

Exact Online

## LEAN MANUFACTURING

Implementing Lean in a  
high-mix, low-volume shop

[www.exactonline.co.uk](http://www.exactonline.co.uk)

## TABLE OF CONTENTS

- 1 Introduction
- 2 Introducing Lean
- 3 Sustaining a Lean Program in the shop
- 4 Lean in the office
- 5 Conclusion

# INTRODUCTION

Owning and running a job shop in today's economy can be quite a job in itself. Customers want you to somehow conjure up lower prices and increase service levels - both at the same time. Your suppliers seem to think you thrive on the challenge, so raw material prices continue to increase. And finding skilled labour sometimes feels akin to pulling a rabbit out of a rather small hat. Yet the need to remain relevant to your customers and grow your business is far from an illusion. In your search for the magic bullet, you may well have come across Lean practices. In many ways, Lean can represent an extremely effective manufacturing strategy. On the other hand, it may not be suited to the type of shop you operate.

*Did you know?*

*The right Lean initiatives, together with an appropriate shop floor management or ERP solution, could reduce costs within a typical small to mid-sized job shop by 30% across the entire operation.*

## 2: INTRODUCING LEAN

# A BRIEF HISTORY

Lean is far from a new idea. Its roots go back to 1900, when time and motion studies were first conducted to measure efficiency. That led to Ford's landmark assembly line production system and really came of age in Toyota's factory organisation, which resulted from Deming's analysis of Japanese management style.

Most of the current Lean concepts and philosophy have been heavily influenced by the Toyota Production System (TPS), which went into full swing in the 1970s (along with ABBA) and drew much from previous efforts at waste reduction. The huge success it enjoyed over the next 30 years demonstrated just how effective a Lean approach could be.

### **The challenge of Lean in a job shop**

But before you put the Champagne on ice in anticipation of a sudden leap in profits, we should point out that Lean's success occurred in a very different environment to your typical job shop. Consider the traditional model for Lean we just mentioned – the Toyota Production System. Highly specialised factories produced a high volume, low mix of parts. Many of the traditional Lean methodologies – such as one-piece flow, Kanban, visual cues, and value stream mapping – and other Lean cornerstones were developed and refined in these large manufacturing environments. Assembly lines and even entire factories were designed around the manufacture of a low number of different parts with very few variations – if any at all. In short, Lean was a huge success. But was it a relevant one?

On top of that, when you look at just a few basic types of manufacturing business, you

soon see that the challenges and operations faced by each all vary widely. In fact, your job shop probably overlaps several categories. You may carry very little finished goods inventory, or none at all. It is likely that external customers ordering new or unique parts largely determine your work in progress. In addition, most of the materials in your shop are undoubtedly bought for a specific job and just-in-time manufacturing. So there is no one-size-fits-all approach.

### **Frustrations and previous efforts**

Because your shop most likely deals with a very high mix of parts in low volumes, you are much more susceptible to the volatility of change, whether in delivery date, engineering or product mix – any of which can occur from week to week or day to day (and usually when you could most do without them). Maybe your customers constantly change their requirements, or make alterations to existing orders.

Most job shops also struggle with a limited number of staff who, rather than being dedicated to specific machines or operations, float from machine to machine. And then there's the fluctuating workload that demands a constant process of adjustment. So if you've ever tried to implement Lean principles in your shop before, it's not impossible that

you encountered one or two frustrating difficulties. If the initiatives just didn't seem to work, however many times you kicked the dustbin, you may have discarded the concept altogether. But don't give up hope just yet...

### **So what's the magic answer?**

Lean manufacturing really can work for a job shop. The successful implementation of any initiative begins with a deep understanding of the type of shop you operate. Then you need to sift through the mountains of available information to figure out which elements apply to your specific environment. Finally, you need the determination, patience and adequate supplies of coffee to see it through. A long-term approach is paramount and requires focused leadership.

### **The 3-year plan**

OK, so first question: what exactly is long-term? Well, you need long enough to identify what you want your Lean initiatives to achieve, establish a road map for achieving it, and have the time to follow it through. A 3-year-plan will help you move from fire-fighting mode to the more long-term, strategic view required. You'll have the time to take a step back and assess how the plan is going on a regular basis. And it demonstrates to the whole company that, this time, you really mean business.

### **Determine where you are and where you need to go**

To gain the understanding you need of where you are right now, SWOT analysis (Strengths, Weaknesses, Opportunities and Threats) will help to determine your company's internal strengths and weaknesses, as well as the external opportunities and threats in the marketplace. You need to identify which key stakeholders are vital to your business, and which internal and external barriers you need to overcome. SWOT analysis provides a framework in which to compile critical business information such as sales data, price and lead-time expectations, capital expenditures and future profit trends. At no time does it involve you dressing in black, abseiling from a roof and raiding a competitor's premises.

### **Your core competencies**

Developing a good understanding of the areas in which your shop excels allows you to judge how closely aligned your capabilities are with the jobs you take on. Formal surveys among and input from both internal stakeholders and customers give you a good start in gauging these competencies, especially when complemented by other tools and techniques such as a machine and final competency matrices.

“Assembly lines and even entire factories were designed around the manufacture of a low number of different parts, with very few variations - if any at all.”

“Developing a good understanding of the areas in which your shop excels allows you to judge how closely aligned your capabilities are with the jobs you take on.”

#### **Communicate to your staff**

Once you’ve completed your information-gathering exercise, conducted an analysis and developed a 3-year plan (now that’s what you call a busy morning), the next move is to share the what, the why and the when with your employees. After all, the changes will have a direct impact on their days, and you’ll want to gain their buy in as early as possible to maximise the chances of success.

#### **Effective communication requires planning**

What content will you present and in what form? You will also need to prepare for some of the tough questions that may come up. You may even want to plant seed questions in the audience. Also take the time to identify any employees that may be either positive or negative towards your plan. You need to encourage allies and determine how to bring the resisters onboard.

What your initial presentation should cover  
Make sure your presentation covers at least these topics:

- What your company learned from developing the 3-year plan.
- Why you are undertaking a Lean initiative.
- The timeline of the implementation.
- The emphasis that input from all employees is vital.
- Assurance that the initiative will be positive for both the company as a whole and employees individually.
- Who the members of your Lean team are.

#### **Benchmarking and networking**

The last step in the preparation phase should involve networking with your peers and other shops in your market space. Yes, over a drink or 2 if you like - for lubrication. This will help you gain practical information and ideas that you can apply directly to your shop. You’ll learn what works and what doesn’t, gleaning insight into the issues faced by other shops that have already implemented Lean. Joining professional industry associations offers an excellent way to gain access to a wealth of information and statistics you can use for benchmarking, as well as opportunities to exchange ideas. Developing a best practice implementation of Lean will be an ongoing process and this will all play a big part.

### Internal Stakeholder Survey

Nobody has a better insight into the workings of your business than the people who do the working, whether on the shop floor or in the back office.

A few questions you could ask:

- Which markets do we serve?
- What is the best lot size we produce?
- What tolerances do we maintain most efficiently?
- Do you see us as a low-cost or high-quality supplier?
- What materials do we work with most effectively?
- How would you assess the skills of your fellow employees?
- Why do customers give us business over our competitors?

### External Customer Survey

Gaining insight into the way your internal stakeholders perceive your company lets you move on to understand how their vision compares to that of your external customers.

A few questions you could ask:

- As what type of supplier do you see us?
- Do you come to us primarily because of price or quality?
- What is the most value-added product or service we supply?
- What current/future products do you see us best suited to manufacture for you?
- What machine capabilities do you assume we have?
- What machine capabilities would you like us to offer?



## 3

# SUSTAINING A LEAN PROGRAM IN THE SHOP

Many of the usual go-to tools for developing a Lean program in a manufacturing environment are simply not practical for the average job shop. As we have already seen, many of them were designed for environments in which annual production volumes were much greater than your high-mix, low-volume shop.

Tools like Value Stream Maps (VSM) and spaghetti diagrams are all well and good when it comes to a relatively steady production cycle, a limited number of different parts and an average workload with few if any peaks and valleys or bottlenecks. In complete contrast, custom made-to-order work usually entails the manufacture of thousands of parts annually and a workload that fluctuates from week to week or month to month. Just imagine trying to map every part number of all the items you produced last year.

## **Developing an alternative to Value Stream Mapping**

So once we eliminate VSM and spaghetti diagrams as a practical option, what are we left with? Well, look for consistency across your parts list. Are there any patterns? What about repeater high-ticket parts? Or parts that have some level of consistency in terms of manufacturing flow? If you have an ERP or shop floor management system in place, you should be able to access this data quite easily.

## **Develop part families**

Your search for consistencies will lead you to an evaluation of the primary operations through which the parts flow, the types of material used in production, and similarities in the size or shape of parts. This information will allow you to focus on the groups of parts that make the highest contribution to your margins (rather than just revenue), determine whether or not they share similar routings, and analyse their flow through your shop.

Once you understand the flow of these high contribution groups of parts, you can then focus on creating a process map for them. Because this information can change due to the fluctuating nature of a job shop, you should keep a close eye on things in case the volumes of these repeaters or mix of parts change.

### Eliminate unnecessary parts

Determining your primary part families will also allow you to clear out certain low-volume parts that disrupt the flow of work through your shop: those that lay outside of your core competencies, for example, or that you manufacture for customers just to keep them happy. These parts are usually the ones whose tolerances are difficult to keep, materials are harder to work with, or delivery requirements make life (even more) difficult.

Outsourcing these parts or helping your customer find another supplier (in a way that doesn't end in 'off') will often yield significant benefits. Higher profit margins, better morale, improved on-time performance, more capacity for key customers as well as the parts suited to your core competencies...oh - and a slightly easier life too.

### Designing your first Lean cell

An understanding of the part families you work with most often, together with the resulting focus on the parts more in line with your core competencies, will put you in a position to start on your first Lean cell.

Moving away from your traditional, functional shop layout, you can think about implementing a cellular approach, grouping together machines based on the families of parts produced. The advantages are numerous.

- Material flow is improved, including reductions in the distance travelled by materials, inventory and cumulative lead times.
- Cells allow you to focus on setup reduction, while workers often become multi-process and multifunctional.
- Individual employees can begin to take responsibility for quality improvements, waste reduction and simple machine maintenance.
- The cell becomes self-balancing and lead times are reduced.
- Cells enable your shop to manufacture high-quality products at a low cost, on time and more flexibly.

### Implementing the first Lean cell

Now you're ready for action. And when it comes to putting theory into practice, it's time to call on your "Lean team" to assist in the process.

- Review the manufacturing process of the part families you've identified, including materials, programming, machines and other processes.
- Specify the Lean area of your shop, and work out your first layout on paper.
- Ensure there is enough room for tool storage as close to the point of use as possible.
- Once everything is drawn up on paper, lay out scale plans of the equipment and tool storage locations on the shop floor.
- Before moving your equipment, double check that you've maximised the use of the cell space.
- Create a timeline and begin moving and configuring the equipment.
- Finally, start running jobs through the cell and measure the results.
- Do you see an improvement in efficiency? Any reduction in setup times across the part family? Higher quality parts with fewer scrap or rework issues.
- If you aren't satisfied with the results, tweak the layout and try again –and again– until you are.

The implementation of this first cell will shape and hone your approach to the rest of the shop. When your cell is up and running, step back and start the process all over again. Take a fresh look at your part families and determine which area you want to tackle next - trying to avoid running different part families through the same cell if possible. Lay the whole shop floor down on paper to analyse how the machinery is arranged. Does it make sense, or can you make improvements and make room for more cells?

Over time shops grow, new machines are brought in, and layouts tend to lose their order. Now is the time to tighten things back up again. Think through every aspect, from material storage areas and their accessibility to machine operators to spaces for quality control and their proximity to the personnel responsible for inspection.

Needless to say, this will all depend on the sort of cells you create and the parts families they're designed around, not to mention the physical limitations of the available space. It will undoubtedly be a case of trial and error, so practice your deep breathing exercises. Yet even small, seemingly insignificant changes like arranging machinery in a logical direction –in line with incoming materials, for example– can result in noticeable improvements.

“If the Lean initiatives you implemented just didn’t seem to work, however many times you kicked the dustbin, you may have discarded the concept altogether. But don’t give up hope just yet...”

#### **Running cells as profit centres**

Once you’ve created your cells, you can begin to focus on managing them as individual profit centres. Making a profit is obviously the main goal, but you also need to know how that profit is made and which part families make the largest contributions. Your Lean practices will allow you to look at your cells from a cost perspective. This understanding will help you to identify any problem areas, spot opportunities for improvement, and take the necessary action: the beginning of a continual process of optimisation to maximise profitability.

#### **Realtime data collection**

Realtime data collection, ideally through the deployment of computer workstations or tablets at the machines themselves, will provide you with the most up-to-date information on the profitability of your parts and, therefore, on your cells too. Employees can instantly log progress and even view job-related documents right there on the screen in front of them. This powerful information-gathering capability can help you to identify problem areas and virtually eliminate waste.

#### **The zero waste job shop**

Yes, you read it correctly: the zero waste job shop is eminently achievable. Point-of-manufacture data collection will help you to identify and isolate the points in your process where waste occurs. In addition, regular waste reduction Kaizen-events can make a significant contribution in making sure your efforts don’t all go to...well, to waste.

## A BRIEF OVERVIEW 10 TYPES OF WASTE AND THEIR SOLUTIONS

- 01 Correction:** Starting a job again because it wasn't done right the first time.  
**Solution:** Ensure that up-to-date instructions and drawings are available at all times to all relevant employees.
- 02 Overproduction:** Too many parts produced or produced too quickly, often to cover up inefficiencies or compensate for future shortages.  
**Solution:** Ensure you use a shop floor management system that automatically determines the optimal flow.
- 03 Over-processing:** doing more to an item than is needed by the internal or external customer.  
**Solution:** Modern shop technology provides a simple pre-close checklist indicating status and notifications for each department.
- 04 Conveyance:** Moving stock over long distances or back and forth around the floor.  
**Solution:** Optimised floor layouts and communication systems create logical flow, minimising movement.
- 05 Inventory:** Retaining excess inventory costs money.  
**Solution:** Shop floor management systems can ensure you only stock what is required at the time it is required to maintain optimal inventory levels. Just-in-time manufacturing, where products are made only when they're needed, not based on a forecast.
- 06 Motion:** Excess movement of people, equipment, machines and tooling is inefficient and negatively impacts on productivity.  
**Solution:** Once you've determined your cell layout, conduct regular motion studies to ensure maximum efficiency of movement around the shop.
- 07 Waiting:** Time wasted waiting for paperwork to come through, equipment to be ready or decisions to be made.  
**Solution:** Shop floor management systems can minimise or eliminate the waste of waiting by showing operators which jobs to run next.
- 08 Overburden:** Over-extended capacity results in too many parts made too early – parts the customer doesn't necessarily even want. It is not only an operational danger, but also a physical and even mental 1 too.  
**Solution:** Scheduling tools allow you to avoid over-production and warn you when it is about to occur.
- 09 Unevenness:** The 'hurry up and then wait' problem where periods of under-capacity fluctuate with periods of operational strain.  
**Solution:** Scheduling tools let you see where issues will arise before they happen so you can adjust accordingly.
- 10 Human mind:** Missing out on process improvements through inadequate communications with staff.  
**Solution:** Allow your employees to contribute their thoughts regularly. Even fast 5-minute daily huddles can be enough to gather important ideas for improvement.



## 4

# LEAN IN THE OFFICE

Lean was originally designed for the manufacturing floor, but there's nothing stopping you applying its principles to your office as well. An increasing number of businesses are realising the advantages of Lean in an office setting. Even the US government has launched a number of Lean initiatives (rather than Cruise missiles) to combat waste.

## The challenge

As you might expect, implementing a Lean office presents its own unique set of challenges. Offices often have little or no definition of quality, certainly not in a tangible sense. And with little measurement of cost outside of headcount, it is often difficult to measure productivity - not forgetting that the number of office staff in the standard job shop is usually limited to just a few individuals anyway.

Office workers usually learn on the job from their predecessors and have very few opportunities for cross-training, while the variety of tasks and lack of hard deadlines makes the concept of process control

unworkable. And if that isn't enough, no empirical data exists to show whether or not the cost, time and effort involved is worthwhile. So if you thought selling ice to Eskimos was a toughie, try getting your average shop owner enthusiastic over a Lean back-office.

## Don't give up hope

In spite of all the above, Lean is still worth attempting in an office. Just as athletes strain to shave milliseconds off their performance, the leaner you can become, the bigger difference it will make in gaining an edge over your competitors. Lean principles have to be adapted to the job shop - and they can also be adapted to the office.

## A COUPLE OF LEAN PROCESSES THAT CAN WORK IN YOUR OFFICE

### Automated workflow

It's not uncommon for information to get lost in the office. It's always a complete mystery how it actually disappears - the cause of many puzzled expressions and scratched heads, never mind annoyed glances.

A buyer calls and talks to his sales rep about an order. The sales rep emails the shop foreman. The foreman misses the email. Or it had got stuck in 'Drafts'. Or lost in the Ether. Or something like that. The buyer calls next day to check on the changes, but the sales rep is out for the day. And guess what? That's right, nobody else knows anything about it. And so the process starts all over again to the frustration of everyone.

An automated workflow or business process management system means no more mysteries.

An electronic workflow system provides a single, effective answer to a lack of visibility, lack of standardised process and lack of data integration. Anyone with access to the system can see the entire flow of information at a glance, from initial phone call to final product.

According to a 2007 report by the Aberdeen Group, 82% of "best in class" manufacturers are likely to have this kind of visibility across all processes, from quotes to cash.

A comprehensive workflow system improves staff communication both in the office and in the shop. It improves efficiency, reduces costs, and allows you to work on continuous process improvements. It also enforces accountability and compliance, bringing the office into line with the rest of the company.

The biggest mystery is how anyone can manage without 1.

### Lean in the office

Lean in the office systems move you on to the next level of business process management and efficiency. They assist you in monitoring every aspect of your business, providing realtime insight into operations, processes, and transactions. In the event of any issue, the system will automatically send an alert allowing you to isolate the problem and take appropriate action in good time.

These system will issue alerts and 'to-do' messages to keep you in the know, in realtime.

- Members of staff with outstanding tasks to complete.
- Delayed shipments so you can notify the customer.
- Client's receivables that have become too high.
- Order confirmations that need sending.
- Client's credit status that has changed.
- Quotes or discounts about to expire.
- Stock nearing its re-order level.
- Prospects that haven't been contacted in 'x' days.

The combination of automated workflow and these systems is a dream team pairing that delivers relevant aspects of Lean into your office and tightens up operations in both your office and shop.

"Just as athletes strain to shave milliseconds off their performance, the leaner you can become, the bigger difference it will make in gaining an edge over your competitors."

## 5

# CONCLUSION

As we've seen, even those job shops characterised by a high mix of parts produced in relatively low volumes can take advantage of Lean to become more profitable and more competitive.

Yes, it may mean adapting and it will certainly involve careful planning and follow through, but isn't that usually the case with anything worth doing?

The following 4 key points will help to ensure the ongoing success of your Lean culture.

- 01** Your Lean goals must be achievable. Setting your sights high is all well and good, but not at the expense of discouraging employees and dooming your project to failure. Set realistic weekly, monthly and yearly objectives.
- 02** Everybody at every level of your organisation needs to get onboard and stay up to speed with your initiative and the key objectives. Write down your goals, show them to someone from the outside and ask for their perspective. If they can understand what you're talking about, your company probably won't think you've gone completely insane either.

- 03** Before you start planning, drawing, moving, and improving, determine the metrics against which you intend to measure success. How often will you gauge your progress? How regularly and by what means will you keep the company updated?

- 04** Make Lean a reality for everyone in the company. Show them what's in it for them. Your business will have its own unique approach, so keep your stakeholders involved and keep the big picture in mind.

Resources such as this guide can only ever be taken as general guidelines, generic information that requires tailoring to your own circumstances. Things won't always go according to plan, but then again when do they ever? With the right goals, the right preparation and the right people, plenty of high-mix, low-volume job shops have demonstrated that Lean initiatives can make a positive impact.

**Now it's your turn.**

//

With the right goals, the right preparation and the right people, plenty of high-mix, low-volume job shops have demonstrated that Lean initiatives can make a positive impact."



**Exact UK**

Building 3  
Chiswick Park  
566 Chiswick High Road  
London W4 5YA  
United Kingdom

Phone: +44 (0)800 052 5689  
Email: [info@exactonline.co.uk](mailto:info@exactonline.co.uk)  
Site: [www.exactonline.co.uk](http://www.exactonline.co.uk)



ACCREDITED  
SOFTWARE