

Lean Profit Potential

Peter Hines
Riccardo Silvi
Monica Bartolini



University of Bologna

EPSRC

Engineering and Physical Sciences
Research Council



CARDIFF
UNIVERSITY

Lean profit potential

This publication was developed during the first 3DayCar Programme, which ran from 1999 to 2001. The programme was sponsored by the Engineering and Physical Science Research Council / Foresight Vehicle and a network of over twenty UK-based automotive industry firms.

The 3DayCar Programme was designed to extend Lean Thinking ideas into the entire automotive sector and to optimise the delivery of customised cars within three working days. The results of the programme have been widely taken up, with each of the six vehicle manufacturers starting a build-to-order programme.

The 3DayCar Programme was run by staff at the Lean Enterprise Research Centre at Cardiff Business School, the School of Management at Bath University and the International Car Distribution Programme with assistance from the University of Bologna. We would like to thank the research team and in particular to acknowledge the assistance of Andrea Raschi and Valentina Rancati of Bologna University; Gavin Cleverly and colleagues; Chris Butterworth, Lyndon Jones, Paul Morris and Dale Williams of S.A. Partners; and Simon Elias, Matthias Holweg, John Kiff and David Taylor of LERC. Also a special thanks to the production team; Claire Gardner at LERC and Theresa Millar, Matt Carey and Matt Patterson at Text Matters.

One of the key areas that has become apparent within the research is that, whilst there are undoubted islands of excellence in the automotive industry, a truly effective focus on delivering sustainable profitability has not as yet been achieved. The ideas set out in this booklet are designed to help this sector and others to unlock their true profit potential through the adoption of a lean approach.

Professor Peter Hines, Professor Riccardo Silvi & Dr Monica Bartolini

June 2002

Published by:
Lean Enterprise Research Centre
Cardiff Business School
Aberconway Building
Colum Drive
Cardiff, UK
CF10 3EU

© Peter Hines, Riccardo Silvi & Monica Bartolini, 2002

First Published 2002

A CIP catalogue record for this book can be obtained from the British Library.

ISBN: 0 9537982 6 7

Edited and designed by Text Matters www.textmatters.com

All rights reserved; no part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise without the prior written permission of the publishers. This book may not be lent, resold, hired out or otherwise disposed of by way of trade in any form of binding or cover other than that in which it is published, without the prior consent of the publishers.

Contents

Lean profit potential 2

The lean vision, principles and lean profit potential 3

1 Understanding value and waste 7

What is value? 7

What is waste? 7

Getting the balance right 8

Four types of activity 9

2 Setting the direction 13

1 Developing critical success factors 13

2 Reviewing and modifying appropriate key performance indicators 14

3 Targeting improvement for each key performance indicator 17

4 Defining key value streams of business processes 18

5 Deciding which key value streams or business processes to focus on 18

6 Sum Up 19

3 Understanding customer value 23

What does the customer really want? 23

How satisfied are they? 24

4 Understanding the big picture 27

Spaghetti diagram 27

Big picture map 28

Phase 1: Customer requirements 28

Phase 2: Information flows 29

Phase 3: Physical flows 29

Phase 4: Linking physical and information flows 30

Phase 5: Complete map 31

5 Detailed mapping 35

The detailed value stream mapping toolkit 35

Process activity mapping 35

Production variety funnel and sales funnel 40

Quality filter mapping 41

Demand amplification mapping 42

Process costing 44

6 Developing a plan, checking its profit potential and ensuring buy-in 51

Developing a set of appropriate projects 51

Catch-balling the change programme 52

Developing project potential 53

A final word 54

Further sources of help 55

Jargonbuster 57

Lean profit potential

Throughout our work at the Lean Enterprise Research Centre, we are often asked a number of searching questions about the application of Lean Thinking. Among the most frequently asked are:

- 1** Where do I start?
- 2** Is there a road map that I can follow?
- 3** What does Lean Thinking involve?
- 4** Who will I have to involve?
- 5** Is it only applicable to the shop floor?
- 6** Is it only for manufacturing firms?
- 7** What will the benefits be?
- 8** Will it make me more profitable?

To help answer these questions we have developed this simple step by step introductory guide to 'Lean Profit Potential'. It is designed to give you and your colleagues enough information to:

- 1** see if going lean is for you
- 2** develop an outline plan and
- 3** point you in the direction of further sources of help.

We have designed this guide with plenty of space for you to write notes next to the text, and have also included a 'jargonbuster' at the back to explain the terms we use.

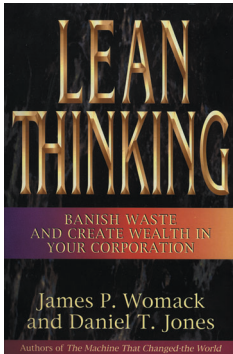
The chart below will help you through the guide as well as suggesting who you might involve in the various stages of the process.

Workbook focus ↓	Senior managers ↓	Line managers ↓	Wider workforce ↓
What is Lean?	Lean thinking		
	Understanding value and waste		
Focusing the Change	Setting the direction		
Mapping Things Out	Understanding customer value		
	Understanding the big picture		
		Detailed mapping	
Will It Work?	Developing a plan, checking its profit potential and ensuring buy-in		
Help!	Further sources of help		

Throughout this guide we will use a simple real case study of a car dealer, called here Main Motors, to illustrate the various methods and help you follow the flow of the approach.

We hope you enjoy reading the guide and wish you a profitable lean journey.

The lean vision, principles and lean profit potential



The characteristics of the lean organisation and the lean supply chain are described clearly in the book *Lean Thinking – Banish Waste and Create Wealth in Your Corporation* by Jim Womack and Dan Jones. This book provides a vision of a world transformed from mass production to a lean enterprise. The authors highlight the huge amounts of waste that occur in most organisations and show that a systematic attack on waste, both within companies and along the supply chains, can have tremendous benefits to the short run profitability and long term prospects of companies and organisations.

Lean production methods were pioneered by Toyota in Japan. *Lean Thinking* distils the essence of the lean approach into five key principles and shows how the concepts can be extended beyond automotive production to any company or organisation, in any sector, in any country.

The five lean principles

- 1 Specify** what does and does not create **value** from the customer's perspective and not from the perspective of individual firms, functions and departments.
- 2 Identify** all the steps necessary to design, order and produce the product across the **whole value stream** to highlight non value adding waste.
- 3 Make** those actions that create value **flow** without interruption, detours, back-flows, waiting or scrap.
- 4 Only** make what is **pulled** by the customer.
- 5 Strive** for **perfection** by continually removing successive layers of waste as they are uncovered.

These principles are fundamental to the elimination of waste. They are easy to remember (although not always easy to achieve!) and should be the guide for everyone in the organisation who becomes involved in the lean transformation.

If you are serious about going lean then the people in your organisation need to read *Lean Thinking* at the outset. If they haven't got enough time to do that they haven't got enough time for what follows!

Lean thinking

In order to go lean, you need to understand customers and what they value. To get your company focused on these needs you must define the value streams inside your company (all the activities which are needed to provide a particular product or service) and, later, the value streams in your wider supply chain as well. To satisfy customers you will need to eliminate or at least reduce the wasteful activities in your value streams that your customers would not wish to pay for.

Next you have to find a way of setting the direction, fixing targets and seeing whether or not change is actually occurring. You need a framework to deliver value for your customers as well as a toolkit to make the change.

If you can do this effectively you won't need to benchmark competitors to set some arbitrary and often incomparable target; perfection or the complete elimination of waste should be your goal. Sounds good, but back to the real world – if it is so easy why doesn't everyone do it?

Sometimes we ask ourselves this question, and when we have gathered a few facts about a company, we ask the company's managers. The answer they give is usually something like 'yes, that makes a lot of sense, but we never saw it that way'. The difficulty is that firms often cannot get into this virtuous circle of improvement.

Lean profit potential

One of the problems is that firms have not previously measured the impact of lean and identified the *profit potential* to their organisation and the wider supply chain. The profit potential is the effect on the 'bottom line' of any activity that occurs during a lean transformation programme. It is likely to help improve the organization, its supply chain, and the value proposition offered to its customer base.

For those interested in improving their Lean Profit Potential, this book is here to help.

Lean thinking

1 →

Understanding value & waste

- ↓
- What is value?
- ↓
- What is waste?
- ↓
- Getting the balance right
- ↓
- Four types of activity

2 →

Setting the direction

- ↓
- Developing critical success factors
- ↓
- Reviewing & modifying key performance indicators
- ↓
- Targeting improvement for each KPI
- ↓
- Defining key value streams
- ↓
- Deciding where to focus

3 →

Understanding customer value

- ↓
- What does the customer really want?
- ↓
- How satisfied are they at present?

4 →

Understanding the big picture

- ↓
- Spaghetti map
- ↓
- Big picture map

5 →

Detailed mapping

- ↓
- The detailed value stream mapping toolkit
- ↓
- Process activity mapping
- ↓
- Product variety funnel & sales funnel
- ↓
- Quality filter map
- ↓
- Demand amplification mapping
- ↓
- Process costing

6

Checking the plan & its profit potential

- ↓
- Developing a set of appropriate projects
- ↓
- Catch-balling the change programme
- ↓
- Developing the profit potential

The rationale behind going lean centres on creating value and removing waste both inside and between companies. This is fundamental to a lean value stream. Improved customer focus and productivity gains lead to leaner operations, which in turn help to expose further waste and quality problems in the system. The systematic attack on waste is also a systematic assault on the factors underlying poor quality and fundamental management problems.

What is value?

Value is what the customer wants. It consists of their articulated and latent needs and may be expressed as a perception rather than in facts and figures. In general there will be a number of key dimensions of customer value; we call these *value attributes*. Examples of value attributes include tangible elements such as product features, quality and delivery times, as well as more intangible elements such as service and relationship. Each customer will have their own set of value attributes for different products and services, although groups of customers may be clustered into distinct market segments.

It is important to start by gaining an external view of value, as a company's view of what is valuable to their customers is very often wrong or distorted. The description of the customers' value profile becomes strategic, as it is the basis of understanding how to create a competitive advantage. It involves the direct participation of the management, but most of all, of the customers. You are moving from an internal focus towards an external one.

It is our contention that an integrated or holistic process-based approach is the most effective way to drive companies towards a value-based competitive advantage. Remember, customers receive the output of complete processes, not just of individual departments!

What is waste?

Waste is anything that does not add value to the customer. As a guide, seven wastes were identified by Shigeo Shingo as part of the Toyota Production System. The Japanese call this *muda*.

- | | | | | | | |
|---------------------|----------|--------------------------|-----------------------------|-----------------------------|----------|-----------------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Over-
production | Defects | Unnecessary
inventory | Inappropriate
processing | Excessive
transportation | Waiting | Unnecessary
motion |



Waste (*muda*)

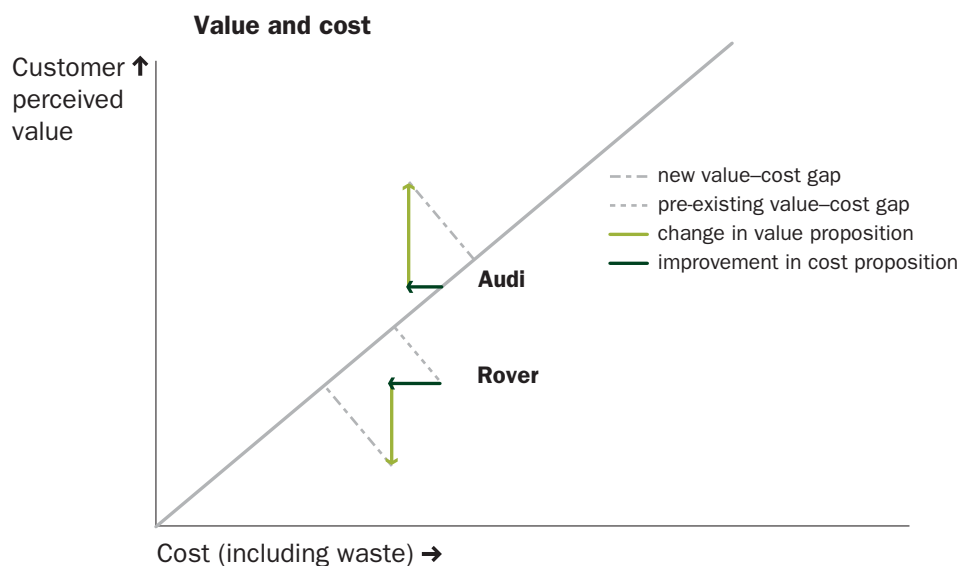
Non value adding to product or service

You can use the following chart to make a note of any of these wastes that are present in your business.

Waste	Description	Examples in your organisation
1 Overproduction	Producing too much or too soon, resulting in poor flow of information or goods and excess inventory.	
2 Defects	Frequent errors in paperwork, product quality problems, or poor delivery performance.	
3 Unnecessary inventory	Excessive storage and delay of information or products, resulting in excessive cost and poor customer service.	
4 Inappropriate processing	Going about work processes using the wrong set of tools, procedures or systems, often when a simpler approach may be more effective.	
5 Excessive transportation	Excessive movement of people, information or goods resulting in wasted time, effort and cost.	
6 Waiting	Long periods of inactivity for people, information or goods, resulting in poor flow and long lead times.	
7 Unnecessary motion	Poor workplace organisation, resulting in poor ergonomics, eg excessive bending or stretching and frequently lost items.	

Getting the balance right

Clearly you need to balance customer value with the cost of generating it, in order to provide a competitive offering. This is true whether your organisation seeks to offer a premium, standard or budget product/service. In the following figure we can plot the degree of customer perceived value for a product or brand against the relative cost of providing it. This cost would include the waste involved in providing the product or service. Offerings that are in the premium market would be in the top right part of the figure, those in the budget end of the market, in the bottom left. However, any offering above the diagonal equilibrium line will add value to the customer. Firms in this position are likely to win market share and grow. Those below the line are much less likely to have a comfortable future. A common feature of lean businesses is their movement to an above-the-line position.



To illustrate this, let us use the example of two mid sector car brands, Rover and Audi, in the late 1990s. For a number of reasons, Rover found themselves in a mid-market position, but with a poor market perception for value. As a result they had a choice as to how to improve their position. They chose to institute a programme of drastic cost cutting (a leftward shift in their position) by measures such as staff redundancies. However, as Rover were frequently in the headlines with such 'bad

news' stories, their perceived customer value fell further, taking them further away from the equilibrium line than before. The result – further reduction in market share

In contrast, Audi were undertaking less radical cost improvements but working on improving their customer value proposition by launching models such as the Audi TT. As a result, a small leftward shift was accompanied by a large vertical increase, meaning that they had repositioned themselves as a firm that was, in the eyes of the customer, adding a lot of value. Their market share increased considerably.

The moral of the story, and one that Rover have now learnt, is to address both the perceived customer value and the degree of waste in an organisation simultaneously. Finding the right balance between the two in future improvement efforts will be a central task for any management team.

Four types of activity

When thinking about waste, it is useful to define the four different types of activity within your organisation:

- 1 Value adding (VA) activity:** those activities that, in the eyes of the customer, make a product or service more valuable. Examples would include converting iron ore (with other things!) into cars, or mending a broken down car on a motorway. A value adding activity is simple to define, just ask yourself if you as a customer would be happy to pay for it!
- 2 Future value adding (FVA) activity:** those activities that, in the eyes of the customer, make a product or service more valuable in some future time period. Examples would include providing marketing information about a product that a customer was not presently aware of, or developing a new product or service.
- 3 Support activity (SA) or necessary non value adding activity:** those activities that, in the eyes of the customer, do not make a product or service more valuable but are necessary unless the existing process is radically changed. Such activities are often difficult to remove in the short term and should be a target for longer term or radical change. An example would be: inspecting every product at the end of a manufacturing line because the firm uses old machinery which is known to be unreliable.
- 4 Waste (W) or non value adding activity:** those activities that, in the eyes of the customer, do not make a product or service more valuable and are not necessary even under present circumstances. These activities are clearly wasteful and should therefore be the target of immediate or short term removal. An example of non value adding activity would be transferring a product from one sized container to another so you can move it around your factory.

In our past research at LERC we have developed a rough guide to the proportions of these four types of activity that we might expect to find in an organisation before any lean improvements:

In a *physical product environment* (manufacturing or logistics flow), the ratio between the time taken in each of the four types of activity in a typical pre-improved organisation is approximately:

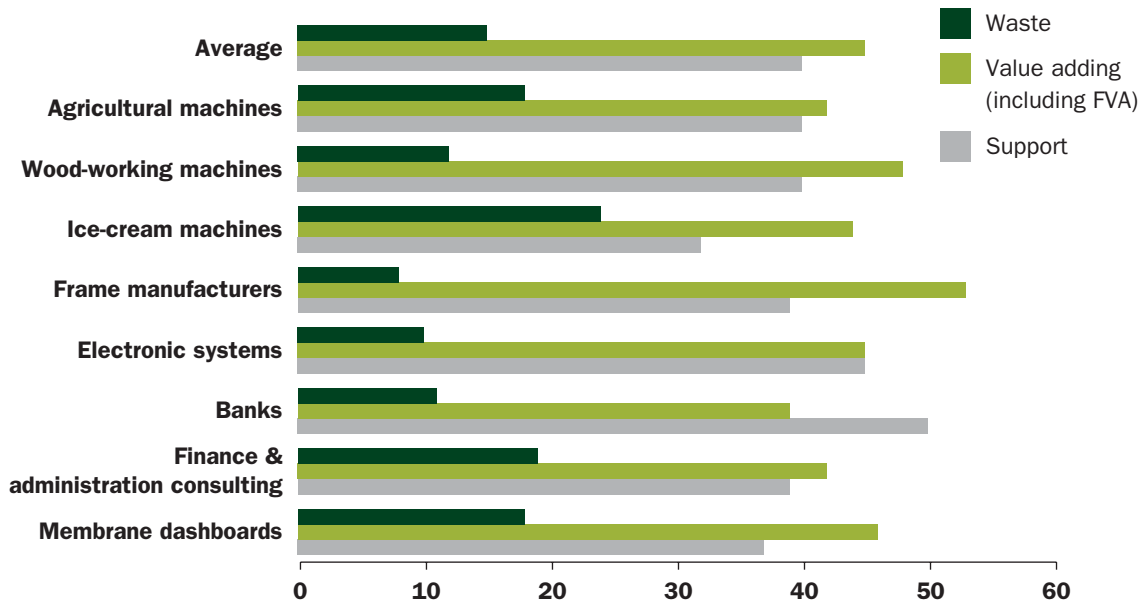
- 4% value adding activity
- 1% future value adding activity
- 35% support activity
- 60% waste

This does not sound too good until the same figures are seen in an *information environment* (e.g. office, distribution or retail) where a common ratio of total value stream time is:

- 1% value adding activity
- 1% future value adding activity
- 49% support activity
- 49% waste

However, this does not mean that the **cost** of waste is quite such a high ratio. Data collected from a number of different industries by the research group from the Department of Management Studies, University of Bologna give these results for the internal **cost** of activities:

Analysis of typical waste, support, and value adding activities within companies, by value



In this sample, on average, over 50% of costs within companies are not value adding, either now or in the future. These figures suggest that in most companies there is considerable scope for reducing waste. We talk about fitting people with ‘*muda* glasses’ – once they are aware of the waste they become increasingly able to see it. The trick is to create a culture that encourages them to eliminate waste once it has been identified.

Waste Removal Tip

Alert staff to the Seven Wastes by running a short seminar to explain these wastes. Choose groups of staff from the main areas of the business e.g. purchasing, production, distribution. Ask staff to note down their views of the specific wastes that occur in their section of the operation and to rank these wastes in terms of their relative importance. Ask for simple suggestions as to what could be done to reduce waste. Then task the staff, either individually or as a group, to change one thing each week that will reduce waste.

Lean thinking

1 →

Understanding value & waste

↓
What is value?
↓
What is waste?
↓
Getting the balance right
↓
Four types of activity

2 →

Setting the direction

↓
Developing critical success factors
↓
Reviewing & modifying key performance indicators
↓
Targeting improvement for each KPI
↓
Defining key value streams
↓
Deciding where to focus

3 →

Understanding customer value

↓
What does the customer really want?
↓
How satisfied are they at present?

4 →

Understanding the big picture

↓
Spaghetti map
↓
Big picture map

5 →

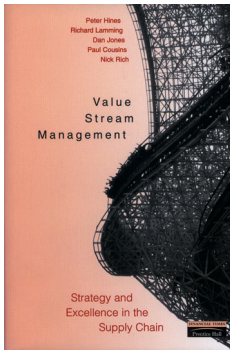
Detailed mapping

↓
The detailed value stream mapping toolkit
↓
Process activity mapping
↓
Product variety funnel & sales funnel
↓
Quality filter map
↓
Demand amplification mapping
↓
Process costing

6

Checking the plan & its profit potential

↓
Developing a set of appropriate projects
↓
Catch-balling the change programme
↓
Developing the profit potential



One of the main difficulties we see when companies try to apply lean thinking is a lack of direction, a lack of planning and a lack of adequate project sequencing and proper measurement systems. Knowledge of particular tools and techniques is often not the problem. In many cases lean initiatives are killed because of a lack of senior management forethought and lean oriented performance measurement systems.

For success, senior managers should:

- 1 develop *critical success factors* (CSFs)
- 2 review or modify appropriate *key performance indicators* (KPIs)
- 3 target improvement requirements over time for each KPI
- 4 define key *value streams* or business processes
- 5 decide which value streams or business processes to focus on

These preliminary steps are sometimes referred to as *policy deployment*. For further information see the book *Value Stream Management* by Peter Hines *et al.*

We will take you through them using our automotive retailing case study, *Main Motors*, before setting the scene for understanding more about customer needs, process mapping and costing.

1 Developing critical success factors

Critical success factors are a limited number of key areas where 'things must go right' for the business to succeed and flourish. They should be directly linked to, and influenced by, the specific factors impacting your company or value stream.

Establish the key forces impacting your business or wider value streams. Divide them into categories, such as:

- general business environment
- industry specific
- customer specific
- company specific

Brainstorm using a flip chart or Post-It notes, facilitated by a team leader.

Main Motors key force analysis

Business environment	Customer
<ul style="list-style-type: none"> ■ Reduced interest rates ■ Lower unemployment 	<ul style="list-style-type: none"> ■ Increased expectations (courtesy car, pick up, etc.) ■ More brand conscious (may be prepared to pay more)
Industry	Company
<ul style="list-style-type: none"> ■ Block exemption ■ Strong brand competitors ■ Other brands making better cars ■ European parallel imports & supermarkets 	<ul style="list-style-type: none"> ■ Central location: easy to get to ■ Willingness in staff for company to succeed ■ Building a long term business, not short term outlook

Define the existing capabilities of your organisation, by establishing its:

- strengths
- weaknesses
- opportunities
- threats

Brainstorm using a flip chart or Post-It notes, facilitated by a team leader.

Main Motors SWOT Analysis

Strengths	Weaknesses
<ul style="list-style-type: none"> ■ Flexibility, new facilities ■ Not a public limited company (plc) ■ New location: untapped market ■ Free to use appropriate sales processes ■ Strong franchise/brand ■ Wide skill base ■ Weakness of local competitor ■ Friendly atmosphere 	<ul style="list-style-type: none"> ■ Lack of brand experience ■ Lack of modern ideas ■ Lack of large company approach experience ■ Space for growth ■ Hard to recruit right skill base
Opportunities	Threats
<ul style="list-style-type: none"> ■ Further growth in after sales (service/parts) ■ Further growth of used car sales ■ New brand products ■ Sales to business market ■ Buy locally ■ Wholesaling parts ■ Web sales/bookings 	<ul style="list-style-type: none"> ■ More experienced brand competitors trying to squeeze us out (parts & new cars) ■ Block exemption ■ Manufacturer may cut dealers ■ Brand & product becoming less desirable ■ Improved competitors ■ Web based buying

Now, bearing in mind what you have established using these and other possible strategic tools, discuss what is key to the success of your business and draw up a list of critical success factors. If you have less than 4 you are probably being too focused, if you have more than 8 it is unlikely that they are all critical.

Here is the list that the senior team at Main Motors developed based on their assessment of their strategic position:

Main Motors critical success factors

- Continue to grow market share for after sales service, new & used cars
- Developing the right balance between these sales channels
- Recruitment, development and retention of skilled & motivated workforce
- Externally influenced innovation
- Close existing & new customer relationships
- Keep the franchise
- Long term focus & profitability
- Continuing to develop brand presence

2 Reviewing and modifying appropriate key performance indicators

Most organisations already have a set of top level (often finance-based) business measures. However, these may not be aligned to the critical success factors. This alignment is very important as existing measures will drive aspirations and ultimately performance. You must check that they are compatible with what is critical in your business environment. At Main Motors the existing key performance indicators were:

- Retail gross profit (%)
- Fleet customers gross profit (%)
- Used car gross profit (%)
- Used vehicle stock turn
- New cars sold with finance deal (%)
- Workshop utilisation (%)
- Part sales per vehicle in area (£)
- Hours sold per serviced vehicle
- Parts stock turn
- Administrative expenses (%)

Let's see how well these are aligned to what is critical for Main Motors:

Critical success factors

	Grow market share	R/D/R & motivated people	External innovation	Balance between 3 channels	Customer satisfaction	Keep the franchise	Long term & profit focus	Develop brand presence
Measure Retail gross profit (%)	○	●		○	●	●	●	●
Fleet customers gross profit (%)	○	●		○	●	●	●	●
Used car gross profit (%)	○	●		○	●	●	●	●
Used vehicle stock turn	○			○		●	●	○
New cars sold with finance deal (%)				○	●	●	●	○
Workshop utilisation (%)		●		●	●	○	●	●
Part sales per vehicle in area (£)	● / -	○		●	○	●	●	○
Hours sold per serviced vehicle	● / -	○		●	○	●	●	○
Parts stock turn				○		●	●	○
Administrative expenses (%)				○	○	●	●	

Key

●	measure is very well aligned with the CSF, likely to drive the right behaviour
○	some correlation with the CSF, but measure is unlikely to cause a change in behaviour
-	measure is likely to have a negative influence on the CSF
(blank)	no correlation.

Here, there is a fairly good correlation with each of the measures having a potentially positive influence on the CSFs. However, there is not a complete coverage of the CSFs by the measures. As a result goals such as 'external innovation', 'growing market share' and 'recruit, develop and retain skilled & motivated staff' may not be achieved. In addition, the existing measures tend to be about maximising dealer efficiency rather than increasing its strategic effectiveness. As a result, some modifications are necessary, particularly in the marketing and people areas. In a small organisation like Main Motors only one level of measurement may be needed, but in most companies with over 50 staff it is necessary to have several deployed levels, generally with no more than 10 measures at any one level.

After some discussion, Main Motors came up with the following set of metrics to address these concerns:

New Key Performance Indicators

- Gross Profit/New Car
- Gross Profit/Used Car
- Finance Penetration New Cars
- Finance Penetration Used Cars
- Admin Expenses
- *Market Share: Region vs National*
- *Retention New: First Service*
- *Retention New: 3 years*
- *Retention Used: First Service*
- Return on Total Turnover
- Volumes: New Cars
- Volumes: Used Cars
- *Service Parts Absorption*
- Stock Turn: Used Cars
- Stock Turn: Parts
- *Overall channel effectiveness: New Cars*
- *Overall channel effectiveness: Used Cars*
- *Overall channel effectiveness: Service*
- *ILU skills/competency*

The measures in italics are new; most of them are self explanatory. However, *overall channel effectiveness* and *ILU* need a little explanation. Overall channel effectiveness is a measure of how efficient and customer-focused a value stream is. It is one of the best lean measures. In a manufacturing environment it is often called *overall equipment effectiveness*. In this case overall channel effectiveness (OCE) may be defined as:

Percentage availability x Percentage performance x Percentage quality

Applying this to the car servicing process at Main Motors we got:

Percentage availability	90.0%
Percentage performance	59.8%
Percentage quality	95.0%
OCE	51.1%

The ultimate target of this measure is 100%. In order to improve the measure attention is normally directed first to the lowest of the three constituent percentage scores.

The following ILU chart shows the skills and competencies that the team defined within the Sales Department. For each skill or competence a score is assigned to each team member depending on their level of expertise:

- blank – no skill/competence
- I for basic level, needs supervision
- L for trained level, needs some supervision
- U for fully competent
- O for expert, can train others.

The total scores for members of the department can then be compared with a departmental or channel target. A check can then be made to see if the team are on target or need more training. In this case further training or development is needed in three areas: 'demonstrate integrity', 'new car stock ordering' and 'selling finance'. This department would be awarded a 5 out of 8 score, or 63%. ILU charting allows for adequate training without over-training. It may also be linked to reward schemes.

ILU chart for Main Motors sales department

Skill or Competence	Adrian	Bruce	Jim	John	Julia	Tony	Target	Actual	On Target
Demonstrate Integrity	U	U	O	U	I	L	4 U, 2 O	1 I, 1 L, 3 U, 1 O	No
Understand Customer Needs	U	U	O	O	U	U	4 U, 2 O	4 U, 2 O	Yes
New Car Stock Ordering	O	U	U	U		L	4 U, 2 O	1 L, 3 U, 1 O	No
Buying Used Cars	L	L	O	U			1 L, 1 U, 2 O	1 O, 1 U, 2 L	Yes
Selling Finance	L	L	O	U	L	L	4 U, 2 O	4 L, 1 U, 1 O	No
Paperwork Accuracy	U	U	U	U	O	O	4 U, 2 O	4 U, 2 O	Yes
Selling & Negotiation Skills	O	O	U	O	U	U	4 U, 2 O	3 U, 3 O	Yes
Telephone Skills	O	O	U	O	U	U	4 U, 2 O	3 U, 3 O	Yes

3 Targeting improvement for each key performance indicator

The next stage is to create targets for each business measure. The following steps may help:

- establish current position
- develop long term vision of what you would ideally like the measure to look like (say 5 years away)
- develop sensible intermediate targets bearing in mind that some measures may not improve in a straight line

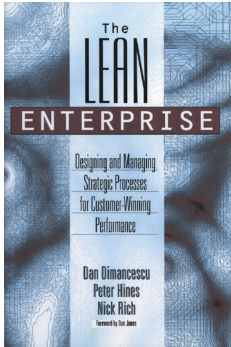
The example produced by the Main Motors managers is shown below:

	Now	Year 1	Year 2	Year 3	Year 4	Vision (Year 5)
KPIs Gross profit (new car)	2.0%	2.3%	2.6%	2.9%	3.2%	3.5%
Gross profit (used car)	7.0%	7.6%	8.2%	8.8%	9.4%	10.0%
Finance penetration (new cars)	23.0%	23.0%	23.0%	23.0%	23.0%	23.0%
Finance penetration (used cars)	16.0%	17.8%	19.6%	21.4%	23.2%	25.0%
Admin expenses	0.9%	1.0%	1.1%	1.0%	0.9%	0.9%
Market share: region vs national	6.8%/6.8%	7.0%/7.0%	7.3%/7.3%	7.5%/7.5%	7.8%/7.8%	8.0%/8.0%
Retention (new): First service	80%	80%	80%	80%	80%	80%
Retention (new): 3 years	30%	36%	42%	48%	54%	60%
Retention (used): First service	25%	26%	27%	28%	29%	30%
Return on total turnover	1.4%	1.9%	2.4%	3.0%	3.5%	4.0%
Volumes (new cars)	550	580	610	640	670	700
Volumes (used cars)	270	296	322	348	374	400
Service parts absorption	60%	68%	76%	84%	92%	100%
Stock turn (used cars)	8	8	8	8	8	8
Stock turn (parts)	7.9	8	8	8	8	8
OCE (new cars)	39.5%	41.0%	42.5%	44.0%	45.5%	47.0%
OCE (used cars)	38.4%	45.6%	52.8%	60.0%	67.2%	74.5%
OCE (service)	51.1%	55.2%	59.3%	63.4%	67.4%	71.5%
ILU skills/competency	45.20%	65%	75%	85%	95%	100%

The first time you try this targeting exercise the result will probably not be the optimum, but it will point you in the right direction. You can adjust targets to suit your company's particular situation and they can be improved on an annual basis.

The targets set a broad direction for the company over the next three to five years. What you now need to work out is how to achieve this. To do that you need to understand the key value streams of your business processes.

4 Defining key value streams of business processes



A key business process can be defined as:

Patterns of interconnected value-adding relationships designed to meet business goals and objectives.

All business processes have a series of inputs and a number of steps, tasks or activities that convert these inputs into a number of outputs. They typically run across several departments in a business (or businesses) and encourage and support inter-departmental communication and co-operation throughout the company or value stream.

In our use of the term 'process' we are referring to a limited number of key activity groups that you need to deliver value to the business or value stream. The fewer you define the easier they will be to manage. Remember that these processes are not everything a company does, but they are the core activities it undertakes and must get right.

Don't fall into the trap of defining 100+ business processes (as you would for Business Process Reengineering). Brainstorm many, but settle on a few. For a more detailed discussion of how to define processes, refer to *The Lean Enterprise* by Dimancescu *et al.*

Once you have agreed on between four and ten key processes make sure each have a definition. This will prevent confusion later. Key business processes applying to Main Motors include:

Strategy formation and deployment: The strategic management of the company, focusing of change, managing critical success factors and ensuring all employees are fully aligned and empowered

Order fulfilment (new cars, used cars, parts): Taking orders, processing the orders, scheduling planning, taking delivery, inspecting, delivery to customer and payment management

Order fulfilment (car servicing & repairing): Taking booking, receiving car, servicing car, returning to customer and payment management

Winning business: Identifying and targeting new customers or business opportunities in order to trigger the order fulfilment process

Property lifecycle management: The identification, acquisition, maintenance, development and disposal of dealer sites

Human resource management: The identification of needs, recruitment, motivation, training, development and reward of people together with the management of their eventual retirement

Information technology: The management of electronic support systems

Legal and financial management: The management of the legal function as well as costs, financial and management accounts.

5 Deciding which key value streams or business processes to focus on

To decide which key business process area is likely to give us the targeted improvements, just ask if the business process is likely to yield benefit in each target area if improved. You can then decide which process or processes need detailed mapping. We will explain how to map processes later on.

To help identify which processes to focus on, try dividing them into

- **strategic processes:** processes focusing overall direction but not directly impacting on targets
- **core processes:** processes directly impacting on targets
- **support processes:** processes indirectly impacting on targets

In our Main Motors example we have classified the processes as follows:

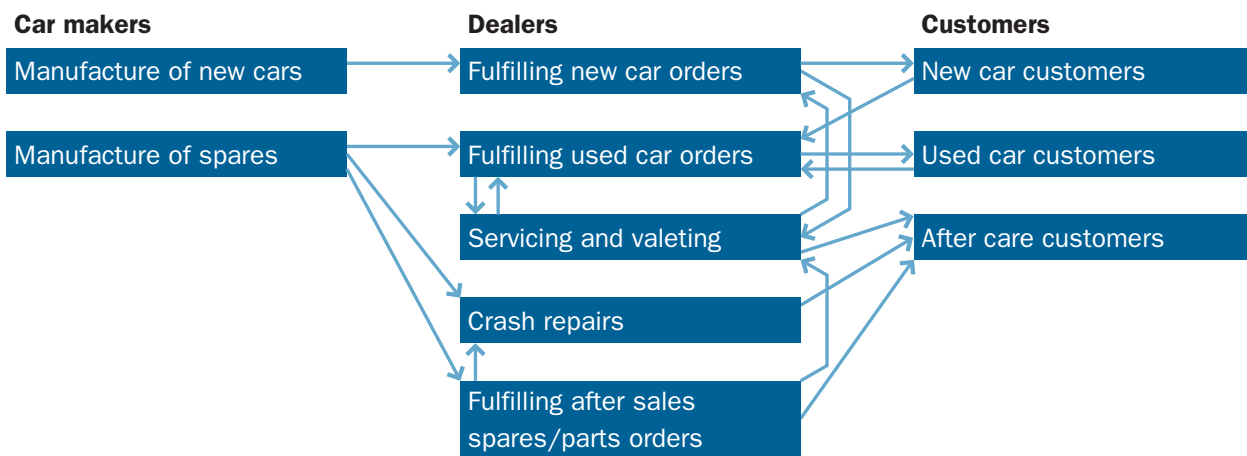
Strategic processes	Core processes	Support processes
Strategy formation and deployment	Order fulfilment (new cars, used cars, parts)	Property lifecycle management
	Order fulfilment (car servicing and repairing)	Human resource management
	Winning new business	Information technology
		Legal and financial management

Strategy formation and deployment sets the direction and the three core processes are required to deliver the targeted results, aided by the four support processes. Remember that this list is appropriate for Main Motors, but may need to be changed substantially for other businesses, for instance those in a manufacturing environment.

As Main Motors did not have the resources for improvement readily available from its 22 staff, a highly focused improvement approach was called for. The management decided to concentrate efforts on the order fulfilment process, as they judged this would be most likely to produce cost effective results.

In their case the order fulfilment process had several different elements or value streams that resulted in different products or services being supplied to customers. In order to understand the situation we created a simple *value stream interaction map* for Main Motors. This map is very important and should be sketched out even if only in rough on a flip chart. Many firms fail to reap the true profit potential of lean as they fail to address the key interaction and bottleneck points where different value streams collide. The value stream interaction map will help.

Value Stream Interaction Map for Main Motors



On closer inspection Main Motors found that, of the five value streams interacting with the customer, new cars, used cars and servicing represented over 99% of the firm's revenue stream. As a result, crash repair and fulfilling after sales spares/parts orders were excluded from later value stream mapping. It was also clear that the servicing and valeting areas of the business were central interaction points, and therefore key bottleneck points.

6 Sum Up

For effective direction setting, take the following steps:

- develop critical success factors
- review and modify appropriate key performance indicators
- target improvement for each performance indicator
- define key value streams of business processes
- decide which value streams or business processes to focus on

Up to this point this is essentially a senior management activity, perhaps involving line managers responsible for the key business processes.

Lean thinking

1 →

Understanding value & waste

- ↓
- What is value?
- ↓
- What is waste?
- ↓
- Getting the balance right
- ↓
- Four types of activity

2 →

Setting the direction

- ↓
- Developing critical success factors
- ↓
- Reviewing & modifying key performance indicators
- ↓
- Targeting improvement for each KPI
- ↓
- Defining key value streams
- ↓
- Deciding where to focus

3 →

Understanding customer value

- ↓
- What does the customer really want?
- ↓
- How satisfied are they at present?

4 →

Understanding the big picture

- ↓
- Spaghetti map
- ↓
- Big picture map

5 →

Detailed mapping

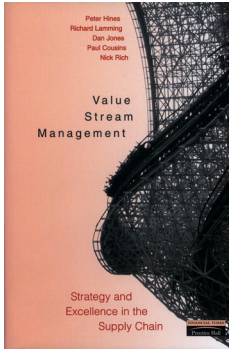
- ↓
- The detailed value stream mapping toolkit
- ↓
- Process activity mapping
- ↓
- Product variety funnel & sales funnel
- ↓
- Quality filter map
- ↓
- Demand amplification mapping
- ↓
- Process costing

6

Checking the plan & its profit potential

- ↓
- Developing a set of appropriate projects
- ↓
- Catch-balling the change programme
- ↓
- Developing the profit potential

What does the customer really want?



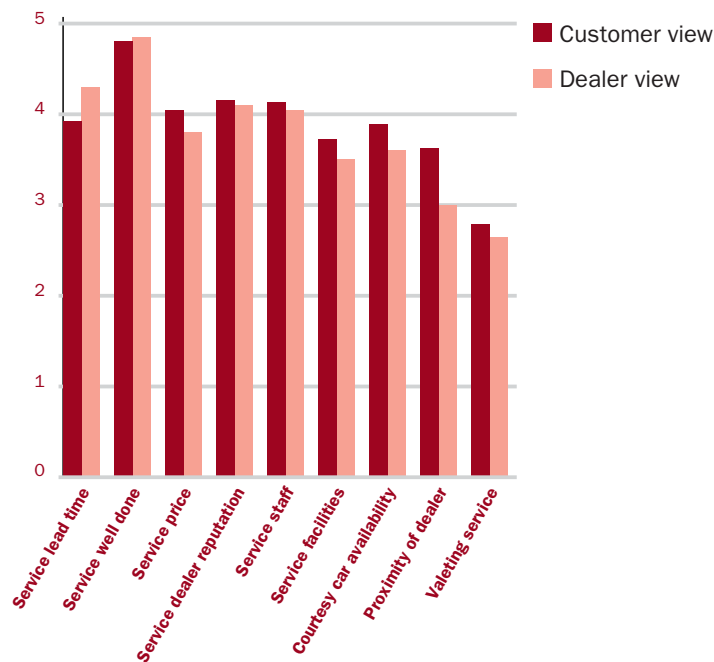
One of the great weaknesses of most lean implementation programmes is that value is defined by the company or their consultants rather than the customer. We need to avoid engineering definitions that do not relate to the real world. We need to ask the customer.

It is a good idea to ask staff within your organisation as well. This will give you a view of how well they understand the customer. To illustrate, we asked all the staff at Main Motors what they thought were the most important value attributes that customers looked for when they bought a car or booked their car in for a service. We then checked whether these were the right factors by asking a sample of 100 customers. We followed this with a large scale postal questionnaire of over a thousand real customers.

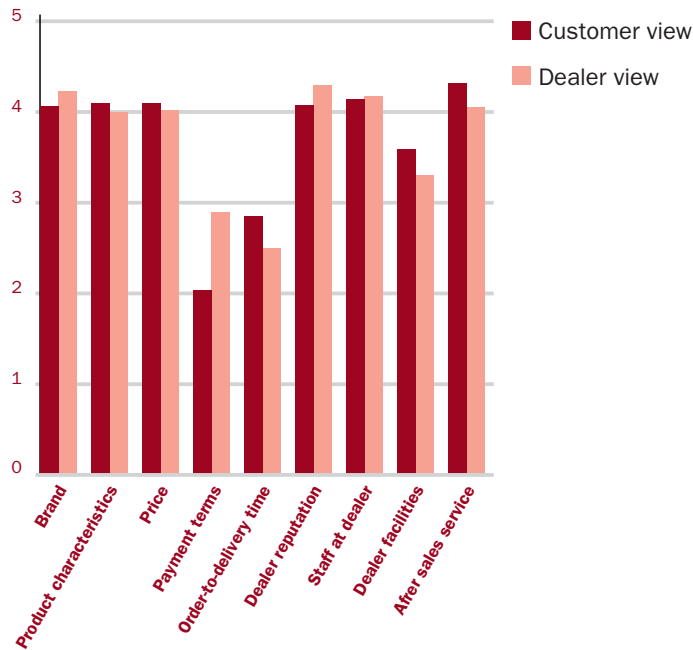
We found that the staff at Main Motors had a very close understanding of customer needs in both selling new cars and in servicing them. However, at least at an aggregate level, they over-estimated the importance of payment term and under-estimated the importance of proximity and order to delivery times.

We also established what was really important to the customers; a key input to our subsequent improvement planning activities.

Customer wants for car servicing and dealer interpretation



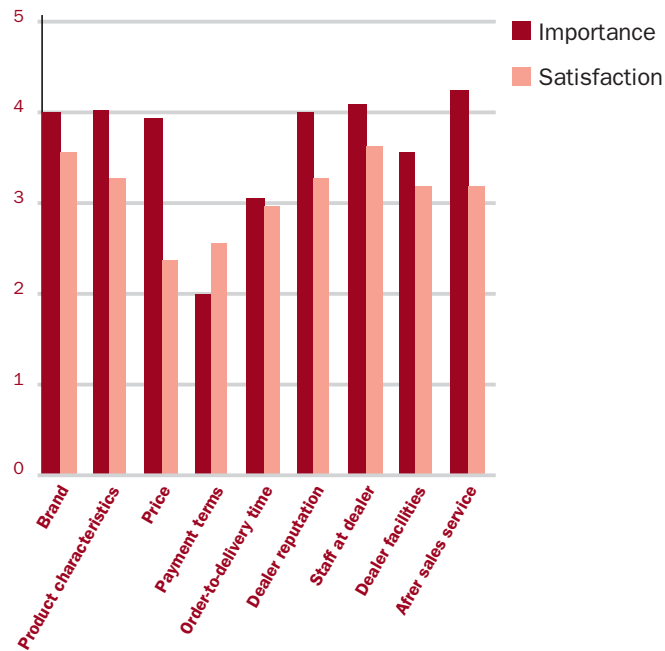
Customer wants for new cars and dealer interpretation



How satisfied are they?

Once we have established what customers want, we can then find out how happy they are. Using the Main Motors customer questionnaire, we found the following:

New car value attributes importance versus satisfaction



In eight of the nine attributes customers want more value. In the other, 'payment terms', has Main Motors over-engineered their solution? Two of the largest gaps are in 'product characteristics' and 'price', areas over which Main Motors has little control unless it was to sell a different brand of car. However, within 'dealer reputation', 'staff at the dealer', and 'after sales service', there is more latitude. As 'dealer reputation' is largely the result of good staff, facilities and service, the key aspects are the quality of staff and 'after sales service'. We have not only established the link between customer values and satisfaction but also that the after sales process is vital to the success of selling new cars. If we had looked at only one of the order fulfilment processes and not asked for the customers' views, we might never have found this out. Understanding what adds value to the customer is vital, before we move on to map the various key business processes and value streams.

Lean thinking

1 →

Understanding value & waste

↓
What is value?
↓
What is waste?
↓
Getting the balance right
↓
Four types of activity

2 →

Setting the direction

↓
Developing critical success factors
↓
Reviewing & modifying key performance indicators
↓
Targeting improvement for each KPI
↓
Defining key value streams
↓
Deciding where to focus

3 →

Understanding customer value

↓
What does the customer really want?
↓
How satisfied are they at present?

4 →

Understanding the big picture

↓
Spaghetti map
↓
Big picture map

5 →

Detailed mapping

↓
The detailed value stream mapping toolkit
↓
Process activity mapping
↓
Product variety funnel & sales funnel
↓
Quality filter map
↓
Demand amplification mapping
↓
Process costing

6

Checking the plan & its profit potential

↓
Developing a set of appropriate projects
↓
Catch-balling the change programme
↓
Developing the profit potential

Before starting detailed mapping of any core process it is useful to develop an overview of the key features of that entire process. To some degree we have already achieved this by using the value stream interaction map. However, in most cases you will need more detail in order to:

- help you visualise the flows
- help you see where waste is
- pull together the lean thinking principles
- help you decide who should be in the implementation teams
- show relationships between information and physical flows
- create buy-in from the senior team undertaking the big picture mapping

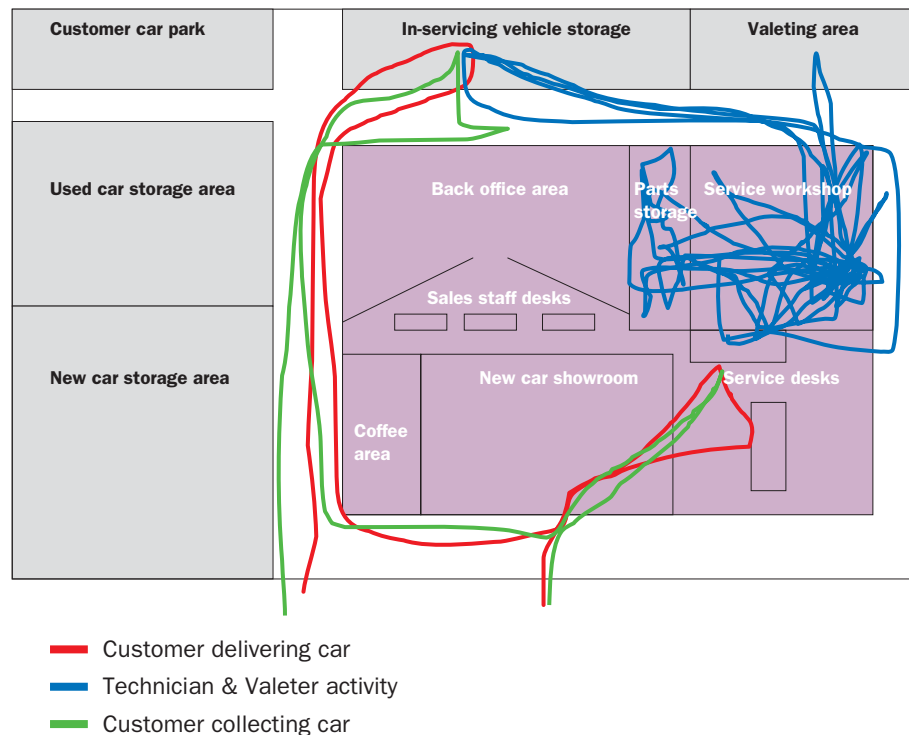
To do this two further tools are used, the *spaghetti diagram* and the *big picture map*.

Spaghetti diagram

The spaghetti diagram is a tool that follows the flow of information and physical activity within a workplace environment. Its strengths are in the fact that it shows clearly where activity is occurring, how complex the flows are, and how far information and products travel. It is very useful for identifying how wasteful movements can be minimized by process improvement and new layout. It can also help to highlight possible bottlenecks, where several value streams interact within a company or organisation.

This is a simplified version of the spaghetti diagram for the order fulfilment of a car service at Main Motors.

Spaghetti diagram for car servicing at Main Motors



Big picture map

Another macro level approach is the big picture map, a tool borrowed from Toyota. You can develop the big picture in five easy phases. Remember to map the reality of what actually happens, rather than what is supposed to happen; don't bring the quality procedure manual into the workshop, it won't help. Focus on a specific value stream or a specific product or product family, purchased by a specific customer or market segment. For Main Motors, we looked at the car servicing process first. This avoids confusion over the different routes or processes adopted for different products or different customers. You can consider other value streams later to see if they differ significantly, as in this case, the order fulfilment processes for new and used cars. Choose a value stream that is important to the company, such as a key product line to a key customer or segment.

When doing this mapping exercise with a senior/line management team try using Post-It notes on a sheet of brown paper. This allows everyone to see what is going on as well as participating in moving things around! You can always record the data in a PowerPoint format later if you need to.

We will illustrate big picture mapping using a simplified version of Main Motors servicing order fulfilment process.

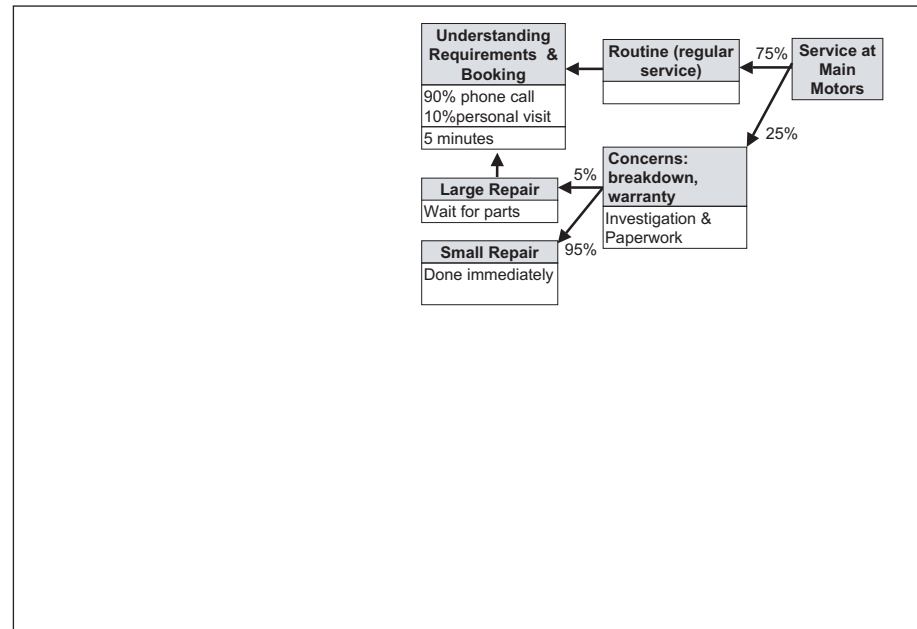
Phase 1: Customer requirements

Ask the following questions and record the answers in the top right hand corner of the paper:

- What is the product family or families to be mapped?
- What is the customer demand, or how many products are wanted and when?
- What is the complexity?
- How many products are delivered at a time?
- How often are deliveries required?
- What packaging or service requirement is needed?
- Any special information e.g. multiple delivery points, delivery windows?

In practice you may not be able to get all of this information immediately. Just record as much as you can.

Servicing phase 1: record customer needs

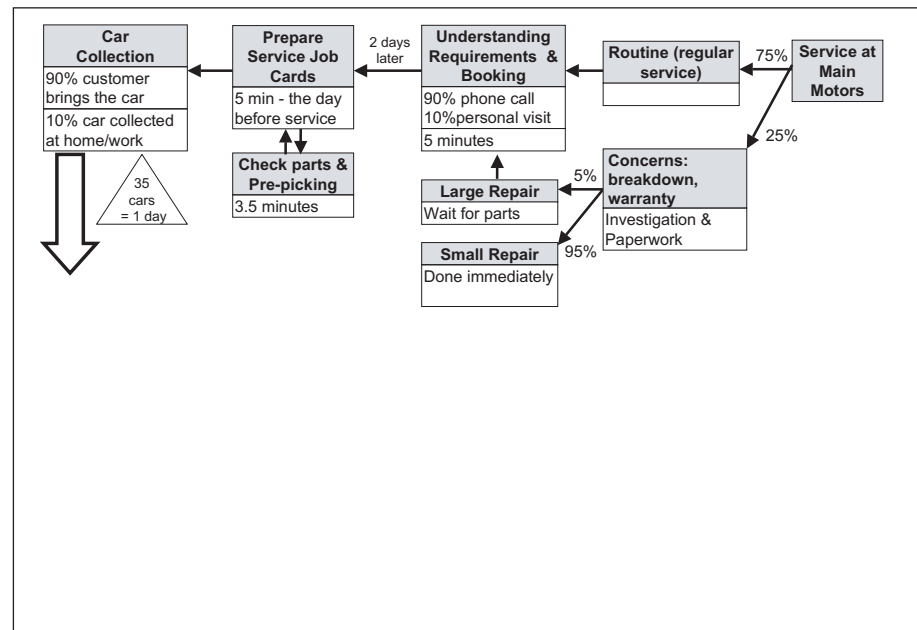


Phase 2: Information flows

Ask the following questions and record the answers from right to left along the top of the paper:

- What sort of forecast and call-off information is supplied by the customer?
- Who (or which department) does this information go to in your firm?
- How long does it stay there before being processed?
- Who do they pass it to as it moves towards suppliers? (we will cover the internal scheduling or production planning phase later, so leave that for now)
- What sort of forecast and call-off information do you give your suppliers?
- What order quantities do you specify?

Servicing phase 2: add information flows



Phase 3: Physical flows

Ask the following questions and record the answers from left to right along the bottom of the paper:

For inbound flows of raw material and/or key components

- What is your demand or how many products are wanted and when?
- How many different parts are required? (usually you would map the main or constraint part)
- How many products are delivered at a time?
- How often do deliveries occur?
- What packaging is used?
- How long does it take to deliver?
- Any special information, eg more than one supplier for a given part number?

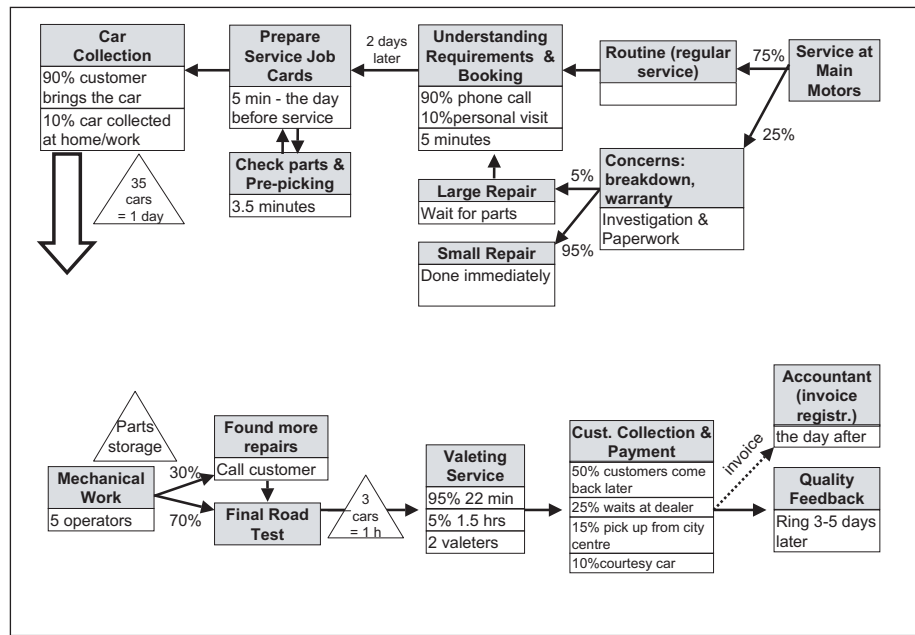
For internal processes

- What are the key steps in your company?
- How long do they typically take? (we often record maximum and minimum values here)
- At which points is inventory stored?
- At which points are there quality checks and what is the level of defects?
- Are there set rework loops?
- What is the cycle time at each point?
- How many products are made and moved in a batch at each point?
- What is the up-time of each operation?
- How much of the product is tested at each point?
- How many hours per day does each work station work?
- How many people work at each work station, is it variable?
- What is a typical changeover time at each work station?
- Where is inventory held and how much is there?
- What are the bottleneck points?

To keep this illustrative map simple many of these details have not been recorded on this version.

If a group of senior and line managers can record this information accurately without going to look then you will already have a lean aligned company. If not, then you will have learned what you don't know and can join the other 99.99% of firms!

Servicing phase 3: add physical flows



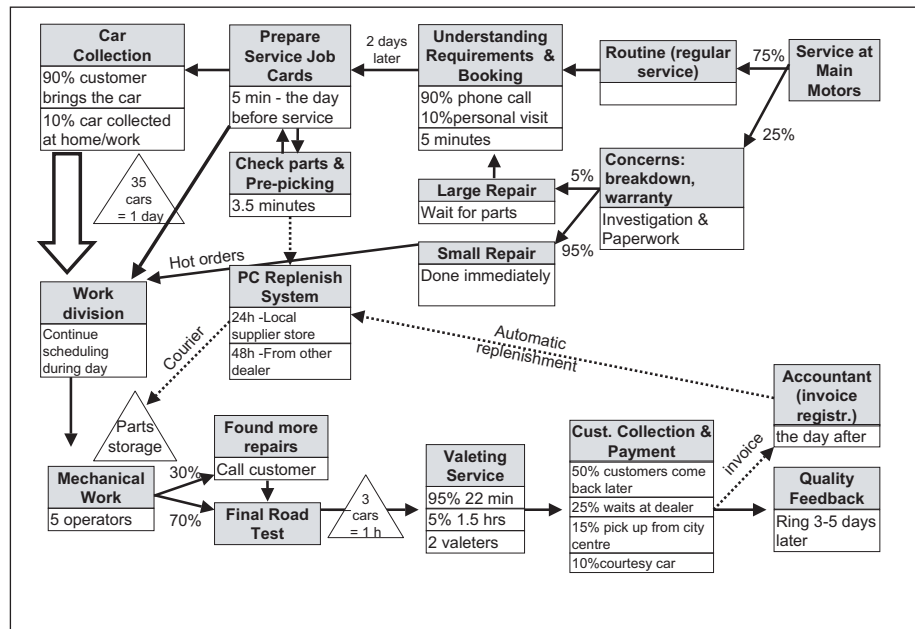
Phase 4: Linking physical and information flows

Ask how the information flows and physical flows are related and draw on arrows to show the links.

- What sort of scheduling information is used?
- What sort of work instructions are produced?
- Where is the information and instruction sent from and to?
- What happens when there are problems in the physical flow?

You should now have linked the upper and lower parts of the figure.

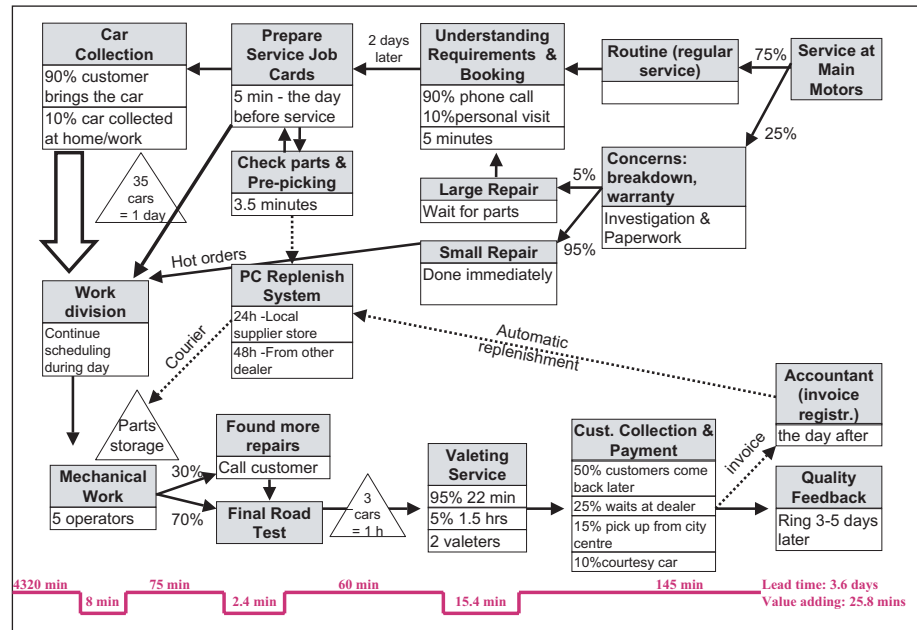
Servicing phase 4: big picture map with flows



Phase 5: Complete map

To complete the map, add a time line at the very bottom recording the total lead time and value adding time.

Servicing: complete big picture map



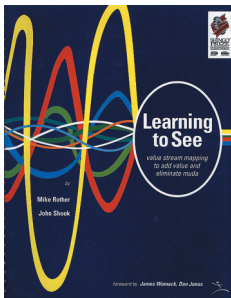
You now have a complete big picture map. At this point some senior managers find it useful to brainstorm major issues, problems or opportunities. You can record these simply by using different coloured Post It notes. Some groups try to re-engineer the supply chain into a possible *future state map*. This can be dangerous at this point, as the information collated needs validation. You will need other, more detailed maps to look at the problem from different viewpoints.

You will not need to do this extra work if you are **sure** that you do not suffer from:

- quality problems
- unstable demand
- poor layout
- people issues

We, however, prefer a more data driven approach and therefore suggest you collect more detailed information about the company by involving a team of line managers and members of the workforce. A future state map can be developed after this if necessary.

For a more complete description of the procedures for big picture mapping we suggest you refer to *Learning to See – value stream mapping to add value and eliminate muda* by Rother & Shook.



Tips:

Before you start mapping an individual business process or value stream you will need to make a choice of which product you should follow. In our Main Motors case this was relatively easy as the order fulfilment process for servicing cars is almost the same for all variants. In the same way it is similar for all used cars and for new cars. However, this may not be the case in your organisation.

We suggest you start with an analysis of your product or services and divide them into:

- runners
- repeaters
- strangers

Runners are products or services that have a regular, ongoing, predictable demand, which represent a low risk in the business and may have low inventories. Such products generally are high volume and have dedicated facilities.

Tips:

Repeaters are products or services that have an ongoing demand but are difficult to predict. They exhibit a medium risk to the business and may have medium levels of inventory. They generally have intermediate volumes but not dedicated facilities.

Strangers are products or services that are hard to predict and will exhibit highly irregular but generally low demand profiles.

Many mapping gurus suggest you look at a high volume product or service. However, we recommend you undertake a runner, repeater, stranger segmentation. The split will vary by industry, but an 80%:15%:5% split is not unusual. The second question to ask is which of these causes you problems; here a 5%, 15%, 80% split is often the case. Our suggestion is that, if you have time, you should map one product in each category as it may be the strangers that cause most of your problems. You should also remember that it is often the interaction of product or service value streams, rather than the value streams themselves, that causes the problems. So look for interaction or bottleneck points by overlaying the different spaghetti diagrams you have produced.

Lean thinking

1 →

Understanding value & waste

↓
What is value?
↓
What is waste?
↓
Getting the balance right
↓
Four types of activity

2 →

Setting the direction

↓
Developing critical success factors
↓
Reviewing & modifying key performance indicators
↓
Targeting improvement for each KPI
↓
Defining key value streams
↓
Deciding where to focus

3 →

Understanding customer value

↓
What does the customer really want?
↓
How satisfied are they at present?

4 →

Understanding the big picture

↓
Spaghetti map
↓
Big picture map

5 →

Detailed mapping

↓
The detailed value stream mapping toolkit
↓
Process activity mapping
↓
Product variety funnel & sales funnel
↓
Quality filter map
↓
Demand amplification mapping
↓
Process costing

6

Checking the plan & its profit potential

↓
Developing a set of appropriate projects
↓
Catch-balling the change programme
↓
Developing the profit potential

5 Detailed mapping

Up to this point we have only involved the senior or line managers, and lean change will not happen unless we involve the wider workforce. By now the senior team will have a pretty good idea of the direction and possible areas that could be addressed. However, this information has not come from the ‘doers’ in the organisation. The bottom-up detailed mapping should, therefore, be done by a team of doers, led by a senior or line manager who has participated in the earlier activities.

There are two reasons for including those actually involved in the day to day information and physical flows:

- they are the only people likely to know what is actually going on, and
- when you use the detailed maps to develop action plans, you will ensure bottom up buy-in by developing plans from the wider team.

The detailed value stream mapping toolkit

For those of you interested in more advanced mapping in a complex job shop with multiple components (low volume, high value environment) we suggest you take a look at work of Shahrukh Irani at <http://www-iwse.eng.ohio-state.edu/ISEFaculty/Irani/research/PFAST/Pfast.htm>

In our value stream mapping work we use a large number of tools to fill in the gaps left by just looking at the big picture level. Here, we will summarise five of the most useful tools. We have not invented all these tools. We have collected, modified or in some cases developed approaches when we have found gaps in what was already available. Here we will illustrate their use within an order fulfilment environment, but they may also be used in many other business processes.

Which are the best tools to use?

Before starting detailed mapping, the table below refers you back to the earlier discussion on wastes and provides an overview of which tool is good at detailing each particular waste. We have simply recorded **yes, maybe** or **no**.

	Process activity mapping	Production variety funnel	Quality filter mapping	Demand amplification mapping	Process costing
Overproduction	maybe	no	maybe	maybe	yes
Waiting	yes	maybe	no	maybe	yes
Excessive transportation	yes	no	no	no	no
Inappropriate processing	yes	maybe	maybe	no	yes
Unnecessary inventory	maybe	maybe	no	yes	yes
Unnecessary motions	yes	no	no	no	yes
Defects	maybe	no	yes	no	yes

Process activity mapping

This is the key tool for the detailed mapping of the order fulfilment process. It is an engineering-derived approach that has traditionally only been used for the shop floor of manufacturing companies. However, we use it more widely to identify lead time and productivity opportunities for both physical product flows and information flows, not only in the factory but also in other areas of the supply chain.

The idea is to map out every step of activity that occurs throughout a process. In the example below we illustrate this in the booking in of a car for a service at Main Motors. However, we would of course map the complete servicing process, rather

than just this information-based section. Remember: there may be more waste in the information flow than on the shop floor, so map the information flows as well as any physical flows.

Process activity mapping of booking in a car for service at Main Motors

Trigger	Customer calls for service	Flow	Activity type	Area	Distance (metres)	Time (min.)	People	Activities performed (in min.)				
								VA	FVA	SA	W	
1	Answer the phone	Operation	FVA	Showroom	0	0.1	2	0	0.1	0	0	
2	Take registration number	Operation	SA	Showroom	0	0.5	2	0	0	0.5	0	
3	Check the registration number on PC	Inspection	SA	Showroom	0	0.5	2	0	0	0.5	0	
4	Understanding customer requirements	Operation	VA	Showroom	0	3.5	2	3.5	0	0	0	
5	Formal booking on computer	Operation	W	Showroom	0	1.5	1	0	0	0	1.5	
6	Put T-card in the rack	Transport	SA	Showroom	5	0.25	1	0	0	0.25	0	
7	Wait until the day before service	Delay	W	Showroom	0	4320	0	0	0	0	0	
end	Final event											
					Totals	5	4326.35	10	3.5	0.1	1.25	1.5
								55.1%	1.6%	19.7%	23.6%	

Before looking at the method in detail, work through the following completed example of a process activity map for a simple activity with which we are all familiar – filling a car with petrol.

Step 1: Fill in the main body of chart as shown (everything except flows):
 Starting with a trigger point (or start of process) and record all activities, areas where they occur, distances moved, time taken, number of people involved in each step and any relevant comments. Then sum the columns for distance, time and people.

#	Activity	Flow	Area	Distance (metres)	Time (minutes)	People	Comments
Trigger	Arrive at garage		Roadside	0.00	0.00	0	Arrive at 08:30
1	Queue to enter forecourt		Roadside	0.00	0.75	1	Early morning congestion, (usually none)
2	Drive to free pump		Forecourt	25.00	0.20	1	
3	Queue for pump to become free		Forecourt	0.00	5.00	1	Cars parked at pump whilst paying (usually none)
4	Drive to free pump		Forecourt	3.00	0.10	1	
5	Open car door and exit car		Forecourt	0.50	0.10	1	
6	Walk to petrol cap on car		Forecourt	2.00	0.10	1	
7	Unlock petrol cap on car		Forecourt	0.00	1.00	1	Cap is faulty and regularly gives problems
8	Walk to petrol pump nozzle		Forecourt	1.50	0.10	1	
9	Retract nozzle		Forecourt	0.00	0.10	1	
10	Walk to petrol cap on car		Forecourt	1.50	0.10	1	
11	Insert nozzle into petrol tank		Forecourt	0.00	0.10	1	
12	Dispense petrol into tank		Forecourt	0.00	3.00	1	50 litre tank, always fill to top
13	Round up value to nearest £1		Forecourt	0.00	0.50	1	
14	Retract nozzle from petrol tank		Forecourt	0.00	0.10	1	
15	Walk to petrol pump		Forecourt	1.50	0.10	1	
16	Replace nozzle		Forecourt	0.00	0.10	1	
17	Close car door and lock car		Forecourt	0.00	0.10	1	Rule I have set myself
18	Walk to shop		Shop	35.00	0.50	1	
19	Queue for cashier		Shop	0.00	3.00	1	Two people in queue
20	Hand petrol card to cashier		Shop	0.00	0.10	2	Collecting air miles!
21	Hand payment card to cashier		Shop	0.00	0.10	2	Payment by card to manage finances more easily
22	Cashier swipes petrol card		Shop	0.00	0.10	1	
23	Cashier swipes payment card		Shop	0.00	0.10	1	
24	Cashier hands payment slip		Shop	0.00	0.30	1	
25	Check slip		Shop	0.00	0.20	1	Past errors at this garage
26	Sign slip		Shop	0.00	0.10	1	
27	Hand slip back to cashier		Shop	0.00	0.10	2	
28	Cashier returns cards and receipt		Shop	0.00	0.20	2	Hand them back in one go
29	Return to car		Forecourt	35.00	0.50	1	
Total				105 metres	16.85 minutes	33 people	

It is surprising how complex even apparently simple tasks actually are.

Petrol station answers
1 = D
2 = T
3 = D
4 = T
5 = T
6 = T
7 = T
8 = T
9 = T
10 = T
11 = T
12 = O
13 = I
14 = T
15 = T
16 = T
17 = T
18 = T
19 = D
20 = T
21 = T
22 = I
23 = I
24 = T
25 = I
26 = I
27 = T
28 = T
29 = T

Step 2: Assign flows

There are four types of flows:

- Operation = O
- Transport = T
- Inspection = I
- Delay (or storage) = D

As a guide assume that:

- operations are value adding steps that you are willing to pay for, or a set rule e.g. don't light a cigarette while filling your car with fuel
- transports are where there is movement but you would prefer to avoid paying for this
- inspections are checks of the quality or quantity of product or information
- delay (or storage) is where a product or information is waiting and there is no activity.

Note: when mapping information flows you may find it useful to add another category:

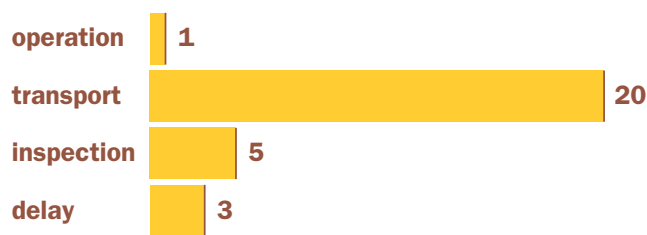
- Communications – this refers to movement or transmission of information. It may involve a time and a distance, for example if people carry documents around, or it may involve no time or distance if data is transmitted electronically.

Now go back to page 37 and assign flows to the petrol station example by completing Column 3. A model answer is shown on the left, but remember there are no hard and fast right answers. It is the discussion that is most important.

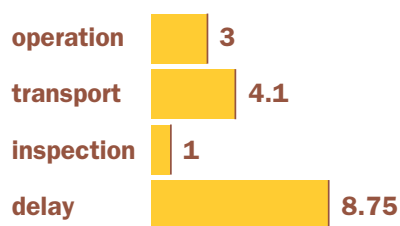
Step 3: Analyse

You will notice in this example that most of the activities involved transport, inspection or delay. This is normal, as surprisingly there is often not much going on that you would really want to pay for.

Number of activity types

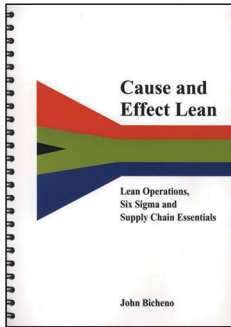


Total time for each activity (minutes)



Now use the data for analysis and action planning. You can do this by identifying the major problems or concerns, understanding the causes of these concerns and developing possible countermeasures.

Concern	Cause	Countermeasure
Queue for pump position	Not enough pumps available	Provide more pumps or spread peak usage throughout day
Long time to dispense petrol	Small nozzle	Larger nozzle, but may be safety risk
Many small transport steps to fill car	Filling procedure not customer friendly	Make customer friendly by redesign to car and/or forecourt
Many small transport steps and delay steps to pay	Paying procedure not customer friendly as garage wants to get you into the shop to buy other goods	Credit card payment system at pump



Clearly there are a large number of other things that you could do. However, if you could address just the few vital areas suggested in the table above then you could probably cut the distance moved, time and number of people and steps by about 80%.

Why not see how the countermeasures work? Redraw the process activity map with these changes.

Mapping your order fulfilment process

In your own order fulfilment process you will have a number of different steps or stages. These may be natural breaks by department or they may be due to different physical locations. Split your process into these natural stages and map the process step by step. Only by seeing the whole can you prioritise which part of the process to attack first. Below is a process activity map covering the whole order fulfilment activity for servicing a car at Main Motors. Note that each row in the figure refers to a major set of activities as shown in the big picture map on page 31.

Process activity mapping of complete car servicing order fulfilment process at Main Motors

	Time use (in min.)				
	O	T	I	D	Total
Understanding requirements & booking	5.60	0.25	0.50	3431.40	3437.75
Prepare service job cards	9	0.70	0.50	330	340.20
Check parts & pre-picking	1.50	2.10	0	210	213.60
Car collection & work division	0.65	2.25	4	122.50	129.40
Mechanical work	10.35	21.10	10.60	73.80	115.85
Valeting service	15.40	7.75	0.25	0	23.40
Customer collection & payment	8.10	4.10	9.75	114.90	136.85
Total time (minutes)	50.60	38.25	25.60	4282.60	4397.05
Percentage of time (by flow)	1.15%	0.87%	0.58%	97.4%	100.00%

Bearing in mind that value adding operations are the only part your customer might want to pay for, there is certainly a lot of waste to tackle! We will look at the costs of this later in this section.

Tips:

- 1 Always record *where* the activity is occurring, *when* it is occurring and *who* is involved.
- 2 When mapping *information* flows: attach yourself to an order or forecast at the point it enters the company and follow it through all stages of order processing and production scheduling
- 3 When mapping *material* flows: attach yourself to a product at the start of your process and follow it through to the point of despatch to the customer
- 4 The level of detail required will depend on what you need the data for. If it is time compression and you want to reduce a lead time from 4 weeks to 1 week, recording to the nearest second is not very useful. However, if you want to reduce time in a particular production cell then minutes will probably be appropriate. Record very small time periods as 0.1 minutes.
- 5 Don't get your units mixed up: never mix metres and kilometres or minutes with hours or days.
- 6 Check that nothing unusual is happening; find out what usually happens, but don't be fooled if you are continually being told 'it's usually much better than this'.
- 7 When analysing the data always start with the steps with the longest distances, longest times and most people involved. These are likely to yield the greatest gain.

Production variety funnel and sales funnel

The production variety funnel is a visual mapping technique that plots the number of product variants at each stage of the manufacturing process. This technique is used to identify the point at which a generic product becomes either increasingly or totally customer specific. The risk of holding 'specific' stock is that it will not sell and the company will be left holding inventory costs. The map also provides some insights into possible factory inventory policies, in terms of combining the flexibility of the plant with short lead time.

This technique also generates a series of questions relating to the logical reasons for product diversity and the need to maintain such complexity for the supply chain. The map also suggests the logical point at which buffer stocks may be held prior to customisation. The technique is useful when analysing the ability to postpone the manufacturing process rather than maintaining stocks of production output at each stage of the production process. The point at which the product variety rises (expands) rapidly is of key concern and it is the buffer (prior to this point) that creates flexibility in the production system. In short, with favourable manufacturing and demand characteristics, this buffer point can be used to create high levels of customer service without incurring the penalty costs of stock holding further downstream. The map also provides useful data for potential product and inventory rationalisation.

Method

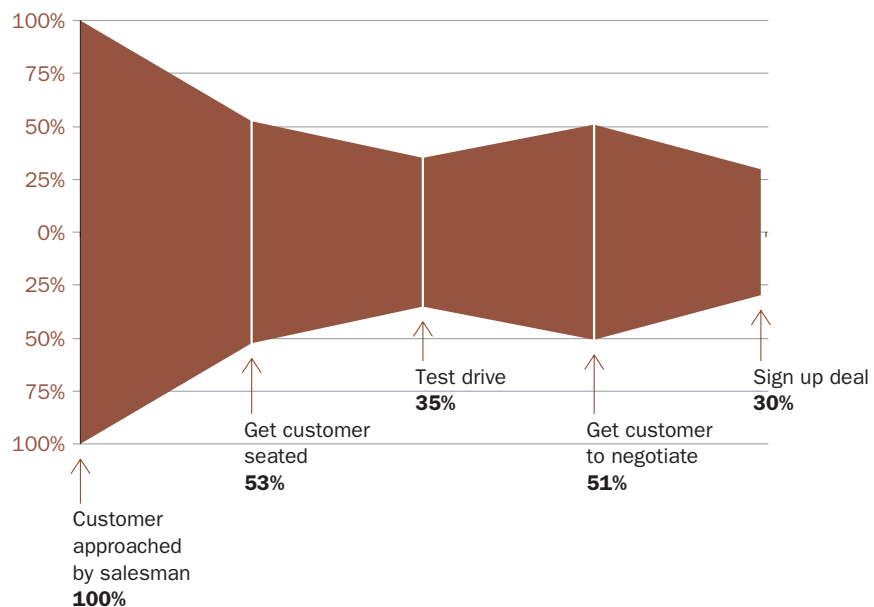
- 1 Take a piece of graph paper and create the horizontal (process path) axis and vertical (number of products) axis.
- 2 Select each product, or generic family group of products, and identify the process path through the manufacturing facility. The key item of the bill of materials is likely to be one which follows the entire length of the production sequence. Examples of these products would include water (the primary element of soft drink manufacturing), yarn or fibre for textiles, or the 'body in white' element of vehicle assembly.
- 3 At each stage of the conversion process, identify the number of products that are created. As each process is analysed, plot the final number of 'outputs' produced from each stage on the chart.

Tips:

- 1 Select the component to be mapped carefully. It must be an element that is integral and significant to the finished product, not a screw or piece of packaging.
- 2 Look for subtle changes in the product at each stage of the process, for example the colour matching, piercing holes in the product, and any other activity which changes the component into a new product.
- 3 Accuracy is always important and therefore it does pay to cross-reference the numbers of outputs, at each stage of the conversion process, with the bill of materials code for that product. The collection of these stock codes is important when secondary analyses are undertaken to find out the actual stock levels of each identified output.

When used in an information environment, the production variety funnel can be used to record the complexity of each step. In the case of Main Motors we have used it as a sales funnel for the new car order fulfilment process and mapped out the percentages of customers that reach a particular stage of the process. This can be very useful for identifying the vital point where sales are lost. In this case, unusually, you will notice that the funnel widens out again as more customers negotiate than take a test drive. This is because some customers may have taken a test drive on an earlier visit or do not feel they need to test the car.

Sales Funnel at Main Motors



Quality filter mapping

This approach is a new tool designed to identify quality problems in the order fulfilment process or the wider supply chain. The map shows where three different types of quality defects occur in the value stream:

- 1 **Product defects:** defects in physical goods that are not caught by in-line or end-of-line inspection and are therefore passed on to customers. In a few cases we have found faulty product that was detected but still passed to customers; this would also fall into this category.
- 2 **Scrap defects:** defects that have been caught by in-line or end-of-line inspection. The in-line inspection methods will vary and can consist of traditional product inspection, statistical process control or poke yoke devices.
- 3 **Service defects:** problems given to a customer that are not directly related to the goods themselves, but due to the accompanying level of service. The most important of these service defects is inappropriate delivery (late or early). Others include incorrect paperwork or documentation, incorrect packaging or labelling, incorrect quantity and incorrect invoicing.

The approach integrates quality and logistics performance measures. It is designed to establish both internal and external quality levels as well as levels of customer service.

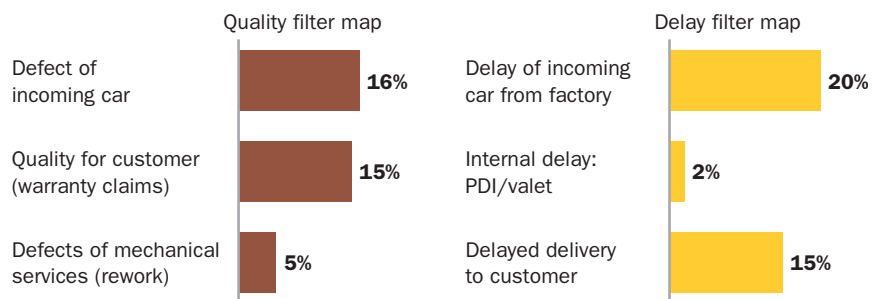
Method

- 1** Map the three types of defect along the various stages of the value stream, using a parts per million (PPM) or percentage scale. If appropriate, plot with a logarithmic scale. Usually the data used to collate the graph is already being collected by the company or companies involved.
- 2** If the tool is being used inside a company, use individual departments or work areas instead of different companies. In that case, record product defects where they are passed on to an internal customer or the next department. Service defects would similarly refer to non-product defects passed on to internal customers. Scrap defects would simply refer to any scrap within each particular work area or department.

At Main Motors we simplified the tool slightly. In this form we recorded quality problems in one chart and delays in the second. Each chart recorded the three key stages of:

- Cars delivered to Main Motors from their supplier
- Internal quality/delay
- Quality or delay of final vehicle delivered to the customer

Quality and delay filter mapping at Main Motors



Tips

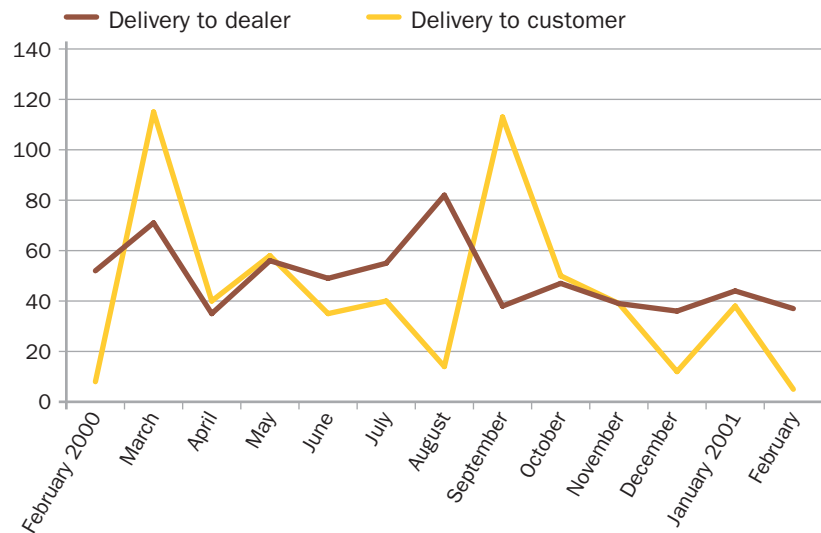
You may find that data you need is not presently being collected by the firm or firms involved. If you have time, start recording the data yourself or set up a scheme to do this. If this is not possible, the resulting graph may have some gaps. However, this result is illuminating in itself. It shows that little or no attention is being placed on the quality and service area, and that improvements in these areas are very likely to be needed. Without the data though, improvement is almost impossible.

Demand amplification mapping

This is a graph of quantity against time, showing the batch sizes of a product at various stages of the production or distribution process. This may be plotted both within a company and along a supply chain. It can also be used to show inventory holdings at various stages along a supply chain through time. A 'snapshot' of one month's data is often adequate, although a four to six month period gives a clearer picture. An important result of the demand amplification map is to show the 'bull-whip' or 'Forrester effect', where demand changes amplify the further one gets away from the original demand source. The map is also useful for examining scheduling, batch sizing policies and inventory decisions.

The chart shows a simple two-point demand effect induced by the UK car registration system and the effect that this has on Main Motors. The major peaks induce consumers to move away from a true demand picture that may be quite flat. Unfortunately these induced peaks carry a heavy cost for the UK car industry and, in this case, Main Motors. You will notice how they attempt to smooth the sales effect by bringing cars in early before the main peak.

Demand amplification mapping at Main Motors



Use this map to:

- 1** See the extent of amplification as orders are passed upstream. The greater the amplification, the more difficult it is to encourage flow. The ideal, of course, is that all stages of production work at the customer's rate of real demand, bringing uninterrupted flow.
- 2** Gain an insight into detailed batch sizing and scheduling policies, looking at both quantity and timing. The reasons for excessive batches or lack of synchronisation may then be explored.
- 3** Check inventory decisions. Inventory is the buffer between demand and supply; inventories should be low if there is synchronisation between demand and supply.

Method

- 1** Identify the stages at which data will be collected. The first stage will usually be actual demands made by the customer. Subsequent stages are at major production or distribution stages. Look out for inventory storage and record data at and after each inventory location.
- 2** Identify the products or parts to be studied. If you have already collected data for other maps, use the same part. Otherwise select a representative part.
- 3** Decide on the time horizon for data collection. The period should include a minimum of three batches in a manufacturing setting, or a complete year in other environments, to capture any seasonal effects. However, it may also be useful to map days over a month, or hours over a day, to capture more micro amplification effects.
- 4** Decide on the period for analysis. This should be a 'typical' period. Avoid 'rush' and 'quiet' periods, if possible. You may be constrained by the company's record keeping system.
- 5** Collect data on batch sizes and inventories. Take care on this: in a manufacturing environment, be aware that a batch may take more than one day to produce. Inventory data may or may not be available, but it can be derived from batch sizes as long as just one accurate snapshot of inventory can be made.
- 6** Plot the data on a graph.

Analysis

The demand amplification map is a very powerful tool for looking at scheduling and inventory policies and decisions. Rather than asking schedulers how they make up schedules (and getting a theoretical answer!), the map allows discussion around what actually happens, and how it can be improved.

Distinguish between amplification due to changeovers and amplification due to inventory or safety stock policies. Changeovers lead to batching, but are the batch sizes appropriate? Look at this in relation to available capacity. Examine amplification due to inventory policies by asking what the policies are, if any.

Look for variation in batch sizes. What is the consistency of the ratio of batch size to customer demand? Then ask about batch sizing policies. Look out for the temptation to overproduce whilst the set-up is in place.

Look out for regularity of batches. A lean operation should be attempting not only to run, buy or ship products as frequently as possible, but as regularly as possible – say the same day each week.

Tips

- 1** Make sure you use appropriate units of measurement. For instance, if you are producing plastic moulding with a shot (raw material) weight of 50g then measure raw material purchases so that 50g is equal to 1 unit.
- 2** In some firms it is possible to collect data from more than a dozen points, but be selective, three or four well chosen points will give you 99% of the information with far less work and analysis time.
- 3** Use this tool to help fine tune your runner, repeater, stranger analysis to help you decide on the type of operations system you might like to adopt. However, first look at the demand profile to see if you are artificially amplifying it; if so, you might find a way to turn what appear to be strangers into repeaters and what appear to be repeaters into runners. Although not a hard and fast rule, kanban pull systems may be suitable for runners, make-to-order system for repeaters and strangers should be avoided if possible. If this is not possible they should either be made to order or even stocked.

Process costing

An effective lean profit potential programme requires proper cost information, such as the critical process costs and the amount of the current value adding, future value adding, support activity and waste costs inside each key process.

Cost data are necessary to:

- identify priorities (which key process should I focus on first?)
- estimate potential benefits of lean initiatives (what is the lean profit potential?)
- set management control systems (what are the links with the budgeting, reporting and incentive systems?)

A step-by-step lean costing approach consists of:

- 1** describing the key processes in terms of main activities undertaken
- 2** relating the activities to the “owner” departments
- 3** costing the activities (inside each department)
- 4** costing the whole of each process
- 5** linking value to the cost.

1. Describing the key processes in terms of main activities carried out

The big picture map provides the description of the main activities inside the key processes. The following chart details the main process activities inside Main Motors.

New car sales process	Used car sales process	Service process
Dealer visit and test drive	Dealer visit and test drive	Understanding requirements and booking
Finalise deal and take order	Continue visit and test drive	Prepare service job cards
Source new car	Take order and arrange collection	Check parts and pre-picking
Car arrival and delivery check	Invoice preparation	Car collection
Delivery arrangement	Mechanical and service works	Work division
Invoice preparation and AFRL	Valeting service	Mechanical works
Pre-delivery inspection	Customer collection	Final road test
Valeting service	Part exchange	Valeting service
Customer collection		Customer collection and payment

2. Relating the activities to the 'owner' departments

This step is necessary because most companies still have a department-based cost accounting system. As a consequence, process cost information is usually unavailable. Therefore, in order to measure the process cost, we need to relate each main activity to the department which performs it. Then we can split the department cost among all the activities undertaken, following a typical activity-based costing approach.

In Main Motors, for instance, the new car sale process involves at least three departments, as shown in the following chart.

New car sales process	Department
Dealer visit and test drive	Sales department
Finalise deal and take order	Sales department
Source new car	Sales department
Car arrival and delivery check	Sales department
Delivery arrangement	Sales department
Invoice preparation and AFRL	Administration department
Pre-delivery inspection	Mechanical service department
Valeting service	Mechanical service department
Customer collection	Sales department

3. Costing the activities (inside each department)

Once we have identified all the activities inside each department, we can link them to the resource consumption, applying an activity-based costing approach. It is useful to produce different cost configurations, starting with just personnel cost and then including technology costs, occupancy costs and so on, up to a full cost position. The following chart shows an example based on Main Motors' Sales Department.

Main Motors sales department activity costs

Activity	Cost	Process
Dealer visit and test drive	£9,866.21	New car sales Used car sales
Finalise deal and take order	£7,125.60	New car sales Used car sales
Source new car	£10,081.24	New car sales
Customer collection	£12,606.83	New car sales Used car sales
Car arrival and delivery check	£7,125.60	New car sales
Delivery arrangement/ Arrange collection	£4,110.92	New car sales Used car sales
Part Exchange	£4,110.92	Used car sales
Total	£55,027.32	

4. Costing the whole processes

We can determine the process cost by sorting the cost of each activity involved. This process cost can be applied to both a single car sold (or service provided) and the annual volume. The following chart reports the annual car sales process cost in Main Motors.

The annual new car sales process at Main Motors

Activity	Cost	Percentage	Department
Dealer visit and test drive	£6,577.48	12.8%	Sales department
Finalise deal and take order	£4,750.40	9.3%	Sales department
Source new car	£10,081.24	19.7%	Sales department
Car arrival and delivery check	£7,125.60	13.9%	Sales department
Delivery arrangement	£2,740.61	5.3%	Sales department
Invoice preparation and AFRL	£2,840.40	5.5%	Administration department
Pre-delivery inspection	£5,899.91	11.5%	Mechanical service department
Valeting service	£2,859.94	5.6%	Mechanical service department
Customer collection	£8,404.55	16.4%	Sales department
Total	£51,280.13	100%	

5. Linking value to the cost

The detailed mapping offers a precise picture of all the operations inside the main activities (reported by the big picture map). Moreover, detailed mapping allows us to collect other operational data (like production and set up times, stock accumulation, people involvement, information flows, etc). These outcomes represent fundamental detail needed to define the value provided by each activity. We now have a sufficient level of detail to classify the activities:

- By their nature: operation (O), inspection (I), delay (D), transport (T),
- In terms of value adding (VA), future value adding (FVA), support activity (SA), and waste (W).

The profile provided through the detailed process mapping can be used afterwards to link the value to the cost. A further deliverable is the amount of value adding, future value adding, support activity and waste in each department.

For example, when we look at the labour cost of the servicing process at Main Motors, we can see that only 29.7% of the labour cost is related to value adding activities, while more than half of the cost is due to support activities; another 16% is waste.

The labour cost value of a regular service

Activity	Labour cost	Percentage	VA	FVA	SA	W
Understanding requirements and booking	1.06	6.2%	0.59	0.02	0.21	0.25
Prepare service job cards	1.71	10%			1.29	0.42
Check parts and pre-picking	0.42	2.5%			0.30	0.12
Car collection and work division	1.24	7.3%			0.72	0.52
Mechanical works	5.10	29.9%	1.85		2.06	1.20
Final road test	1.25	7.3%	1.03		0.23	
Valeting service	2.43	14.2%	1.60		0.83	
Customer collection and payment	3.85	22.5%			3.51	0.34
Total labour cost	17.07	100%	5.06 29.7%	0.02 0.1%	9.15 53.6%	2.84 16.6%

The results of the detailed mapping also highlight the need for a deeper investigation within the operations (or micro-activities), in order to find out what the main causes of waste at Main Motors are. In particular, we identified three sub-processes which appeared to be poor and which would, therefore, be targets for improvement programmes:

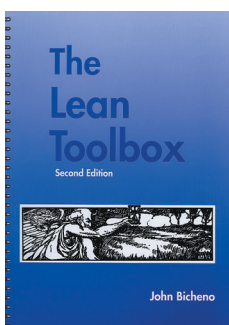
- The car movements sub-process,
- The T-cards and job-cards management sub-process,
- The checks and inspections sub-process.

Importantly, due to the identification of all the activities related to checks and inspections, we were able to estimate the 'cost of quality' at Main Motors. We found that the firm spends more time in checks and non-conformity corrections than in prevention activities.

The lean profit potential

Analysing the nature of, and the value related to, each main and micro-activity enables us to estimate the profit potential generated through improvement activities. At Main Motors we found four categories of profit potential, each of which would have a contribution to improve the business value to cost ratio. A detailed profit potential evaluation is shown in next section.

For more details on the application of each of the mapping tools described in this section and other mapping tools, see *The Lean Tool Box* by John Bicheno.



Lean thinking

1 →

Understanding value & waste



What is value?



What is waste?



Getting the balance right



Four types of activity

2 →

Setting the direction



Developing critical success factors



Reviewing & modifying key performance indicators



Targeting improvement for each KPI

Defining key value streams

Deciding where to focus

3 →

Understanding customer value



What does the customer really want?



How satisfied are they at present?

4 →

Understanding the big picture



Spaghetti map



Big picture map

5 →

Detailed mapping



The detailed value stream mapping toolkit



Process activity mapping



Product variety funnel & sales funnel

Quality filter map

Demand amplification mapping

Process costing

6

Checking the plan & its profit potential



Developing a set of appropriate projects



Catch-balling the change programme



Developing the profit potential

Developing a set of appropriate projects

At this point the team will have gathered a great deal of information. They will then need to turn this into a workable plan over a sensible time frame. We suggest that this is done at the lowest possible level guided by the firm's critical success factors. As a framework to brainstorm this we suggest you think in terms of projects that will:

- 1 add value to customers
- 2 reduce waste
- 3 create the necessary support structure
- 4 be external to your business (although this again could be sub-divided into value adding and waste reducing)

It will also be useful to categorise your projects into time horizons. This will help avoid initiative overload. We suggest a simple use of projects assignments as:

- **Just do it: within 1 month**
- **Short term: within 3 months**
- **Medium term: within 12 months**
- **Long term: 1 year plus**

In Main Motors' case this brainstorming exercise resulted in the following projects:

Value adding	Waste reduction	Support structure	External
Used car loyalty scheme (incentive scheme to retain used car buyers for car servicing)	Scheduling of service bay (application of lean scheduling)	Annualised hours (flexible hours during the year to cope with demand peaks)	Improved new car ordering (reduce reliable order to delivery time)
Service customer care (improved customer service)	Scheduling of valeting (application of lean scheduling)	Measurement scheme (introduce new scheme)	
Service pricing (differential pricing for customers requiring courtesy car)	Right first time lean servicing (application of 6 sigma quality system)	Skills/competency scheme (introduce ILU charting)	
Used car replacement cycle (after-sales care for used car buyers)			

At this point we also need to ask a few questions:

- Are all the projects likely to deliver?
- Are the projects correctly sequenced?
- Are the project hand-overs sensible?
- Do we think it is going to work?
- Can we afford the time and cost?
- Are there too many projects at any one time wanting the same people?
- Are there enough project team leaders?
- Are there enough project team members?
- Are there bottleneck people and/or skills areas?
- Is the plan so far off that it needs reworking?

If we are happy we can move on.

Catch-balling the change programme

Once the projects have been developed in outline they need to be checked. Will they deliver against the key performance indicators that the organisation has defined and successfully address the critical success factors? There are many ways to catch-ball the projects. We will illustrate one of the simpler methods with the projects from Main Motors:

KPIs	Now	3 year target	Used car loyalty scheme	Service customer care	Service pricing incl. courtesy car	Used car replacement cycle	Scheduling of service bay incl. PDI	Scheduling of valeting	Right first time lean servicing	Annualised hours/shifts	Introduction of measurement scheme	Introduction of ILU	Improve new car ordering
Ease (1-5 5 as hard)			1	3	1	2	4	4	5	4	3	2	5
Gross Profit/New Car	2.0%	2.9%		*	*		**	**	**	**	*	*	**
Gross Profit/Used Car	7.0%	8.8%	**	*	*	***	**	**	**	**	*	*	
Finance Penetration New Cars	23.0%	23.0%								*	*	*	
Finance Penetration Used Cars	16.0%	21.4%								*	*	*	
Admin Expenses	0.9%	1.0%	†	†	†	†					†	†	
Market Share: Region vs National	6.8/6.8	7.5/7.5		*	*		**	**	**	**	*	*	**
Retention New: First Service	80%	80%		*	**		*		**	*	*	*	
Retention New: 3 years	30%	48%	*	***	***		**	*	**	*	*	*	
Retention Used: First Service	25%	28%	***	**	**		*		**	*	*	*	
Return on Total Turnover	1.4%	3.0%	**	**	**	*	**	*	***	**	*	*	*
Volumes: New Cars	550	640		*	*		***	**	**	**	*	*	**
Volumes: Used Cars	270	348	**	**	**	***	***	**	**	**	*	*	
Service Parts Absorption	60%	84%	**	**	**	*	***	**	***	***	*	*	
Stock Turn: Used Cars	8	8	**	*	**	***	*	**	*	**	*	*	
Stock Turn: Parts	7.9	8					*		**	**	*	*	
OCE: New Cars	39.5%	44.0%		*			***	***	***	**	*	*	**
OCE: Used Cars	38.4%	60.0%	*	*	*	**	***	***	***	**	*	*	
OCE: Service	51.1%	63.4%	**	**	**	*	***	***	***	**	*	*	
ILU skills/competency	45.2%	85.0%					**	**	**		*	***	
When (JDI, ST, MT, LT)			JDI	ST	JDI	ST	MT	MT	MT	MT	ST	ST	LT

As you can see we have recorded the actual position against each KPI and the three year target. We have also assessed each project on a * to *** scale of how likely they are to deliver benefits against a particular KPI. Where there are no benefits, the cell is left blank and in one KPI where a negative position is foreseen, a † is recorded. In general, where large improvements are required, most projects are likely to lead to benefits.

As a second check, each project is assessed for its ease and timing. In this case, ease is a combination of technical difficulty and resource requirements with projects scored as 1 – ease/low resource up to 5 – hard/high resource. The timing is assessed as Just do it (JDI – this month), Short term (ST – within three months),

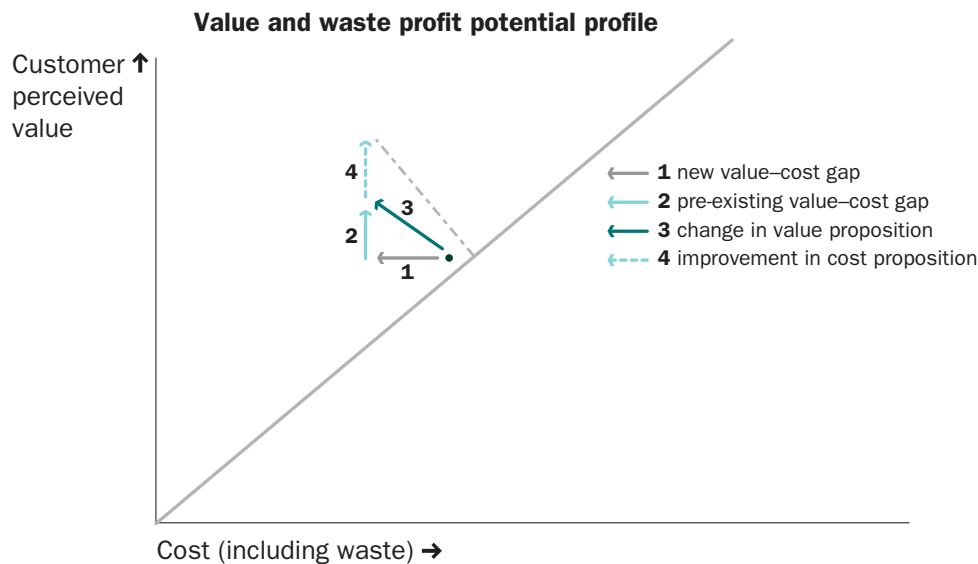
Medium term (MT – within eighteen months), or Long term (LT – within three years). This check can ensure, at the simplest level, that only a few vital projects are attempted at any one time.

Developing project potential

Behind every successful organisation is a successful Finance Director who, quite rightly, questions any human or financial investment. The key question here is ‘Do the figures add up?’

In the last section we explored a process costing approach, which gave us the basis of a realistic costing within the three core order fulfilment channels at Main Motors. By going back to this financial model it is possible for the operating level team to develop a ‘what-if’ scenario if the expected results that they predict are achieved. We prefer to call this the *profit potential* of the work rather than the cost savings, as lean implementation is as much about creating value as reducing cost.

To illustrate this let’s look at the profit potential at Main Motors. As we outlined above, the two major areas of benefit are reducing waste and improving perceived customer value. These are depicted here as a left arrow and an upward arrow respectively. Each of these two effects will help produce a lean result and add to the profit potential of the organisation.



Using the Main Motors data we have estimated these effects as:

- Reducing internal waste: £50,000
- Developing customer value £62,000

The combined effect of these annualized savings is £112,000 which is equivalent to a 73% increase in profitability to Main Motors, as well as a far higher level of service to their customers. We estimate this is achievable in 18 months from the end of the mapping work.

However, we have also estimated that there is likely to be a secondary volume multiplier effect as more cars sold leads to more servicing business. Likewise, better retention of after sales customers is likely to lead to more car sales. Another effect, outside the control of the programme, can also be estimated, namely extraneous events. In this case it is the strengthening of Main Motors vehicle brand in the marketplace, which again will lead to more sales and greater profitability. We feel it is important to gauge this extraneous profit potential before work starts to avoid the ‘We would have got these benefits anyway’ remarks after a successful lean programme has been completed.

At Main Motors we found the profit potential of these effects were, over a three-year period, likely to be:

- Multiplier effect £43,000
- Brand development £82,000

Thus in total we could estimate a £237,000 or 155% improvement in profitability, of which two thirds would be the result of the lean transformation. The result of this analysis was a Finance Director willing to give the lean transformation the green light!

A final word

A lean transformation will take time and commitment to achieve, but if properly designed and executed, it will be worth the effort. Adopting the planning process described here and implementing its results will give you and your organisation a great chance to go lean.

Good luck in your lean journey!

Further sources of help

Research assistance at LERC

At LERC we have a number of ongoing research programmes in both the manufacturing and the service environment, either on a group or individual basis. If you would like to discuss your specific requirement please contact:

Professor Peter Hines, Director
Lean Enterprise Research Centre
Aberconway Building
Colum Drive, Cardiff, CF10 3EU, UK

e-mail: hinespa@cardiff.ac.uk or visit: www.cf.ac.uk/carbs/lerc

Educational assistance at LERC

A range of educational courses are run at LERC including Masters level courses in Lean Operations and in Supply Chain Management; the Automotive Retail Management Programme; Lean Awareness courses and a number of tailored short and specialist courses. For further information please contact:

Claire Gardner, Education Manager
Lean Enterprise Research Centre
Aberconway Building
Colum Drive, Cardiff CF10 3EU, UK

e-mail: gardnerca@cardiff.ac.uk or visit: www.cf.ac.uk/carbs/lerc

Further assistance at University of Bologna

The Department of Management Studies at Bologna University, Forli Campus, is undertaking extensive work on Strategic Cost Management. This research programme spans the spectrum from Cost Structure Benchmarking to Profit Potential Analysis, from both a single and an inter-firm perspective. Cost Analysis research is also applied to customer-focused and knowledge-focused organisations. Studies have been carried out both in manufacturing and in service environments.

If you are interested in further discussions or information please contact:

Professor Riccardo Silvi or Dr Monica Bartolini
Faculty of Economics, University of Bologna, Forli Campus
P. le della Vittoria, 15
47100 Forli (FC) – Italy

e-mail: rsilvi@spfo.unibo.it, mbartolini@spfo.unibo.it

Publications

J. Bicheno, *Cause & Effect Lean*, (Buckingham, Picsie Books, 2000)

Available from Picsie Books: tel. +44 (0)1280 815023 or visit:

www.axiom.co.uk/picsie/

An excellent reference summary to cause and effect analysis.

J. Bicheno, *The Lean Toolbox*, 2nd edn (Buckingham, Picsie Books, 2000)

Available from Picsie Books: tel. +44 (0)1280 815023 or visit:

www.axiom.co.uk/picsie/

An excellent reference summary text of the most important lean tools.

J. Bicheno, *The Quality 75: Towards six sigma performance in service and manufacturing*, (Buckingham, Picsie Books, 2002)

Available from Picsie Books: tel. +44 (0)1280 815023 or visit:

www.axiom.co.uk/picsie/

An excellent reference summary text of the most important quality tools.

P. Hines, J. Bicheno & N. Rich, *End to End Lean*

(Portland, Oregon, Productivity Press, 2003)

A more in-depth text on how to apply lean thinking.

- P. Hines, R. Lamming, D. Jones, P. Cousins & N. Rich (eds), *Value Stream Management: strategy and excellence in the supply chain* (Harlow, Financial Times Prentice Hall, 2000)
The result of a five year research programme into implementing world class supply chains.
- R. Kaplan, and R. Cooper, *Cost & Effect. Using Integrated Cost Systems to Drive Profitability and Performance*, (Boston, Harvard Business School Press, 1998)
- C. J. McNair, *The Profit Potential. Taking High Performance to the Bottom Line*, (Essex Junction, VT, Oliver Wight Publications Inc., 1994)
- C. J. McNair, L. Polutnik and R. Silvi, Outside-In: Cost and the Creation of Customer Value, *Advances In Management Accounting*, Spring, vol. 9, pp. 1-41, 2000
- C. J. McNair, L. Polutnik and R. Silvi, R., Cost Management and Value Creation: The Missing Link, *The European Accounting Review*, vol. 10, no. 1, pp. 33-50, 2001
- M. Rother & J. Shook, *Learning to See* (Brookline, Mass, The Lean Enterprise Institute, 1998)
Direct e-mail to: info@lean.org or visit: www.lean.org
Textbook summarising how to use the big picture mapping tool.
- J. Shank and V. Govindarajan, *Strategic Cost Management*, (New York, The Free Press, 1993)
- D. Taylor and D. Brunt (eds), *Manufacturing operations and supply chain management – the lean approach* (London, International Thompson Business Press, 2000)
A case book detailing the application of lean thinking within an automotive supply chain context.
- J. Womack & D. Jones, *Lean Thinking: Banish Waste and Create Wealth in your Corporation* (New York, Simon & Schuster, 1996)
The definitive text on the five lean principles and their application.
- J. Womack, D. Jones and D. Roos, *The Machine that Changed the World* (New York, Rawson Associates, 1996)
The classic lean text that describes the results of benchmarking the world's major auto makers.

Jargonbuster

Big picture mapping A specific visual approach designed to display, at a high level, a major part of or whole *Lean enterprise*.

BPR Business process re-engineering, where minute activity sets are defined as processes and improvement generally takes the form of a complete redesign.

Catch-balling The feedback and agreement process for plans with *Policy deployment*.

Core processes Those central processes that directly deliver results against targets. See also *Key business processes*, *Strategic processes* and *Support processes*.

Critical success factors (CSFs) Those key external or internal elements that a business needs to focus on for success, such as market growth or employee involvement.

Current state map A visual method of succinctly recording the key aspects of the current structure and processes in the whole or any part of a supply chain. See *Big picture mapping*.

Flow All activities being undertaken within the *Lean enterprise* at an even rate without delays, interruptions or other batching.

Future state map A vision of a lean system which is used as the guide for the change process.

Future value adding (FVA) activity Those activities within a company or supply chain that directly contribute to satisfying end consumers in some future time period; activities consumers will therefore be happy to pay for.

Hoshin Kanri See *Policy deployment*.

ILU charting A skills and competency charting method that visually displays the existing position for each employee against a given set of targets to identify necessary training and development needs

Key business processes Patterns of interconnected value-adding relationships designed to meet business goals and objectives, or the main cross-functional activities required in a business for success. See also *Strategic processes*, *Core processes* and *Support processes*.

Key performance indicators (KPIs) A set of measures designed to benchmark a business's most important characteristics against a set of strategic targets.

Lean A consumer-focused approach to the provision of effective solutions involving the consumption of a minimum of resources.

Lean enterprise The extended supply chain responsible for effectively satisfying consumer requirements using a minimum of resources.

Lean thinking The process by which individuals can understand the need for, create and implement a *Lean enterprise*.

Mapping The use of appropriate tools and technique to analyse the current situation in any process.

Muda The Japanese term for *Waste*. Any activity which consumes resources but adds no value.

Overall channel effectiveness A modification of the Overall equipment effectiveness measure when applied to a total *Value Stream* or *channel*.

Overall equipment effectiveness A composite measure of the ability of a machine or process to carry out value adding activity.
 $OEE = \% \text{ time machine available} \times \% \text{ of maximum output achieved} \times \% \text{ perfect output}$.

It measures the degree to which machines are adding value by not being waste-fully employed due to planned or unplanned downtime or in producing defects.

Overall supply chain effectiveness A composite measure of supply chain performance.

OSCE = % orders delivered on time x % order completeness x % on time delivery.

Pareto analysis Sometimes referred to as the '80:20 rule'. The tendency in many business situations for a small number of factors to account for a large proportion of events. For example 80% of total sales volume might be attributable to 20% of customers and to 20% of the product range. In terms of quality, 80% of defects might be attributable to 20% of causes. The 20% is sometimes referred to as 'the vital few.'

Perfection The complete elimination of *muda* so that all activities along a value stream create value.

Poke-yoke A mistake-proofing device or procedure to prevent a defect during order intake or manufacturing.

Policy deployment A strategic decision-making tool that focuses resources on the critical initiatives necessary to accomplish the *Critical success factors* of the firm. The term usually also encompasses the cascading of this by *Key business processes* together with the control, measurement and feedback of results. Also known as *Hoshin Kanri*.

Profit potential The profit potential is the effect on the 'bottom line' of any activity that occurs during a lean transformation programme.

Pull All activities being undertaken within the *Lean enterprise* according to and at the rate of the actual demand requirements of the end consumer.

Repeaters Products or services that have an ongoing demand but are difficult to predict. They exhibit a medium risk to the business and may have medium levels of inventory. They generally have intermediate volumes but not dedicated facilities.

Runners Products or services that have a regular ongoing, predictable demand which represent a low risk in the business and may have low inventories. Such products generally are high volume and have dedicated facilities.

Seven wastes A framework of seven types of activity that do not add value, originally defined by the Toyota company.

Strangers Products or services that are hard to predict and will exhibit highly irregular but generally low demand profiles.

Support activity (SA) or necessary non value adding activity Support activities which are necessary under the present operating system or equipment. They are likely to be difficult to remove in the short term but may be possible to eliminate in the medium term by changing equipment or processes.

Strategic processes Those processes that help focus overall direction but do not directly impact on targets. See also *Key business processes*, *Core processes* and *Support processes*.

Support processes Those processes only indirectly impacting on targets but providing support to the *Core processes* that do. See also *Key business processes*, *Strategic processes* and *Core processes*.

Uptime The % of time that a machine is available for productive work.

Value adding (VA) activity Those activities within a company or supply chain that directly contribute to satisfying end consumers, or those activities consumers would be happy to pay for.

Value attribute A value attribute is a feature directly desired by the customer and considered as a core criterion in making a purchasing decision.

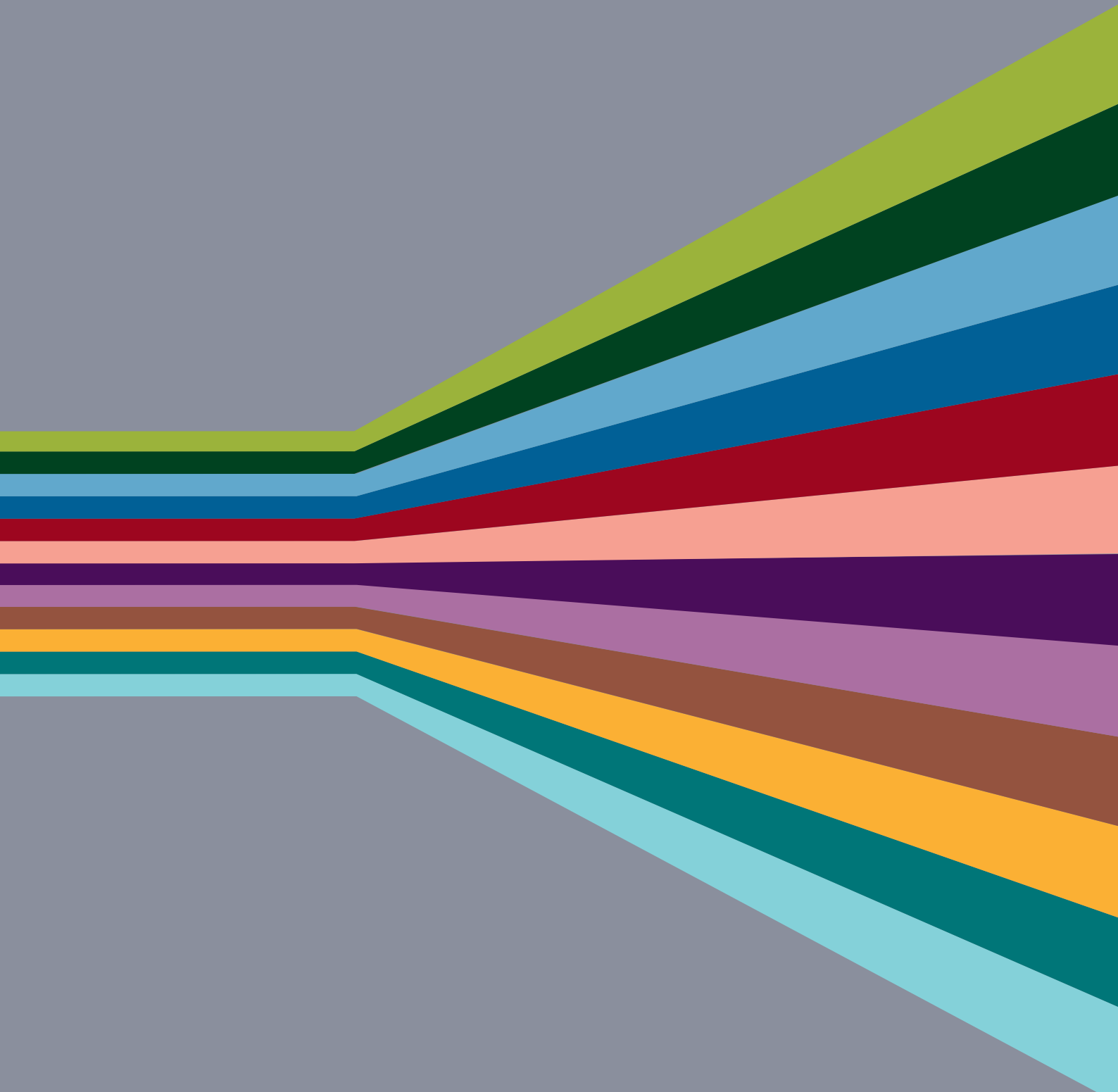
Value stream The specific activities within a supply chain required to design, order and provide a specific product or service.

Value stream mapping The process of charting out or visually displaying a *Value stream* so that improvement activity can be effectively planned. See *Mapping*.

Waste (W) or non value adding activities Those activities within a company or supply chain that do not directly contribute to satisfying end consumers' requirements. Useful to think of these as activities which consumers would not be happy to pay for. Sometimes called *Muda*. See also *Seven wastes*.

W' A symbol used in process activity mapping to designate those activities within a company or supply chain that do not directly contribute to satisfying end consumers' requirements, but do not actually cost anything.

Notes



Lean Enterprise Research Centre, Cardiff Business School
Aberconway Building, Colum Drive, Cardiff CF10 3EU, UK
tel: + 44 (0) 2920 876 005 / email: hinespa@cardiff.ac.uk

Department of Management Studies, Faculty of Economics
University of Bologna, Forli Campus, P. le della Vittoria, 15
47100 Forli (FC) – Italy / tel: +39 0543 374 629
email: rsilvi@spfo.unibo.it, mbartoli@spfo.unibo.it