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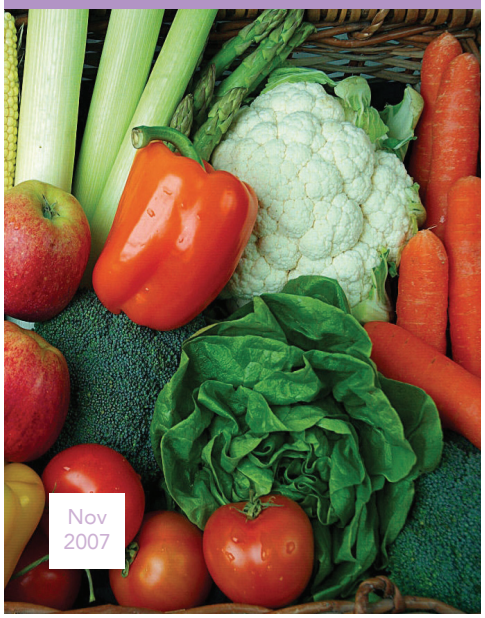
Applying Lean Thinking to the Fresh Produce Industry

Fresh Produce: Summary Report



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Purpose

The fresh produce industry collectively – growers, processors and their customers in retail and foodservice are wasting £400m. These savings could be realised if the industry applied some simple approaches to business improvement and developed better business relations along the supply chain.

This conclusion has been reached after the application of a pilot programme conducted over the last 2 years by the Food Chain Centre using a method known as 'lean thinking'. This was work done in partnership with Cardiff Business School and the Industry Forum and formed one part of the Food Chain Centre's programme to test business improvement methods and new ways of working across the agri-food industry.

In this report we:

- Demonstrate how wasteful activities that cost time and money can be identified in fresh produce supply chains;
- Identify generic issues faced by the fresh produce industry;
- Provide potential solutions that can be adopted to realise savings.

Background

A wide ranging report on the future of the fresh produce sector was published by the National Horticulture Forum in 2006. This showed amongst other things that there had been an increase in the overall level of professionalism among growers and suppliers in order to meet the technical and commercial demands of the multiple retailers who account for around 80% of the market.

As a result:

- fresh produce supply chains are often short and exhibit a high degree of customer awareness;

- there is considerable vertical integration and consolidation in the sector (by comparison with, for example meat or dairy production);
- collaborative relations are well developed to ensure for example all year round supply.

However, despite these strengths, the report indicated that the industry was vulnerable to a range of national and international forces. It showed that while the grower base has been consolidating over half of all holdings were less than one hectare in size and that both profitability and investment were low.

The report went on to conclude that:

- The prospects for small-scale players were precarious and that to survive they will need to adopt improvement strategies;
- Production and marketing efficiencies should be harnessed across the industry;
- Well-defined business strategies allied to the changing market had to emerge.

Against this background, between 2005 and 2007 the Food Chain Centre applied a method of business improvement known as lean thinking to 7 whole chain and 10 shop floor projects to test whether the method could deliver commercial benefits. These projects have covered a wide range of product sectors including potatoes, apples, leeks, herbs, peas and lettuce sold into multiple retailers and foodservice including schools. In two projects the produce was grown organically.

The whole chain projects were the first to apply genuinely cooperative efforts throughout the chain on an industry scale. The shop floor projects were the first to apply lean on a significant scale outside the ornamental sector.

Both approaches are complementary.

Our work was supported throughout by industry bodies including the NFU, HDC, BPC and FPC.

All the case studies derived from this work are available on: www.foodchaincentre.com

Identifying Waste

'Lean thinking' describes an approach to business that aims to deliver more and more with less and less – less human effort, less equipment, less time and less space – while coming closer and closer to providing consumers with exactly what they want. It involves identifying waste in supply chains and focusing on what delivers value.

Although 'lean' originated in car manufacturing, it has been applied extensively in the food industry, initially by Tesco in the late 1990's.

Lean has proven to be very adaptable because it is based around a sound set of principles that relate to the organisation of work. It can be applied to single businesses including SME's or across whole supply chains.

Briefly, these principles are:

- Specify value by product - not from the perspective of individual businesses but from that of consumers.
- Distinguish between the actions necessary to create that value and those that just add cost.
- Make product flow through the chain with minimum interruptions between the steps.
- As closely as possible produce at the rate at which consumers' take from the shelf (known as 'consumer pull').
- In pursuit of perfection - keep reconfiguring the chain to become ever more efficient and responsive.

To put these principles into practice for the 7 pilot projects, we developed a robust approach that could be replicated across the industry (as well as in other sectors). This involved a series of steps:

- Identify a particular consumer product to focus on (such as an apple or bag of carrots) – this helps to reduce complexity;

- Pull together a team drawn from each of the businesses in the supply chain, for instance a farmer, processor and retailer;
- Support the team with a facilitator (from Cardiff Business School).

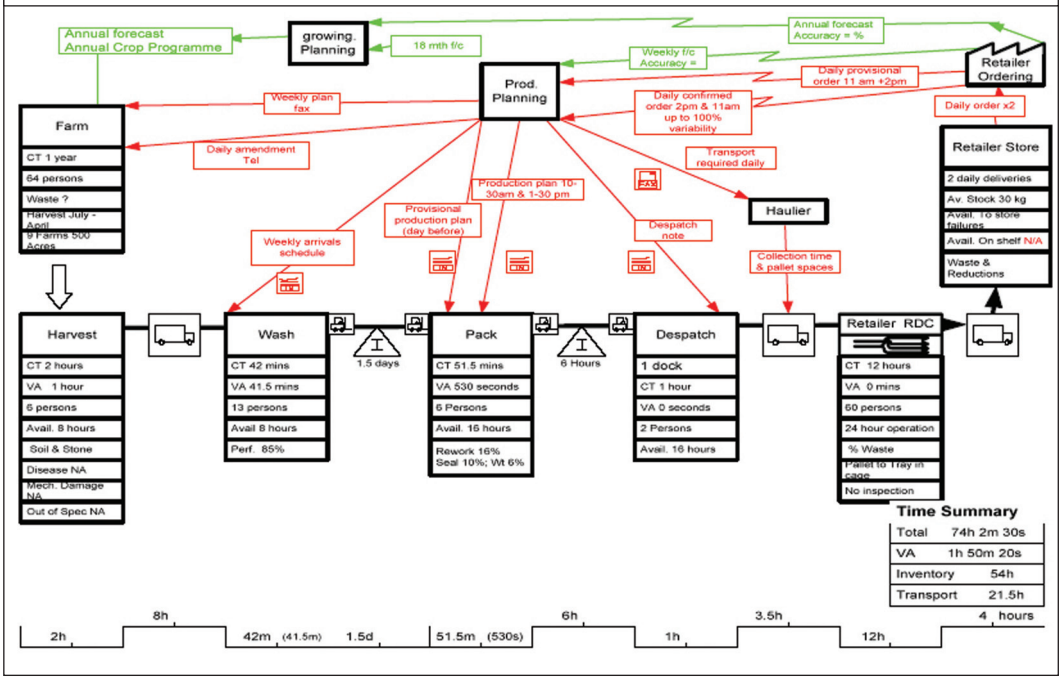
In the 10 shop floor projects we used the Industry Forum engineers as facilitators and they used a structured approach based on the lean principles known as a 'Masterclass'.

Both approaches involve 'learning by doing'. So we did not act as typical consultants but instead helped the businesses involved to find their own solutions. In this way we were able to encourage teamwork as well as train the individuals that took part.

The aim is to capture what is actually happening within a business or across the supply chain not what is supposed to happen. This involves the detailed assessment of all processes in the chain including the collection of data on performance. Our approach focuses on operations rather than financial information.

This information collected by the team was then summarised on a chart. A typical chart is shown below. This chart relates to an organic carrot chain.

1kg Organic Carrot Current State Map



These charts can be drawn for separate businesses or for the whole supply chain. They have three components.

(a) Product Flow

Along the bottom, each chart shows for the single product all the steps taken to transform it from a raw material state to a final product.

Deciding on what constitutes a value adding activity is critical. The test we adopted for this was to put yourself in the position of the consumer and ask if you would pay less for the product or be less satisfied with it if a given step and its necessary time were left out.

(b) Information Flow

The top of the chart shows the information flow. This starts where an order enters the system and flows mainly in the opposite direction to the product.

(c) Timeline

The charts also shows the time-line, that is how long the product takes in the value chain and the proportion of that time that is value adding.

The team also collect data on key performance measures for the supply chain such as the following:

- Not right first time
- Delivery schedule achievement
- People productivity
- Stock turns
- Overall equipment effectiveness
- Value added per person
- Floor space utilisation

After summarising the chain in this way, the team examines problems and opportunities for improvement. It then creates a vision of an ideal chain for the future. A medium term 'future map' is then created with a time horizon of 12-18 months. This sets out what the teams thought was practically achievable and leads to an action plan.

Opportunities for Improvement in the Fresh Produce Chain

For all the 7 whole chain products we examined, in excess of 95% of the time between harvesting to consumer purchase is inactive time that is the product is either waiting or involved in steps that add no value. If this time can be reduced or even eliminated then various costs can also be reduced.

The lean thinking approach puts the spotlight on recognising and sharing exactly what it is that consumers want from a product. In most of the examples we looked at, some people had a good appreciation of consumer needs but this was not shared throughout the chain. Improving this helps to encourage better service levels, more effective innovation and ultimately higher sales.

Across the 17 projects we have identified 6 ways that wasteful activities typically impact in the fresh produce industry.

1. Understanding customer value
2. Tracking and reducing product loss though the chain
3. Demand management
4. Operational effectiveness
5. Transport inefficiency
6. Supply chain key performance measures

1. Understanding customer value

In the whole chain projects there was a requirement and opportunity to gain a clearer and more consistent understanding of what is value from the point of view of the customer.

Understanding customer value needs to be approached at two levels.

First, each chain member needs to be aware of what represents value for their immediate customer: the grower for the pack house; the pack house for retailer. Value attributes between chain partners usually focus around quality, cost and delivery.

Typically each organisation in the chain develops its own view of customer value and these often do not align. Indeed even within a single company, individual managers often have different views of customer value.

Secondly, our work highlighted the opportunity for all partners along the supply chain including grower, processor/packer and retailer to develop a common and clear specification of end-consumer value. This needs to be identified in terms of product characteristics, packaging, pricing and service levels so that all parties in the chain are aiming at common 'goal posts'.

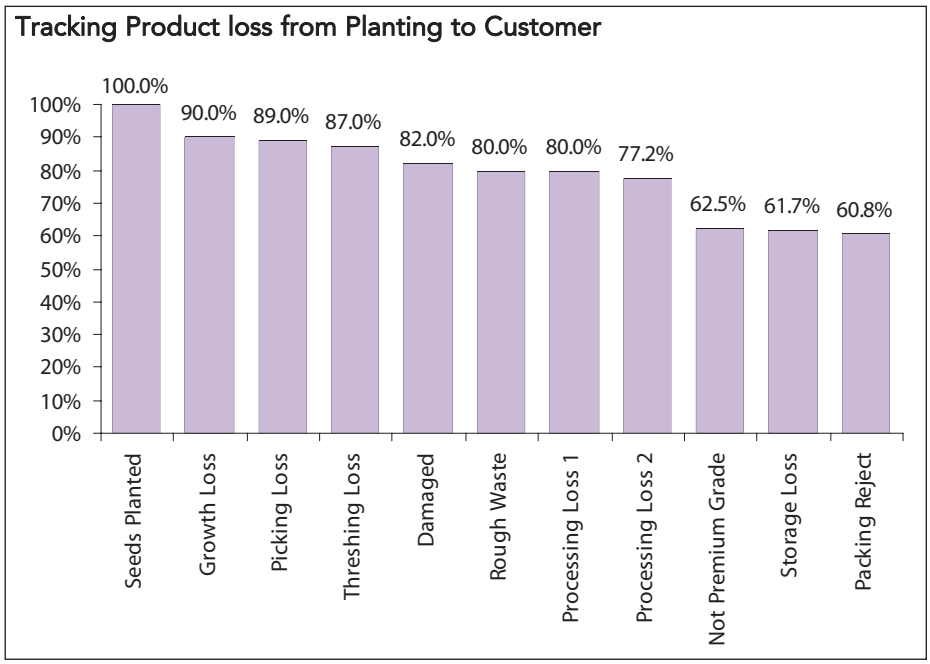
In order to achieve a deep understanding of consumer value, there needs to be a systematic approach to market research. Often upstream partners tend to leave the task of 'understanding the consumer' but because retailers handle such a wide range of products, there is often an absence of detailed consumer research for individual products. The packer and/or grower would benefit from more detailed consumer research on their particular products. If possible this should be done in conjunction with a retailer.

2. Tracking and reducing product loss though the chain

Product waste was defined as any item that was damaged, scrapped, lost or down-graded such that it could not be sold at its intended price.

Our projects introduced a systematic approach to tracking product waste at every stage of the chain from planting, growing, harvesting, processing, packing, transport, warehousing and retailing. Although the level of waste at any point in the chain was often relatively low, when aggregated, the level of waste was alarmingly high with anything between 30% and 50% of product being scrapped, down-graded or subject to rework.

The chart overleaf illustrates this using data for one product.



In this case there was almost a 40% loss from the seeds being planted to the product in pack for sale.

Our work not only quantified the level of waste but also included 'root cause analysis' with a view to waste reduction.

In many cases mangers tended to accept high levels of product waste as inevitable, on the basis that they were dealing with a live product subject to natural variability or the vagaries of the environment. Clearly there is some truth in this view, however the causes of waste can to be categorised as 'controllable or 'uncontrollable.'

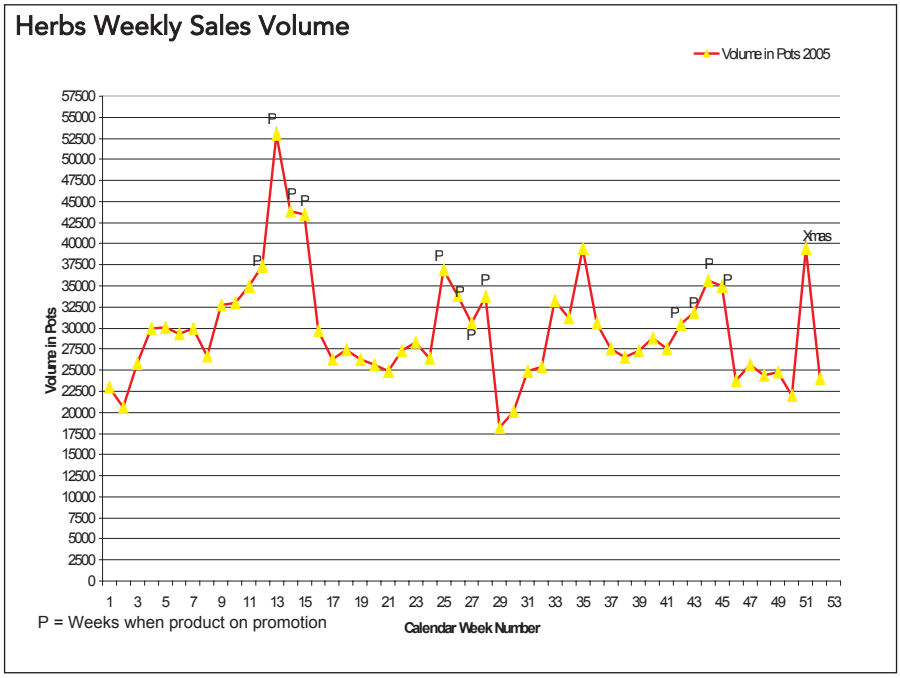
Remedial action can be focused on controllable issues such as damage during harvesting or losses during storage and processing. In one vegetable chain losses were reduced by slightly slowing the rate of picking in the field. Although less volume was picked, a higher volume of undamaged product was delivered to the pack-house

3. Demand management

Two key themes emerged from detailed analysis of demand and activity rates.

First, for many fresh products the consumer demand as captured by retail sales is quite variable on a week by week basis. However closer investigation showed that although there is some seasonal variation, typically underlying demand was actually quite stable and much of the variability is caused by promotional activity.

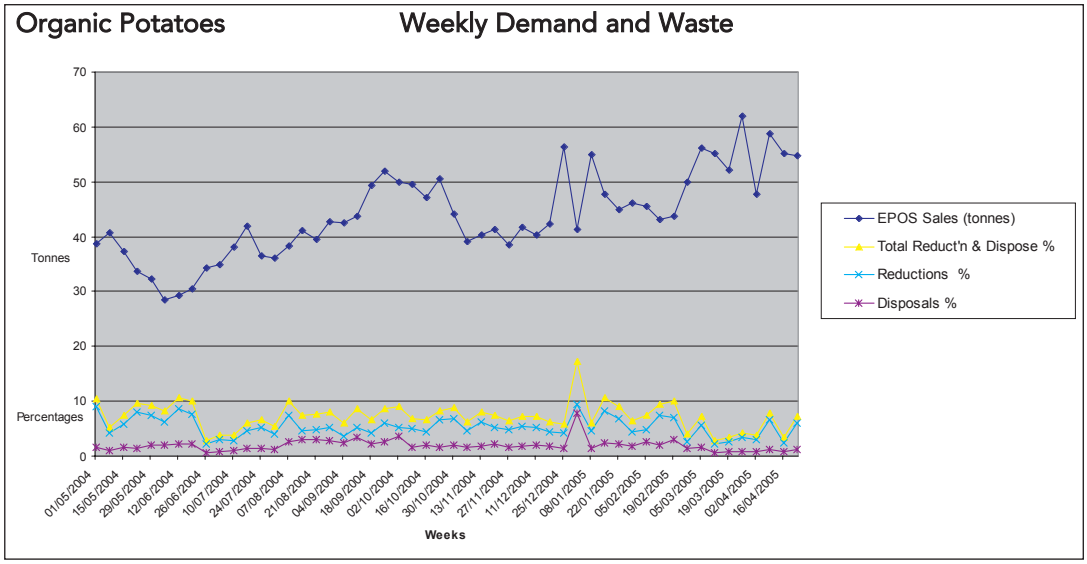
The figure below shows the demand pattern for a herb product. The accepted wisdom was that variability in the weekly volume of sales was due to uncontrollable factors in consumer usage perhaps related to weather or special events. However when the pattern of promotional activity was plotted on the same chart, it was clear that most of the demand spikes were related to promotions.



Secondly, variability in consumer demand quickly becomes exaggerated as demand signals are passed up the chain as a result of 'demand amplification' or the 'bull-whip' effect. Small changes in end-user demand become amplified due to ordering policies, inventory policies and the tendency of managers to over-order 'just to be on the safe side.'

Variability in demand has significant negative impacts on supply chain operations and cost in terms of production planning, inventory levels, resource requirements, and product wastage/mark-downs.

The figure below shows the sales of a particular pack of organic potatoes through a major supermarket. Demand is highly variable largely because of promotional activity at the retailer. The chart also shows the impact of this variability in terms of product waste. The lines at the base of the chart show the level of price mark-downs as product approached sell-by date and the level of disposals as product passed its sell-by date. Taken together these two figures averaged 7.5% of sales by value (12% of sales by volume) and in consequence wiped out the profitability of this product line for the retailer.



In most of the chains we studied, tracking the impact of demand variability effects was not conducted routinely. Consequently its negative impacts were generally not quantified or even recognised by the businesses and there was no attempt to manage demand pro-actively.

4. Operational management

We have divided this into 3 areas.

(a) Grower efficiency

Although we did not collect data on grower costs in any part of this work we were made aware that considerable variability exists between growers beyond that caused by geography or farming system. This issue has been addressed separately by the Food Chain Centre through its business club programme for growers known as Hortbench.

(b) Harvesting effectiveness

Many of the products we covered in this work are harvested by sophisticated machines. Typically these involve considerable capital expenditure and represent a major cost to the supply chain. The productivity of these machines can vary for many reasons but we found no systematic attempts to measure their performance.

Until data is collected on harvesting performance it is not possible to gauge whether or not efficiency is improving. One way to do this would be by using the concept of Overall Equipment Effectiveness (OEE) a commonly used metric in lean production operations. OEE gives a composite measure of a piece of equipment in terms of its availability, its performance and the quality of its output.

We applied OEE to harvesting as a first step to measure the efficiency of harvesting machinery. The chart below shows the actual figures for one harvesting operation which had seven harvesters. The OEE of 45% means that these harvesters were working at 55% below their maximum capacity. An OEE of 100% would never be achievable, but if the OEE could be improved by even 7%, one fewer machine would be needed. OEE is thus a good indicator of 'hidden spare capacity.'

Performance:

$$\frac{\text{Actual Tonnes Harvested}}{\text{Actual Hours Worked} \times 35 \text{ tn/hr}} = \frac{16919}{728 \times 35} = 66\%$$

(35 tn /hr is maximum capability of harvester)

Availability:

$$\frac{\text{Actual Hours Worked}}{\text{Total Available Hours /week}} = \frac{115}{7 \times 22} = 75\%$$

Quality:

Total product harvested minus

Picking loss	1.5%	}		
Threshing loss	2.0%	}	8.1%	= 92%
Damage	4.6	}		

Overall Equipment Effectiveness: = 66% x 75% x 92% = 45.5 %

A more sophisticated approach based on the same concept would be to examine the whole operation. Is there the right amount of equipment and people? Are these resources being used as efficiently as possible? Is there any hidden spare capacity? Such a measure could be called Overall Harvesting Effectiveness (OHE). Early applications of the measure indicated that in some harvesting operations, OHE might be as low as 30% to 40% of the maximum achievable.

(c) Processing operations

Capital equipment is also essential for processing operations like grading and packing. We looked for evidence to show that participating businesses were collecting data on machine performance and using it to improve operations.

Our work showed that the majority of businesses do not collect or analyse measures like OEE. Where we were able to measure performance the data showed that machines are operating at between 28% and 48% of the maximum, in others there was considerable scope for improvement (a world class operation achieves 80% efficiency).

Right across fresh produce processing - washing, grading and packing - we found a wide range of areas that are open to improvement. The most pervasive of these are as follows:

- *overproduction* occurs in small amounts on a daily basis due to the customer schedules being received during the afternoon whilst work on that order has started early in the morning .

- *double handling* is common with operators packing into trays or boxes between different operations. This is usually as a result of a poor factory layout and batch production methods.

- *unplanned downtime* is a persistent problem with many companies failing to analyse and therefore solve the root cause of downtime issues.

- *operator or machine inactivity* frequently occurs during every process cycle because many processes have operations that are out of balance and lead to both operator and machine idle time.

- *unnecessary motion for operators* arises such as excessive walking, bending, turning or reaching.

- *scrap or defective product* is common, with most companies having a high level of defective product waste. Packaging materials is also another area where scrap levels are high.

Significant benefits are available by addressing each of these issues and there are well proven techniques for doing so.

5. Transport inefficiency

Transport of produce from field to pack house was a common area for improvement.

Typically, the transport operation, although a necessity, was not seen as a core activity by either grower or packer and thereby has not had as much attention given as other parts of the operation. Transport operators were typically selected on the basis of price with cost per tonne as the sole efficiency measure.

Our work has shown that by adopting a more active approach to managing and monitoring the transport operation, costs can be reduced and service levels improved.

6. Supply chain key performance measures

If the companies that we worked with are typical, then the main performance measures used by the fresh produce industry are financial. Less attention is given to operational measures and this means that the data needed to drive improvement is often not available.

In each whole chain project a set of between six and ten 'Whole Chain Key Performance Indicators' was developed by the team members. These measures were specific to each chain but would typically include parameters such as pack-out rates, lead time from harvest to consumer, inventory levels, transport time, food miles and on-shelf availability at the store.

The KPI's were subsequently used to set 'Future State' improvement targets and periodically monitor the effects of supply chain improvement initiatives.

The chart below gives an example of a set of KPI's from a produce chain.

Whole Chain KPI's - A Fresh Produce Chain		
	Current State	Future State Targets
Pack-out Rate	52%	75%
Lead Time (Harvest to Consumer)	74 hrs	48 hrs
Value Adding Time	2 hrs	2 hrs
Value Adding Time as % of total time	2.7 %	4.2%
Inventory	54 hrs	30 hrs
Transport Time	20 hrs	20 hrs
Waste & Reductions in Store	1.7%	1%
Un-Available to Store	1.5%	1%
Un-Available to shelf	0.5%	0.3%
Farm to Pack-House delivery performance	96%	99%
Pack-House to Retailer delivery performance	99.2 %	99.5%

Improvement Solutions

As a rule of thumb we believe the areas of waste identified above comprise around 20% of costs within the fresh produce industry. Using data from the National Horticulture Forum report, UK production is valued at about £2bn. A broad brush estimate of the potential cost reduction for the industry is around £400m.

Clearly this is a generalisation. All fresh produce chains are different and there is no such thing as a waste free chain. However, we believe that with the sustained application of lean thinking along the lines of our pilots that significant savings are achievable and that these are of a magnitude to have a major impact on the industry's profitability and international competitiveness.

As a first step, the following building blocks are recommended.

- A greater emphasis on collecting and acting upon operational data.
- Agreement between supply chain partners to establish shared KPI's and targets and jointly work towards their achievement

- More internal communication so that all employees know what the targets and performance measurements are. Every employee should know if the previous day was a 'good day or bad day'. Because the industry employs large numbers of foreign nationals communications is particularly critical.
- More attention devoted to small, workplace based improvements. The simple or basic solutions are usually the most cost effective and easiest to implement.
- More root cause analysis. Many companies do not allow sufficient time or resources for solving problems. This leads to companies 'fire fighting' rather than finding permanent solutions.

Building on these foundations, the fresh product industry could then make further improvements through the following steps.

1. Focus on quality – pack out rates

One of the startling findings of our work has been the high levels of product wastage in many of the chains. In some cases as little of 50% or 60% of the product harvest is packed out as prime product. There may then be further mark downs or losses at the retail level as product approaches its sell by date.

There would be a big payback if companies all along the chain carefully monitor product losses, identify the root causes and develop plans to reduce the losses. These might range from adjusting harvesting or production processes to reconsidering product / packaging specifications in conjunction with retailers.

2. Demand Management -Vertical Collaboration in the Chain

There is a real opportunity for chain partners to develop cooperative approaches to demand management.

This is relatively low cost and low risk and an excellent starting point for developing broader collaboration between supply chain partners. It usually results in benefits to all parts of the chain in terms of lower inventories, improved service levels and more efficient use of production resources, particularly if linked to the adoption of lean production policies.

3. Supplier Associations - Horizontal Collaboration Amongst Growers

A 'Supplier Association' is a club of suppliers who form together for mutual self-help and learning and involves a long term relationship. Supplier Associations are well established in other industry sectors such as automotive, where the large auto manufacturers bring together groups of their suppliers to develop and apply continuous improvement strategies.

The most obvious framework for a Supplier Association in fresh produce would be the group of growers that supply a particular pack-house or processor.

The objectives of a Supplier Association will typically focus on process improvement and may include such issues as:

- Improving harvesting effectiveness
- Improving quality / reducing waste for example through better feedback of product performance, reviewing product specifications, sharing best practice
- Developing the abilities and skills of suppliers through training and the use of appropriate continuous improvement methods.
- Improving the delivery performance, for example through better scheduling or improved logistics
- Facilitating strategy formulation and the flow of information including the latest market developments
- New product development
- Comparing the performance of suppliers in a structured way

Supplier Associations are most effective when the customer of the group eg the pack house is directly and actively involved. Indeed it is likely that in practice the pack house will be required to instigate and lead the association as individual growers may neither have the resources nor the capability to do so.

To be effective there needs to be a degree of mutual commitment between the pack house and the growers in the association particularly as improvements may require longer term effort to come to fruition.

4. Process Management at Pack-houses / Processing Plants

With few exceptions lean concepts were new to the plants included in our projects.

In all cases, there were significant opportunities to increase productivity and efficiency by the introduction of lean improvement techniques.

Companies should start by systematically mapping their production processes and identifying all the value adding and non-value adding steps. This exercise in itself will usually identify opportunities in terms of cost savings.

This should then be followed by a systematic approach to lean production by a variety of well tried lean techniques, such as batch size reduction, improved layout to improve product flow, OEE, total productive maintenance and 5S housekeeping to name but a few.

Companies that are early adopters of these approaches have the opportunity to gain significant competitive advantage.