to jet engines, but also the service sector in the form of Taco Bell fast foods, Southwest Airlines, and the UK agri-foods industry.

The Lean model is attractively simple in suggesting that organisations should obsessively focus on the most effective and efficient means of producing what the customer wants. Whilst there is a myriad of published detail underpinning the concept, it can be distilled into five basic principles:

- **Specify what the customer values** – this is the starting point for the process as 'value' can only be defined by the ultimate customer.
- **Identify the value stream** – the resultant 'value stream' is all the specific actions required to bring a service or product through the three critical activities of product or service definition, information management and physical transformation.
- **Eliminate friction** – work should flow steadily and without interruption from one value-adding activity to the next. Any activity that does not add value should be identified and eliminated.
- **Pull** – any system must react to customer demand and ensure that nothing is produced by the upstream supplier until the downstream customer signals a need. In other words, it is the customer who defines what is made, and in what quantity.
- **Pursue Perfection** – the introduction of the first four steps should lead to a virtuous circle of improvement. In essence they enable a better understanding of the system as a whole which, in turn, allows further improvement and eradication of waste.

## Lean in a Volatile Environment

As indicated above, there is no reason why these principles should not be applied in a volatile environment and, with this in mind, one of the authors of this article decided to do just this when appointed to command 15 Equipment Support Company



15 Equipment Support Company real estate in Basra [David Worrell]

(15ES) in mid-2005. 15ES formed part of 19 Light Brigade, a formation of seven battlegroups that was focused on the South East of Iraq. However, in parallel with the deployment of 15ES to Iraq, there was a clear political desire to reduce theatre troop numbers and to rationalise the number of fixed military bases in the country. This led to a geographical reorganisation, and the concentration of British Forces in the Contingency Operating Base (COB) located at the Basra International Airport situated approximately 8km to the west of the city.

In simple terms, the role of 15ES was to inspect, maintain, refurbish and recover land equipment throughout Iraq, in order to ensure that all commanders had the right equipment in sufficient quantities, in the right place and at the right time to achieve their missions. 15ES was formed by grouping the various armoured repair and recovery capabilities usually found in a Close Support Company with the more in-depth repair capabilities of a General Support Company (e.g. vehicle repair; electronic and instrument repair; weapon repair, metal repair and power pack repair and regeneration). 15 ES was also enhanced with a quartermaster element and a Royal Logistic Corps (RLC) stores section. The resultant total manpower was 6 officers, 157 soldiers and 54 locally employed civilians.

The principal operational output of 15ES was the sustained maintenance of equipment in order that the manoeuvre commander had sufficient to successfully complete his missions and tasks. Therefore, the key measure of ES effect was the provision of serviceable equipment in accordance with the manoeuvre commander's plan. Such equipment must also have been maintained to the point where there was significant engineering confidence that it would complete the mission without breaking down. Delivery of these requirements led to the construction of a four-step action plan which was developed in accordance with the lean principles discussed above.

#### Step 1: Define the Customers and Their Requirements

The process of identifying the customer was relatively easy. 15ES was tasked to provide support to all equipment owned

and operated by elements within 19 Light Brigade. The more complex issue was that of defining the customer's requirements. The importance of getting this right could not be underestimated as it was to be this definition which would go on to clarify those engineering processes which added value and, hence, determine those processes that were adding little or no value (i.e. that represented waste).

Perhaps even more importantly, this Step also helped to ensure that the operational commanders understood their role in the overall process. No longer was it acceptable for equipment to be demanded without due consideration of the resource implications; rather battlegroup operational staff had to engage with their counterparts in 15ES to understand what could be achieved within a given period of time. This, in turn, dictated the need to create a robust link to the Brigade planning team via the Brigade Equipment Support branch. This mechanism helped overcome the inevitable fluidity and unpredictability of military operations and resulted in a daily conference at which both equipment and unit priorities were set.

#### Step 2: Map the Current Process

As the repair and overhaul operation of 15ES was being housed in a new location (the COB), the opportunity to design the operation based on a 'blank canvas' was seized. The first step was to carry out a Material and Information Flow Analysis (MIFA) as a precursor to the creation of a number of 'product lines' where expertise, tools, facilities and spares could be grouped geographically in order to minimise the time to effect the repair for a given family of equipments. This approach was already in existence for electronic, optics and telecommunication repairs, but was broadened to create a number of additional repair lines for light, medium and heavy vehicles.

Each line was developed in a customised location with handbooks, equipment, stocks of spare parts and consumable items (e.g. the appropriate oils and greases) all immediately to hand. In addition the MIFA provided a single overview of



Armoured repair in progress [David Worrell]



Light vehicle repair shop [David Worrell]

how things should be done and the basis on which to gather appropriate data (e.g. how many people would be needed in each process, how long each task would be likely to take, etc.). This approach also led to the development and definition of suitable performance measures to assist with the management of production and to act as triggers for management action if the standard time limits for key processes were broken.

**Step 3: Re-align the Processes and Eradicate Waste**

Having identified the optimal physical design, the next step was to align the repair processes so that the equipment could be repaired in a logical sequence. The resultant delivery of the customer requirement was based on two general models: centralised scheduled maintenance (servicing) and centralised equipment repair. The former was achieved through a synchronisation of each of the supported unit’s scheduled maintenance programmes against the maximum capacity of the repair organisation in order to meet the regulatory deadlines, but without overloading available resources. Equipment repair, on the other hand, was almost always unexpected, and 15ES had to be ready to respond to such ‘unscheduled maintenance’ in order to minimise equipment downtime. To achieve this, all potential sources of waste such



Metalsmith bay [David Worrell]

as delay, incorrect inventory, over-production, unnecessary movement and under-utilisation of skills were ruthlessly attacked through a variety of Lean techniques.

**Step 4: Align the Leadership Structure with the New Processes**

The final step was to reshape the organisational (and thus leadership) structure of 15ES to deliver the customer requirement. Both the Vehicle Support Group (VSG) and General Support Group (GSG) commanders were provided with the means and the responsibility for delivering repairs within their area of interest and, even more importantly, the relevant manpower that normally worked in direct support of the operational units (i.e. those engaged in 1st Line repairs) was placed under the command of 15ES.

This action vastly increased the flexibility of the manpower pool and the mix of skills available to the VSG and GSG leaders. In addition, each repair line was put under command of a senior non-commissioned officer (SNCO) who was invested with the trust and resources to deliver the required output. Each process within the organisation was captured in the form of a flow diagram and regularly reviewed by an audit team of three tradesmen headed by an SNCO that included junior personnel as a means of helping to ensure the buy-in of their peers as well as providing an ideal opportunity to broaden their experience and knowledge.

**Summary**

Notwithstanding the genesis of Lean Thinking within the Japanese automotive industry that is, conceptually, some considerable distance from the environment of an operationally deployed British military unit, the experience of 15ES demonstrates that Lean principles can be applied within such an organisation. Furthermore, the effect on the operational output of the Company can be judged from the doubling of its efficiency (computed as the total time an equipment was actually under repair divided by the total time the equipment was held within the organisation). Furthermore, this was achieved through a significant reduction in resources as it proved possible to return 72 tradesmen (18% of those originally deployed) to UK and out of the potential danger from the regular insurgent attacks.

In short, by concentrating on the core principles of Lean Thinking – and in particular the ultimate aim of meeting the customer’s demands – 15ES were able to demonstrate that this approach does, indeed, have validity in an uncertain environment. ■

**NOTES**

- 1 The National Audit Office reported in 2007 that the use of Lean methodologies in the repair and overhaul of fast-jet aircraft saved £1.4Bn in the period 2001–2007.
- 2 J. Womack, D. Jones & D. Roos, *The Machine that Changed the World*, Rawson and Associates, New York, 1990