

The International Adoption of Lean in agriculture and horticulture

# Review 13<sup>th</sup> April 21

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# Aims/Objectives and proposed approach

The aim is to deliver a review of the international adoption of Lean in agriculture and horticulture, and to map against other industries and businesses where Lean has been adopted within that locality.

The outcomes of this review will be used to inform future AHDB study tours and international communication opportunities and recommend to AHDB the next steps for KE delivery around Lean.

The key objectives to deliver this are:

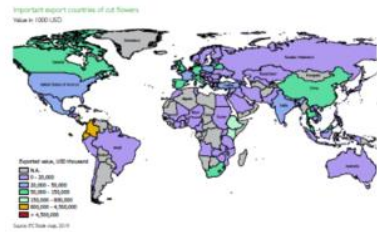
A) To review, map and report on the international adoption of Lean management and associated practices in agriculture and horticulture.

B) In the areas/countries where Lean adoption has been identified, provide an overview of other businesses and industries locally that have also embedded Lean.

- Level 1 – International areas where there are concentrations of agricultural and horticultural businesses
- Level 2 – Within these concentrations, the number of agricultural and horticultural businesses who have implemented Lean to some degree and the number of Lean businesses outside of the sector within the concentrations defined above
- Level 3 – For each business, an overview, their experience of Lean, how far they are on the Lean adoption scale, can they host visits?

# Aims/Objective and our Proposed Approach

## Level 1 – International Heat Map



	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5
Area 1					
Area 2					
Area 3					
Area 4					
Area 5					

## Criteria

1. A high concentration of Agricultural and Horticultural products
2. Initial indication shows that there is some level of economic activity in these areas
3. There are other sectors who have potential to develop in the region
4. It is relatively easy to undertake a study to identify the language/cultural barriers, travel not prohibitive
5. The effort to undertake the research is not prohibitive (language/cultural barriers, identified local people)

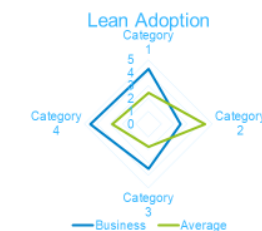
## Level 2 – Region Heat Map



No.	Sector	Criteria 1	Criteria 2	Criteria 3
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
...				

### Level 3 - Overview of Business 1

## Short Overview of Business

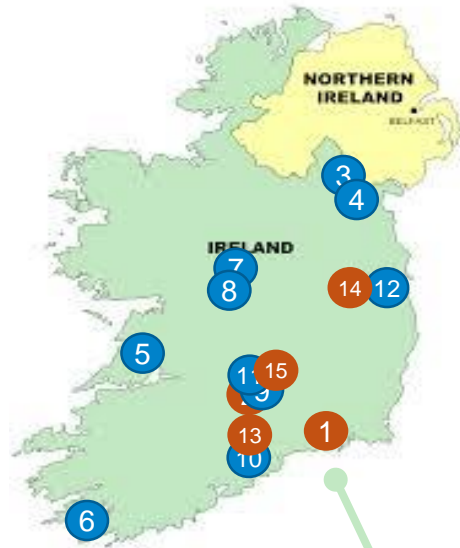


Ability to Host

Key Information	
Employed/Seasonal Employees	
Turnover	
Gross Profit	
Sector	
Lean of Other Tools Used	
Area(s) of Business	
Benefits Realised	
Support Used	
Investment Made	

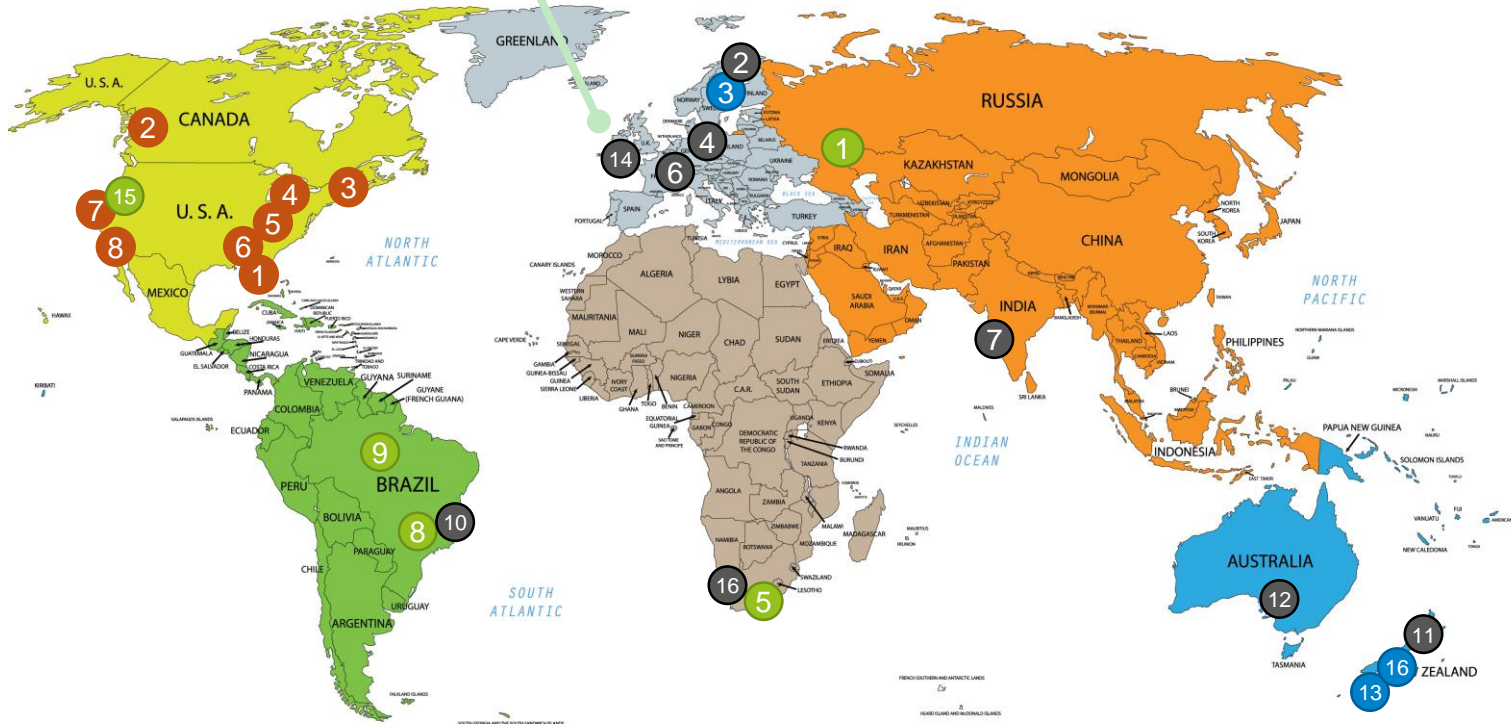
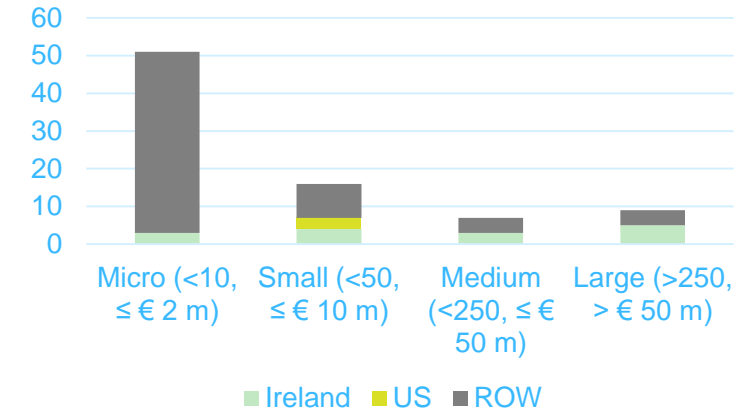
### Key Lessons Learnt

# Work Completed to Date

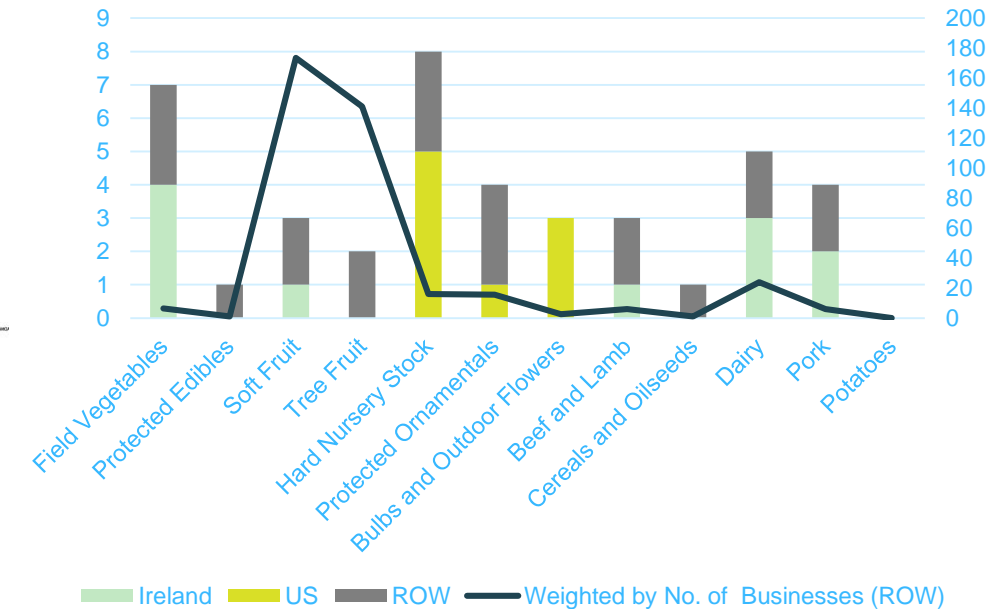


	Ireland	US	ROW
● Direct/ Intermediary Interview	5	8	-
● Case Study	10	-	3
● Article	-	-	5 (9)
● Academic Paper	-	-	9 (380)

Company Sizes (where known)



Breakdown by Sector (where known)



# High level findings

## Triggers/Catalyst for Lean Implementation

- Skills shortages
- Read or heard about Lean and decided to find out more
- Immediate term operational issues (productivity, quality, yield)
- Investing in production facilities & equipment
- A general desire for more order/control, consistency and team work

## Tools/Methodologies

- Traditional waste elimination (7 wastes, process mapping/analysis, waste walks)
- Assist in planning, managing, communicating and continually improving (Performance boards, measures of Continuous Improvement (CI), Visual Management (VM))
- Standardisations (work instructions, VM)
- Scheduling tools and line/labour optimisation

# High level findings

## Benefits realised

- Productivity Improvement (range between 15 – 80% reported)
- Improved product yield (range between 10 – 50% reported)
- Increased sales by eliminating capacity constraints (range between 56 – 200% reported)
- Improved quality
- Softer benefits (improved communication, team work and morale)

## Lessons Learnt

- Adapt lean to the sector (variability, pull, word “Lean” and other terminology)
- There are quick wins (high vol/labour) but it takes time to embed
- Can be employee resistance
- Important to train all at Farm is possible
- Leadership/management is crucial (buy in and culture)
- Challenge perceptions
- Use peers and other farmers to drive programme
- Preference for the practical rather than theory
- In US, the adoption of a standard model for scheduling, pull, flow and line balancing



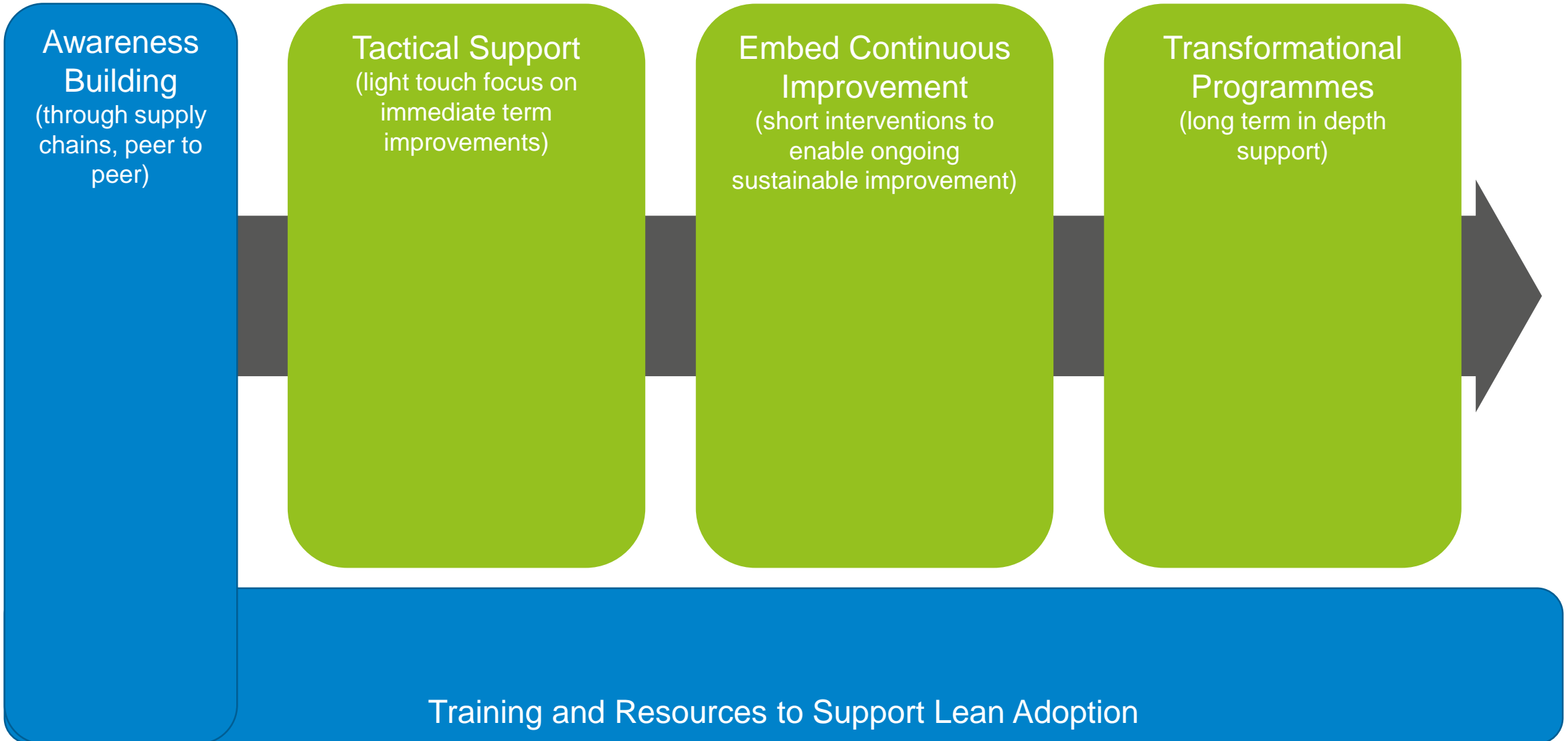
# Proposed Model/Roadmap

## Key points from the research and international programmes

- Adapt lean to the sector (farm experts as intermediaries, peer learning and support)
- Action orientated and practical - deal with immediate operational issues (focus on delivering tangible results).
- Recognise that **embedding lean** is longer term and strategic
- To support the above, use a balance of the tactical waste elimination tools and those for embedding continuous improvement in the medium to longer term
- One of the key challenges is resistance from employees, it is important to train all staff
- Leadership/management buy in and change in culture is crucial to sustained improvement
- There is evidence of increased benefit in transforming prime companies and their supply chains (Ireland case studies)

# Proposed Model/Roadmap

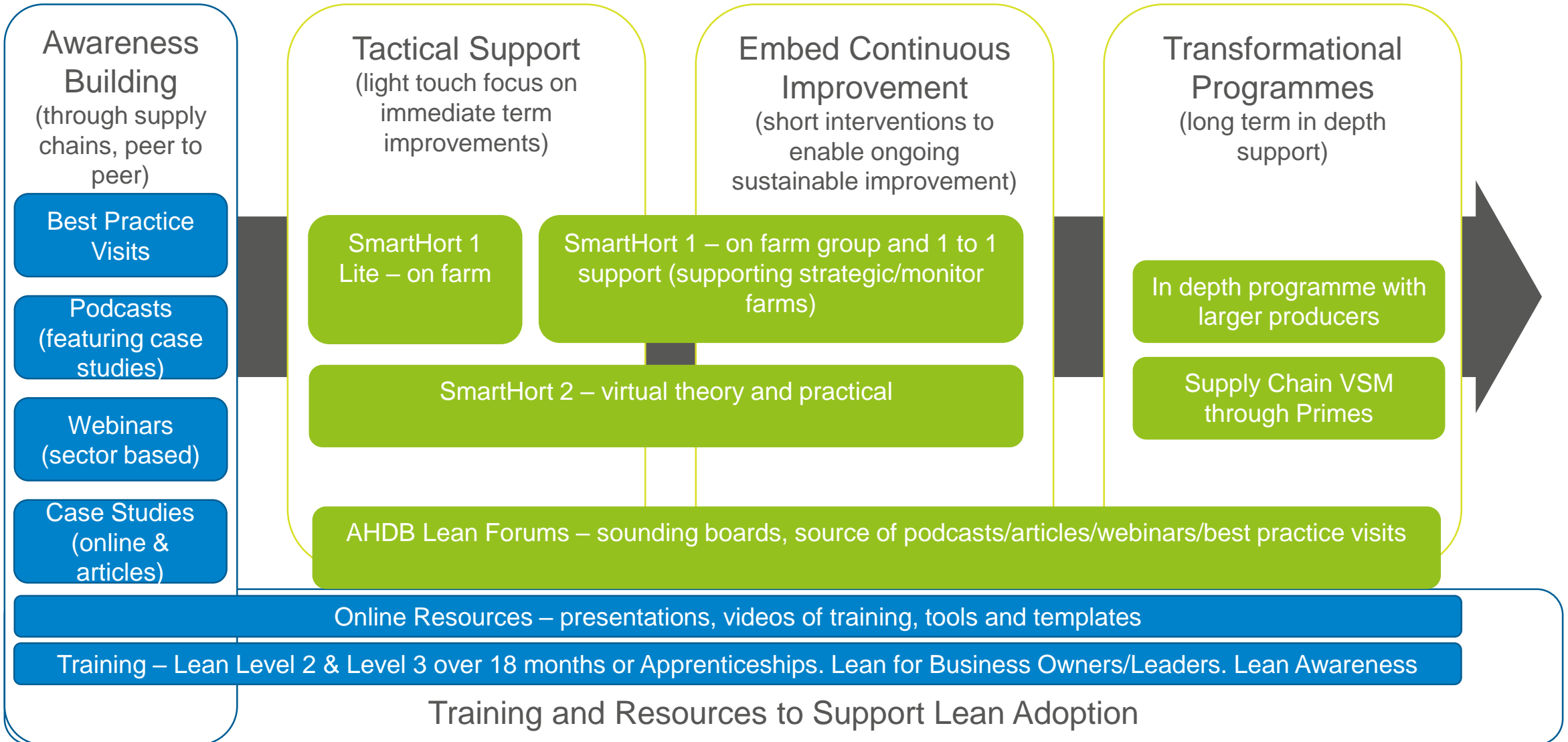
## Overview





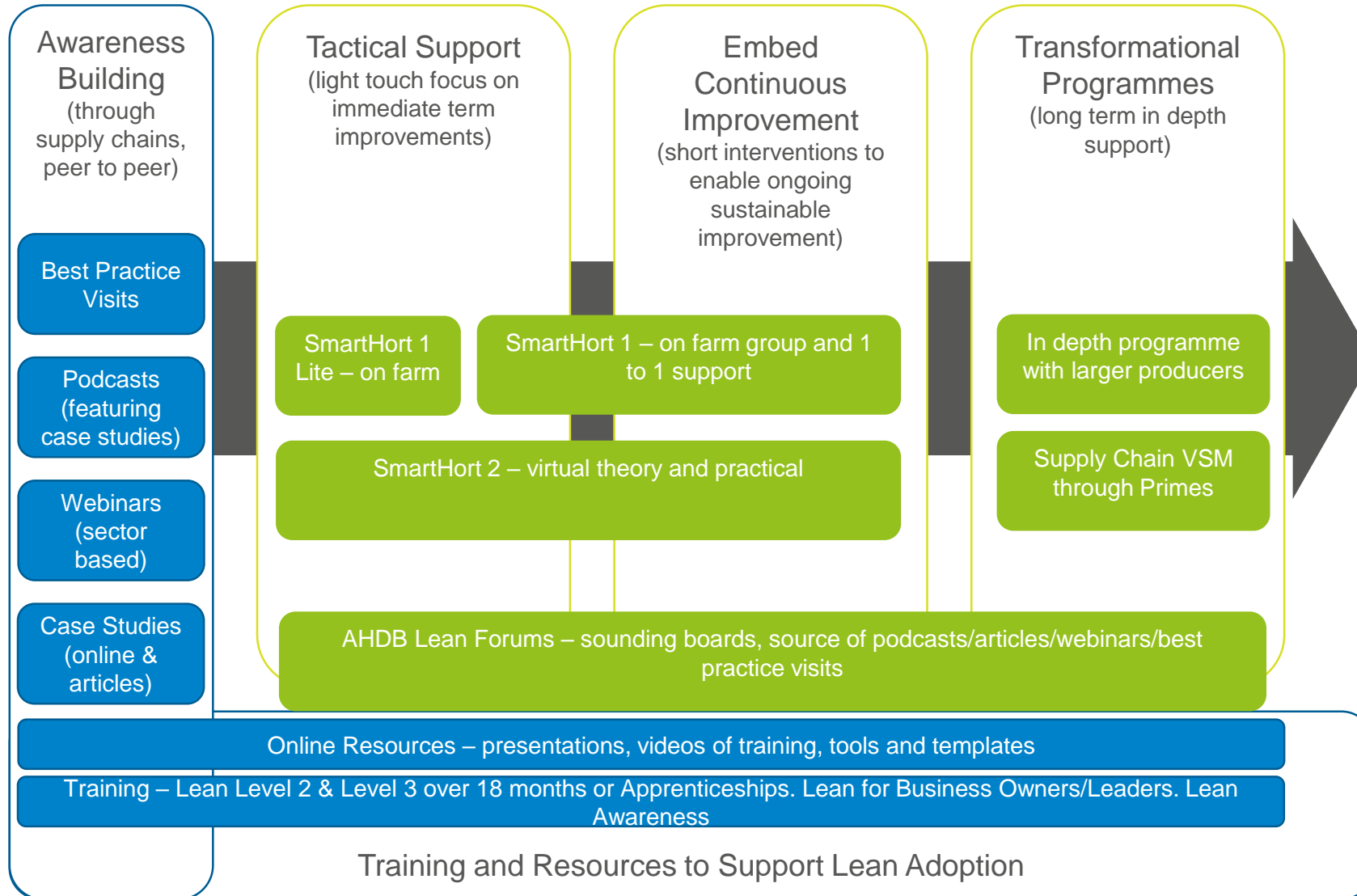
# Proposed Model/Roadmap

## Overview



# Proposed Model/Roadmap

## Overview



## Design Principles

- Adapt lean to the sector (farm experts as intermediaries, peer learning and support)
- Action orientated and practical
- Balance of the tactical waste elimination tools and those for embedding CI
- Availability of training for all
- Leadership/management buy in and change in culture
- Utilise prime companies and their supply chains

# Lessons learnt from research

Initially we found it easy to identify the global hotspots (Ireland, US, Sweden)

There did appear to be a lot of material about Lean implementation in the sector

It has been incredibly hard to get to the lean businesses to have a discussion (COVID, study tour elements, commercial concerns)

Consequently, we spent the majority of team speaking to intermediaries, trying to get to the businesses

We have delivered the first Aim/Objective – a review of international adoption of Lean

It has been harder to identify hotspots where businesses will commit to study tours, although there is willingness to share best practice

However, it means we have thought of different ways to share the best practice and learning

## Potential Next Steps

Use the data and information we have collated to give insight to the sector (articles, blogs, podcasts – lessons learnt from Lean in US or Ireland)

Create some “virtual” best practice sharing (tours, videos, podcasts)

A hosted virtual event (e.g. Toyota Management Centre – Deeside, North Wales)

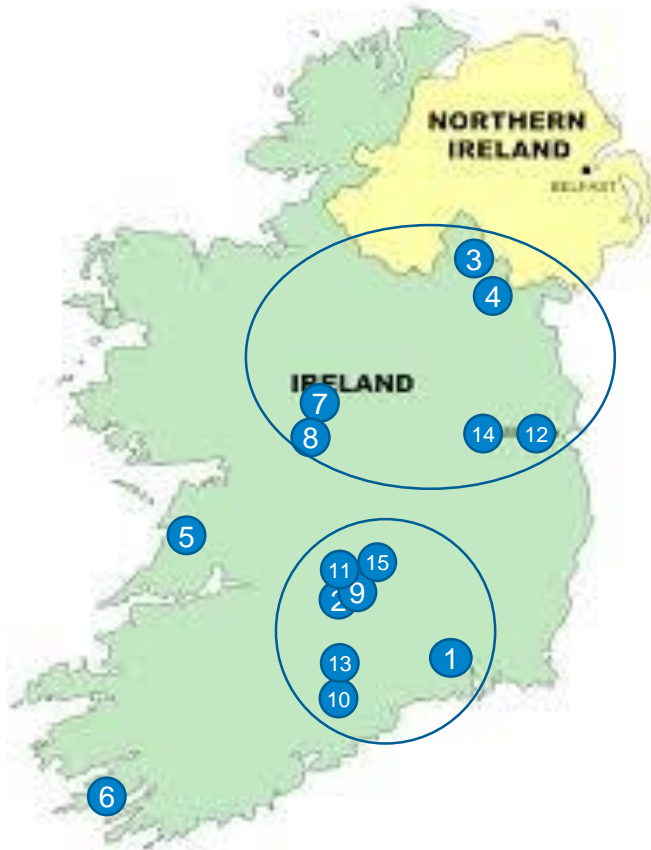
Develop best practice material (guides, templates etc.), building on the SmartHort material

# Region 1

Ireland



# Level 2 – Regional heat map



## Criteria for Sub Region Companies

- |   |  |
|---|--|
| <ol style="list-style-type: none"> <li>1. They are within in travelling distance of each other (assuming a study tour would visit two businesses per day)</li> <li>2. The 8 businesses are from horticulture or agriculture not a mix</li> <li>3. Through initial desk based research they appear to have adopted Lean</li> </ol> | <ol style="list-style-type: none"> <li>1. It appears, there are two clusters of companies that are within travelling distance of each other</li> <li>2. They are a mix of both horticulture and agriculture, probably more in the latter (9 of 14)</li> <li>3. Ireland was selected as it clearly had some programmes and expertise around Lean in Agri/Hort through Enterprise Ireland</li> </ol> |
|---|--|

In addition as this was the first region, we considered

1. Proximity to UK (for travel and comms)
2. Political Alignments
3. Language



# Overview of Businesses Selected for Ireland

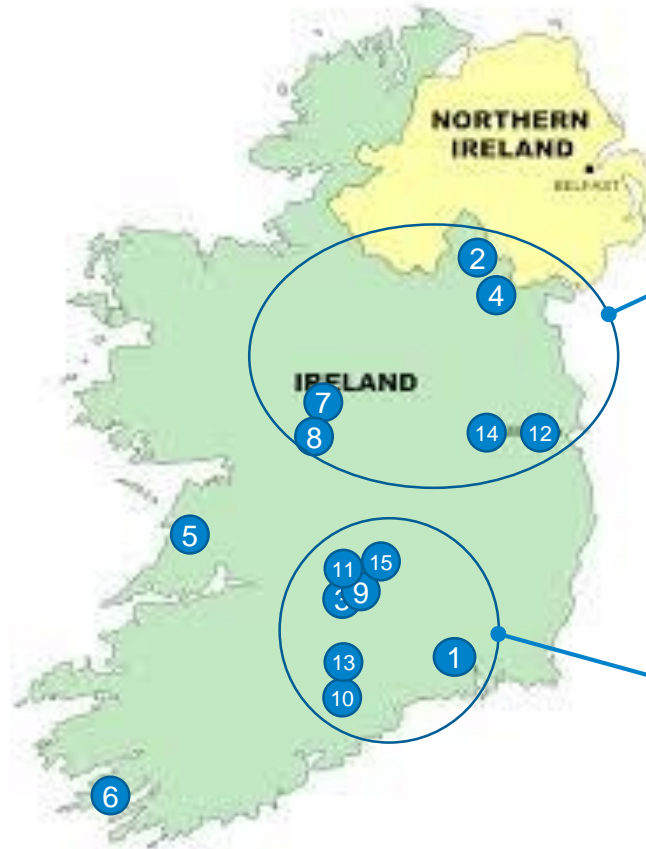
Business Name	Size (Employees and Turnover)	Sector (AHDB Sub Sector)	Main areas where Lean has been implemented	Summary of Benefits	Investment	Level of Lean Adoption Scale (1 – 100)	Ability and Willingness to Host Visit
Meadow Fresh Foods	Small (Emp. < 50, T/O ≤ € 10 m)	Field Vegetables	Field Crops - Potatoes - Potato packing line	Using Yield as a means of driving cost reduction of poor performing suppliers	Lean Start - 7 days programme over 8 to 10 weeks	Not Known	Not Known
Sillis Veg Ltd	Small (Emp. < 50, T/O ≤ € 10 m)	Field Vegetables	Supply of prep veg & fruit - Scheduling/planning process	Reduce Daily Production Planning from 1hr to 15mins Dispatch waste reduced by 50%	Lean Plus - medium scale training project facilitated/supported by external provider typically over 6 - 9 months (project costs up to €100K, €900/day, 50% funded)	Not Known	Not Known
Tipperary Coop	Medium-sized (Emp. < 250, T/O ≤ € 50 m)	Dairy	Diary farm - milk - Energy & utilities usage	Certification to ISO50001 achieved in 2019. 6.3% year to date reduction in energy consumption. Winners of the Large Business award in the 2019 SEAI Energy Awards.	Green Plus - medium scale training project facilitated/supported by external provider typically over 6 - 9 months (project costs up to €100K, €900/day, 50% funded)	Not Known	Not Known
Manor Farm	Large (Emp. > 250, T/O > € 50 m)	Poultry	Chicken farm - Whole business	7% Reduction in Whole Bird Weight Give Away 2% Reduction in Fillet Weight Give Away	Lean Transform - a large scale, extensive and holistic training programme which focusses on developing the capability and capacity of employees, typically 12 - 24 months in duration.	Not Known	Not Known
Red Bank Food Co	Micro (Emp. < 10, T/O ≤ € 2 m)		Micro business - oysters - Whole business	Several Thousand € identified and implemented as cost savings. New Strategy for 2019. Clear plan for what needs to be done. Importance of Data gathering and analysis is clearly understood. Greater ability to think strategically, and better use of documentation.	Lean for Micro	Not Known	Not Known
Celtic Sea Minerals	Unknown	Cereals and Oilseeds	Animal feed - Whole business	15% improvement in productivity. 10% improvement "in process" quality. Improved consumables raw material stock control using pull systems. Greater awareness of production performance through KPI tracking. Improved individual accountability.	Lean Transform - a large scale, extensive and holistic training programme which focusses on developing the capability and capacity of employees, typically 12 - 24 months in duration.	Not Known	Not Known
Waldron Meats	Micro (Emp. < 10, T/O ≤ € 2 m)	Pork	Sausages, bacon & pies - Process lines	50% improvement in productivity	Lean for Micro	Not Known	Not Known
Beechlawn Organic Farm	Small (Emp. < 50, T/O ≤ € 10 m)	Field Vegetables	Organic veg farm - Packhouse	Productivity up 80% Savings €57k per year	Lean for Micro	Not Known	Not Known
Dovea Genetics	Medium-sized (Emp. < 250, T/O ≤ € 50 m)	Beef and Lamb	Artificial insemination - Main production process	Total savings per year of €75K	Lean for Micro	Not Known	Not Known

# Overview of Businesses Selected for Ireland

Business Name	Size (Employees and Turnover)	Sector (AHDB Sub Sector)	Main areas where Lean has been implemented	Summary of Benefits	Investment	Level of Lean Adoption Scale (1 – 100)	Ability and Willingness to Host Visit
Silver Pail Dairy	Micro (Emp. < 10, T/O ≤ € 2 m)	Dairy	Ice cream processor - NPD & preventative maintenance	5% reduction in waste 2% reduction in Operations costs as a result of increased batch sizes, better planning and overall improved efficiencies allowing more product to be produced in the same time. 10% less downtime as a result of improved preventative maintenance. All lines performing to meet a minimum of 95% Performance to Plan. 4% reduction in Spare Parts spend	Lean Plus - medium scale training project facilitated/supported by external provider typically over 6 - 9 months (project costs up to €100K, €900/day, 50% funded)	Not Known	Not Known
Ashbourne Meat Processors	Small (Emp. < 50, T/O ≤ € 10 m)	Beef and Lamb	Beef processing - Productivity of processing lines	Increased line productivity by 16%, going from 43 cattle per hour to 50 cattle per hour. OEE introduced and improved by 10% Bottleneck operation identified as Hide Puller, process variation on this key step reduced by 35%	Lean Start - 7 days programme over 8 to 10 weeks	Not Known	Not Known
Rosie & Jim Gourmet Foods	Medium-sized (Emp. < 250, T/O ≤ € 50 m)	Poultry	Chicken processors - Product reengineering	Achieved raw material savings of €58k	Lean Start - 7 days programme over 8 to 10 weeks	Not Known	Not Known
Dairy Gold	Large (Emp. > 250, T/O > € 50 m)	Dairy	Dairy coop - Lean within Central Operations (Milk processing, packing, warehouse, admin and Retail)	Capacity (efficiency in manufacturing) 8.4M Business Process Optimisation (making different products) 1.2M Supply Chain Optimisation (admin) 2.2M Total quantification of £ saved per annum as a summary €11.9M	Lean Transform - a large scale, extensive and holistic training programme which focusses on developing the capability and capacity of employees, typically 12 - 24 months in duration. Now has a Lean Team with annual budget of €800K	Not Known	Not Known
Dairy Gold	Large (Emp. > 250, T/O > € 50 m)	Dairy	Dairy coop - Introduce lean into all suppliers - lean farm trial Mostly in milking process and maintenance	Reduced walking of farmer by 116km p.a. 18 days of labour saved p.a. 100% of those that attended would recommend doing it €1500 on average per annum	DairyGold provided the Lean expertise (a cost of €120K per annum) Farmers get 1 day of training. Approx. 50% then have 9 days of coaching, 50% 1 day	Not Known	Not Known
Rosderra Irish Meats	Large (Emp. > 250, T/O > € 50 m)	Pork	Pork Processing - Production, Maintenance and Quality	Productivity from 18K to 40K pigs per week without significant change to scale of plant Equipment utilisation from 80-85% to 90-94%	Initially Lean Plus - medium scale training project facilitated/supported by external provider typically over 6 - 9 months (project costs up to €100K, €900/day, 50% funded) Now have team of 4 supporting delivery and training	Not Known	Not Known
Monaghan Mushrooms Group	Large (Emp. > 250, T/O > € 50 m)	Field Vegetables					

# Geographic Spread of Businesses

1. Meadow Fresh Foods
2. Sillis Veg Ltd
3. Tipperary Coop
4. Manor Farm
5. Red Bank Food Co
6. Celtic Sea Minerals
7. Waldron Meats
8. Beechlawn Organic Farm
9. Dovea Genetics
10. Silver Pail Dairy
11. Ashbourne Meat Processors
12. Rosie & Jim Gourmet Foods
13. Dairy Gold
14. Rosderra Irish Meats
15. Monaghan Mushrooms



130km (1hr 45mins)  
between No. 2 Sillis Veg in  
Monaghan and No. 8  
Beechlawn Organic Farm  
in Ballinasloe 130Km

90km (1hr 25mins)  
between No. 1 Meadow  
Fresh Food in Waterford  
and No. 11 Ashbourne  
Meat Processors in  
Tipperary

# Overview of Dairygold Co-Operative Society Limited

## Short Overview of Business

Dairygold is Ireland’s largest co-operative, supporting thousands of shareholder farmers for more than 150 years. Focus is on producing cheese and dairy ingredients that can be traced from grass fed cows in Europe’s most fertile pastures

Business is split into 3 areas, Food Ingredients, Agriculture Businesses (Farms) and Retail (39 Stores)

Key Information	
Employed/Seasonal Employees	572
Turnover	€1BN
Gross Profit	€56.6M
Sector	Dairy
Lean of Other Tools Used	Started with Lean moved onto Six Sigma In 2018 start to use Integrated Business Planning
Area(s) of Business	Milk processing, packing, warehouse, admin and Retail
Benefits Realised	<b>Total Saving of €11.9M p.a.</b>
Support Used	Lean Transform Programme
Investment Made	<b>Lean Team has an annual budget of €800K</b>

## Lean Adoption



## Ability to Host

The business has facilities, but is constrained by COVID based rules and regulations which had started to relax but now are tightening up again.

Conforms to employer regulations and HSE standards

## Key Lessons Learnt

- There is a **fear factor with Lean** (term does not help) - People are afraid of what the consequences are and can be sceptical. Therefore don't use term Lean use Continuous Improvement
- Have to think hard about not only what is in it for the business but also the individual
- Safety as a 1<sup>st</sup> Measure of Improvement.** No one can argue with changes which benefit in safety improvements for them and their colleagues
- Leadership was critical and come from the top and be visibly supportive.** This had to flow down the hierarchy, the challenges were often in areas where the Head was not engaged or bought in.
- Start Ugly, don't wait for perfection, 80% is good enough**
- Doing the Gemba.** Go see it, walk it and understand the reality to ensure changes is appropriate
- Value of champions across the site.** These are topic/techniques based (5S, Visual Management)
- Communication is key. Using VM/Huddles.** Business was surprised how aligned the business became and how comms were faster and more effective. Include an active CI section in VM/Huddles
- "Stones in shoes"** – what issue is causing the most pain

# Overview of Dairygold Milk Suppliers

## Short Overview of Business

This second summary is related to the Milk Suppliers Programme. Dairygold has **3000 milk suppliers as part of the cooperative**. In 2017 they ran a **Lean pilot with 16 of the milk suppliers**, in 2018 they then started to roll this out and have currently done 1000.

## Lean Adoption



## Ability to Host

Same as previous slide

Key Information	
Employed/Seasonal Employees	Generally Family Business (Herds ranging from smallest is 40 largest is 400+ average would be about 110)
Turnover	
Gross Profit	
Sector	Dairy
Lean of Other Tools Used	Performance Boards for maps of site, comms, work instructions, plans
Area(s) of Business	Mostly in milking process and maintenance Less so in cereals (harvesting/spraying)
Benefits Realised	<b>€1500 p.a. average savings, 18 day of labour p.a. (93% saw improvement in safety, 100% would recommend)</b>
Support Used	DairyGold provided the Lean expertise (a cost of €120K per annum)
Investment Made	Farmers get 1 day of training. Approx. 50% then have 9 days of coaching, 50% 1 day

## Key Lessons Learnt

- **Use peers and other farmers to drive the programme (waste walks)**
- They are less concerned about the word Lean but **hate the other Lean base terminology and therefore this needs converting into Farming Language**
- **Training should occur on Farm** as much as possible
- Need to **engage the whole Farming Family** to help overcome the sceptics by embracing those more keen
- Has heard that some farmer turned up to the programme thinking it would be pointless and they could pull holes in it, but then they were converted to strong advocates

# Overview of Rosderra Irish Meats Group

## Short Overview of Business

Rosderra Irish Meats Group is the **largest pork processing company in Ireland** (55% of national kill, principal supplier in Ireland exporting 48% worldwide). They operate two state-of-the-art slaughtering as well as a speciality meat ingredients facility, a pork-curing facility and a Cooked Meats facility. In addition, they have **7 farms supplying product** with 10/11 people on each.

## Lean Adoption



## Ability to Host

Yes already been part of BP Programme (<https://www.eu-japan.eu/events/lean-europe-visit-18-rosderra-irish-meats>)

Key Information	
Employed/Seasonal Employees	1200
Turnover	> € 50 m
Gross Profit	
Sector	Pork
Lean of Other Tools Used	Have used Lean in its broadest sense, started in a smaller unit (approx. 50 people) to demonstrate the benefits
Area(s) of Business	Found success in Production, Maintenance and Quality. Currently developing means of capturing real time data to support PIT and shorter interval control.
Benefits Realised	<b>Productivity from 18K to 40K pigs per week without significant change to scale of plant</b> <b>Equipment utilisation from 80-85% to 90-94%</b>
Support Used	<b>Lean Start and Lean Plus Programme</b>
Investment Made	A Group Lean Manager and 4 Lean Coordinators, supporting delivery and training of staff

## Key Lessons Learnt

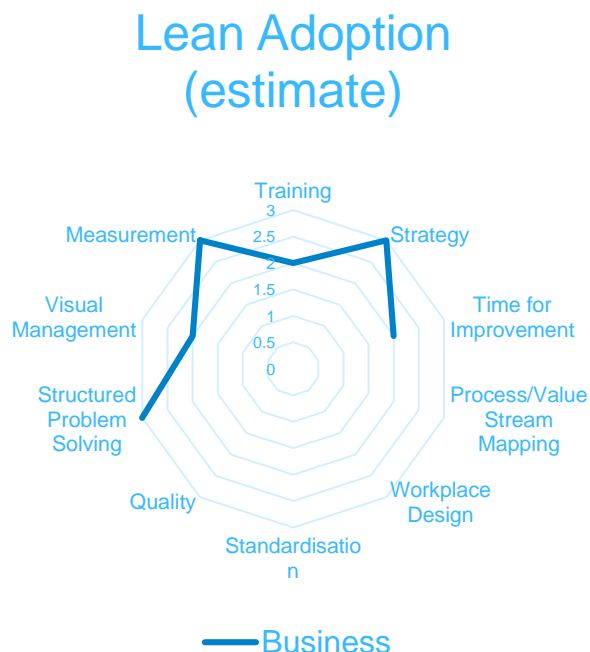
- Lean in Farms – **resistance from managers**, felt more important things to do and it was not relevant. Therefore, **tried to fix simple things to overcome noise**. This then opened up the opportunity to start Lean
- Each **farm piloted projects and approaches to find the “best way”** which they then shared with the other farms
- There are regular **best practice groups** to share their issues and hear from experts and customers
- Has to be people first, if they perceive or don't believe it, it won't work. **“What's important to you”** as starting point
- Training is key, keep it simple and relevant**
- Challenging if you have key influential people that don't believe or participate



# Overview of Sillis Green Veg Limited

## Short Overview of Business

Established in 1997, Sillis Green Veg Ltd supplies ready prepared vegetables to the catering and retail industry. Based in North Monaghan they sell a wide range of products from 10kg bags of peeled potatoes to pre-packed 400g bags of baton carrots, and everything inbetween. They have a wide customer base that includes some of the leading hotels, retail companies and wholesalers in Ireland.



Ability to Host

Key Information	
Employed/Seasonal Employees	<50
Turnover	≤ €10 m
Gross Profit	
Sector	Field Veg, Soft & Tree Fruit
Lean of Other Tools Used	Measures, PIT (Perf Board), PDCA, CI, Visual Mgmt
Area(s) of Business	Across the whole business
Benefits Realised	Reduce Daily Production Planning (60 to 15 mins), Dispatch waste reduced by 50%, Improved Comms
Support Used	LeanPlus Programme delivered by LBS Partners.
Investment Made	Up to €30K matched by Enterprise Ireland

- Key Lessons Learnt
- Developing Scheduling Systems that could cope with the unpredictability and variation in daily demand
  - Get staff used to the accountability that comes with having production metrics in place
  - Having the right management culture and buy in to drive the changes through

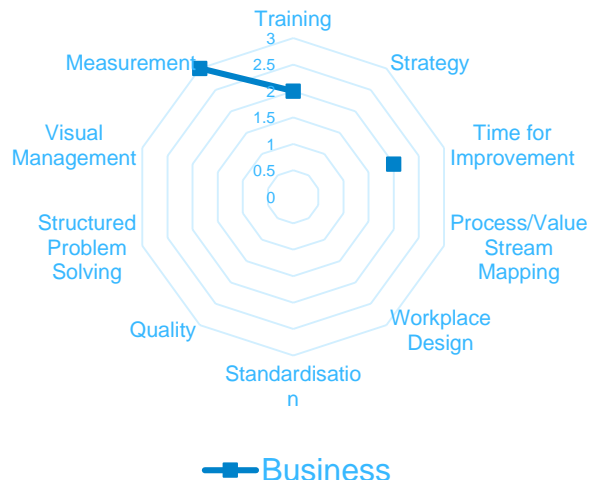
# Overview of Meadow Fresh Foods

## Short Overview of Business

Meadow Fresh Foods supplies a large variety of quality, freshly prepared vegetables to the wholesale trade, food service, HSE and ingredients to food manufacturing plants. Meadow Fresh Foods is a family company owned and managed by the Geary family. Established in 1993 as a small tradership. In 1996 the business was incorporated as a company Meadow Fresh Foods Limited

Key Information	
Employed/Seasonal Employees	<50
Turnover	≤ €10 m
Gross Profit	
Sector	Field Vegetables
Lean or Other Tools Used	Yield Measurement, PDCA
Area(s) of Business	Preparation and Packing
Benefits Realised	Improved Yield
Support Used	LeanStart Programme delivered by LBS Partners.
Investment Made	Small contribution to €6300 funding by Enterprise Ireland

## Lean Adoption (estimate)



## Ability to Host

### Key Lessons Learnt

- The main challenge was the seasonality of potatoes, trying to see a difference by implementing changes on the line was hard because the potatoes were old season and generally, these would not have a very consistent yield at this time of year.
- Get staff used to the accountability that comes with having production metrics in place
- Having the right management culture and buy in to drive the changes through

# Ireland – Findings against level 3 hypothesis

Hypothesis	Evidenced?	Notes
Businesses of a certain scale can more successfully implement improvement activities	Not conclusive	Both companies sampled are large and demonstrate they have had success but not enough other companies sampled to compare
Businesses that are more advance in the adoption of Lean see sustained improvements in their overall business performance (especially their bottom line)	Some indication correct	Both Rosderra and DiaryGold have quantifiable benefits from adoption
Businesses that produce at high volumes with low levels of variability are more successful in adopting Lean	Some indication correct	Businesses where lean implementation is more successful tend to be high volume/low variance
There are common processes within a sector where Lean is predominantly applied	Not conclusive	Not enough businesses to compare
Processes or areas where there is high volume with low levels of variability are where Lean is predominantly adopted	Some indication correct	Businesses where lean implementation is more successful tend to be high volume/low variance
There is correlation between the amount of effort put into Lean activity and the results it achieves	Not conclusive	Not a large enough sample
Lean has relatively quick payback periods	Not conclusive	Indication of work on farms shows this is the case

# Ireland – Findings against level 3 hypothesis

Hypothesis	Evidenced?	Notes
Support from outside the organisation accelerates the adoption of Lean and its associated benefits	Some indication correct	By the nature of how we found these businesses, they have all had support
There is a common set of Lean tools that used regardless of the level of adoption of Lean	Not conclusive	It seems on farms, simple forms of PDCA/CI and standardisation have biggest benefit
Agricultural and Horticultural business will generally have lower levels of adoption than the more traditional sectors where Lean is applied (e.g. manufacturing)	Not conclusive	
Companies implementing Lean come across similar barriers to success	Some indication correct	Buy in from managers and how applicable the tools are
There are common things that go well and not well when adopting Lean	Some indication correct	Keeping it simple and engaging with their issues
The selected businesses are happy and able to host visits in an appropriate manner	Some indication correct	Businesses who embrace lean also see the benefit of sharing

# Enterprise Ireland - Lean Business Offer – 2009 – 2012

Data Source: PLM Report April 2015



Programme	Activities	Objectives / intended outcomes
Lean Start	<ul style="list-style-type: none"><li>▪ Short in-company consultancy project</li><li>▪ 7 days input from expert consultant, up to €6,300 in cost (€5,000 (80 percent) funded by Enterprise Ireland)</li><li>▪ Complete a specific cost reduction project (up to 8 weeks)</li></ul>	<ul style="list-style-type: none"><li>▪ Cost reductions achieved/demonstrated in pilot project</li><li>▪ Introduce Lean skills as foundation for future Lean activities/ projects</li></ul>
Lean Plus	<ul style="list-style-type: none"><li>▪ Medium scale business improvement project with external expert consultant (not less than 6 months in duration)</li><li>▪ Up to €70,000 (50 percent funded by Enterprise Ireland)</li></ul>	<ul style="list-style-type: none"><li>▪ Significant productivity improvements in project conducted</li><li>▪ Embedding of culture of continuous improvement</li><li>▪ Cohort of trained staff</li><li>▪ Longer-term plan to pursue company wide improvement</li></ul>
Lean Transform	<ul style="list-style-type: none"><li>▪ Extensive holistic programme with an external consultant(s) to enact change and embed culture of continuous improvement</li><li>▪ Projects expected to cost of order of €100,000 (with the level of Enterprise Ireland support decided on a case by case basis)</li></ul>	<ul style="list-style-type: none"><li>▪ Company-wide transformation in culture and performance</li><li>▪ Considerable productivity and business performance targets achieved</li><li>▪ Sustainable continuous improvement culture programme established</li></ul>

# Enterprise Ireland's approach – Lean Business Offer summary metrics

403 Projects

46% of the projects were in the food sector

6,029 people trained

78 consultancies developed

83% of participating companies reported capacity increase benefits

10 – 15% mean productivity improvement for participating companies

59.7 M Euros invested during this time period

662 M Euros total productivity gain (Return on investment of 11:1)

20% productivity improvement based on annual sales per employee increase over time period (total sales/total no. of employees)

The above figures are conservative as a lot of the businesses were sales constrained during this time period



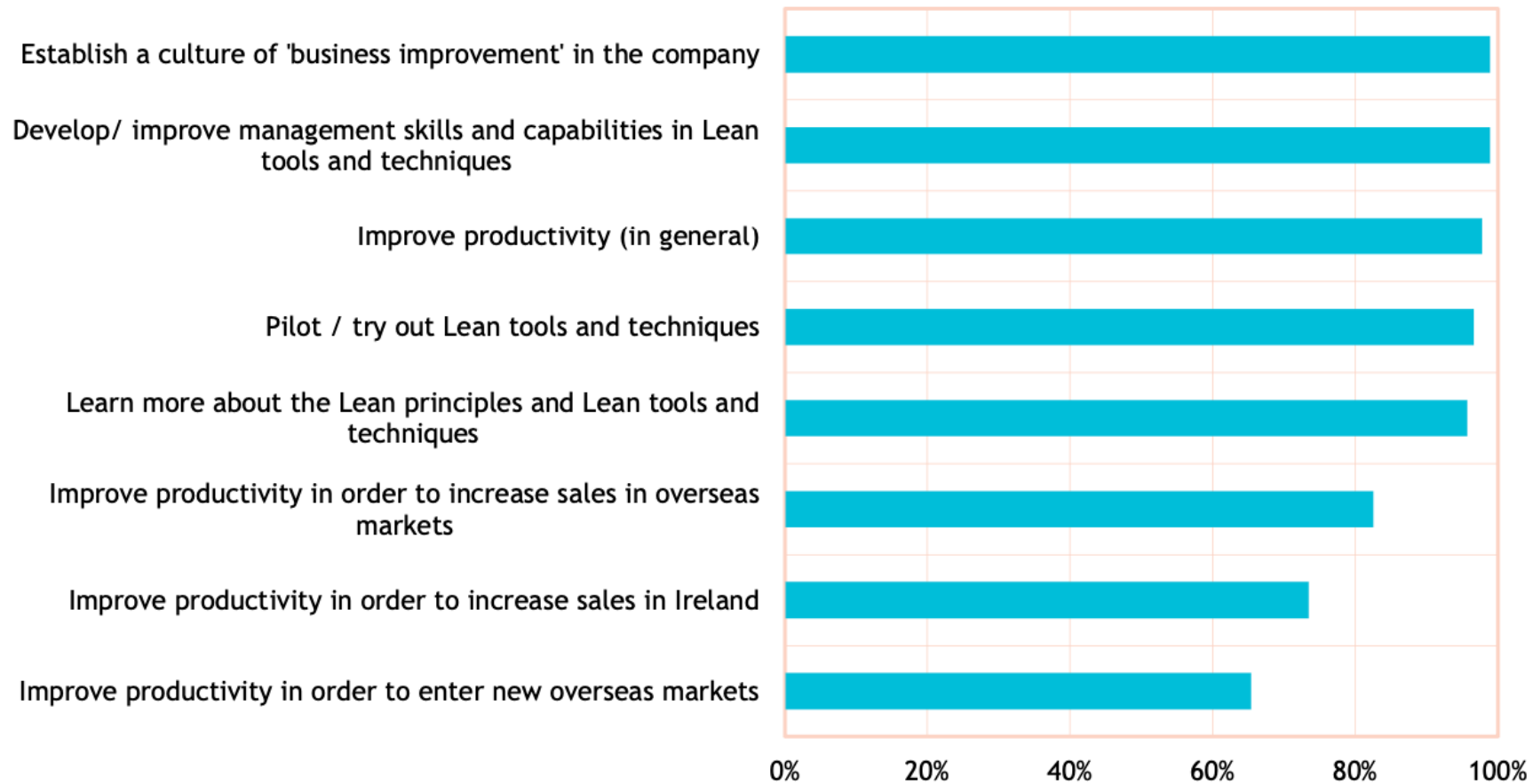
# Typical projects

- Reduction in materials costs through reduced waste, re-work etc.;
- Improved workflows;
- Reduced inventory and work-in-progress;
- Reduced set-up time and downtime;
- Increased staff utilisation rates;
- Increased production area / more efficient use of production area; and/or
- Improved lead times and delivery performance.

LBO stage	No. of projects	No. of projects (percent)	Total grant value (€ Million)	Total grant value (percent)
Start	283	70.2%	1.392	9.9%
Plus	82	20.3%	1.995	14.2%
Transform	38	9.4%	10.654	75.9%
Total	403	100%	14.042	100%

Source: Enterprise Ireland grants database

# What the participants got out of the programme



Source: LBO participant survey

# Investment vs. Productivity gains

	Cost (2009-2012)	Cost (%) (2009-2012)
LBO grants approved	€14.04M	23.5%
Enterprise Ireland indirect costs ( <i>estimated</i> )	€1.07M	1.8%
Company contributions ( <i>estimated</i> )	€44.6M	74.6%
Total	€59.71M	100%

Source: Technopolis

Year of approval	Number of companies that had a grant approved for Lean	Total number of employees, in year following first approval	Total productivity gains (in million EUR)
2009	19	1,086	40.2
2010	76	4,127	152.7
2011	175	12,682	469.2
Total			662.1

Source: Technopolis (2013)

Lessons Learnt from Enterprise Ireland's Approach

1. Knowledge Exchange (KE) / Industry specific technical expert as an advisor to support the lean consultant with the intervention to stop them 'going down rabbit holes'

# Region 2

US



HORTICULTURE

# Map of US



1. Sun Bulb Company
2. Van Belle Nursery Inc
3. North Creek Nurseries
4. Corso's Horticulture
5. James Greenhouses
6. Flowerwood Nursery Inc
7. Dark Heart
8. Mellano & Company

## Short Overview of Business

Sun Bulb Company is a third generation, family-run, wholesale grower and supplier of plant supplies. Primarily serving big retail (e.g. Homedepot) and internet business (most through distribution and Amazon). Product groups are plants (indoor foliage), potting supplies, pots (SK pottery, imported from Germany) and plant foods (Better-Gro)

### Lean Adoption



### Ability to Host

Key Information	
Employed/Seasonal Employees	130 People
Case Study Page	<a href="https://www.greenhousemag.com/article/gm0414-maximizing-efficiencies/">https://www.greenhousemag.com/article/gm0414-maximizing-efficiencies/</a>
Company Website	<a href="https://sunbulb.com/info/our-products/orchids/">https://sunbulb.com/info/our-products/orchids/</a>
Sector	Hard Nursery Stock, Bulbs and Outdoor Flowers
Lean and Other Tools Used	Production Lines based on a plan with standard times, meeting every Friday to look at demand, using FlowVision to define resource required on each line to meet demand (move between lines based on surplus/deficit). Provides metrics to manage progress hour by hour Grocery/Supermarket – pull from greenhouse and push into production line
Area(s) of Business	All part of the business
Benefits Realised	4x increase in sales – down same lines and planner. In excess of 20% labour efficiency
Support Used	Used FlowVision Consultancy
Investment Made	Initial intense consultancy support and then visits every two months for 18 months from FlowVision

### Key Lessons Learnt

- Get buy in throughout the business – they have accepted they will lose people along the way if they don't buy into the new ways of working
- Ensure training is ongoing it helps embed the philosophies (all employees go through 2-day workshop with FlowVision)
- Always have a philosophy that there is always room for improvement
- A natural in-house lean champion has emerged who is the main point of contact, due to this and ongoing training and experience of previous projects they are able to do more themselves and use the expert engineers for checks and as a critical friend

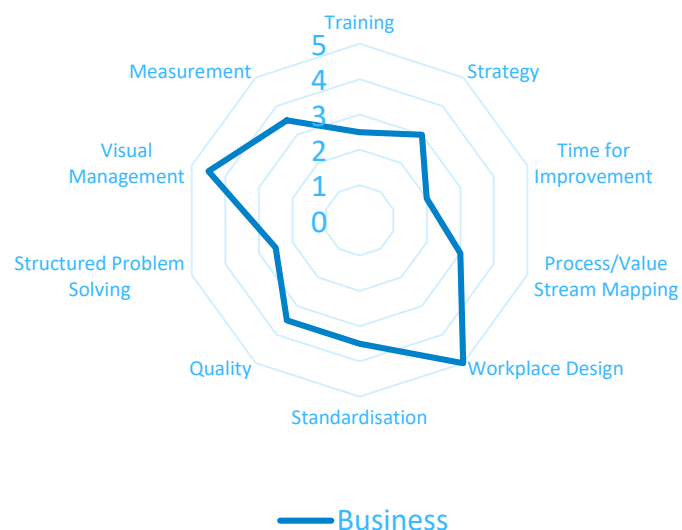


## Short Overview of Business

Van Belle is a wholesale plant nursery, established over 40 years ago. They supply starter plants to other growers in North America. For finished plants, they supply to box stores in Western Canada as well as the Pacific Northwest USA.

The marketplace for Van Belle is like that encountered in the UK. They compete by offering a wide product range in relatively small volumes. This provides the usual operational challenges with lead-time being the differentiator

### Lean Adoption



### Ability to Host

The business would be happy in conjunction with FlowVision to share its experience of lean to a degree (assume if not commercially sensitive, competitive or other reasonable constraints)

Key Information	
Size of Business	70 Employed/150 Seasonal/Temporary 28.6M CAD
Case Study Page	<a href="https://flowvision.com/case-studies/flowvision-helps-van-belle-nursery-drives-significant-efficiencies-through-their-whole-facility/">https://flowvision.com/case-studies/flowvision-helps-van-belle-nursery-drives-significant-efficiencies-through-their-whole-facility/</a>
Company Website	<a href="https://vanbelle.com">https://vanbelle.com</a>
Sector	Hard Nursery Stock, Protected Ornamentals
Lean and Other Tools Used	Implemented FlowVision (demand and daily resource planning) and flow boards (hr target v actual perf). In addition, have utilized various other Lean tools (Process Mapping, CI, Performance Boards etc.)
Area(s) of Business	Start with propagation but has also been applied to shipping, office and tag room. The principle however is to look at the holistic process rather than just components of it
Benefits Realised	Aim for a 30% improvement per implementation (generally achieve 25-30%)
Support Used	Used FlowVision Consultancy
Investment Made	First Implementation was more than 100,000 CAD

### Key Lessons Learnt

- The company is forward thinking and progressive. Lean with its lack of bureaucracy and empowerment of the staff fits, well with Dave's personal philosophy
- In first instance Gary took the whole business through 4 days of training (including cannon simulation) this was very enlightening and generated several "light bulb moments" for everyone involved
- Success starts with Leadership, need a champion with authority. Then need managers/supervisors to have the drive to recognise there are problems and solve them.
- Then involving front line workers is crucial for buy in as well as continuous improvement
- Number one issue is supervisors who don't want to give up control – they impeded the process and if they can't adapt you have to let them go

# Overview of North Creek Nurseries

## Short Overview of Business

North Creek Nurseries is a wholesale propagation nursery that provides starter plugs to retail and wholesale nurseries, garden centres, mail-order companies and landscaping professionals

Based in Pennsylvania they specialise in ferns, ornamental grasses, perennials and vines. A key element of the business is sustainability .

## Ability to Host

The business would be happy in conjunction with FlowVision to share its experience of lean to a degree (assume if not commercially sensitive, competitive or other reasonable constraints)



Key Information	
Size of business	
Case study page	<a href="https://flowvision.com/case-studies/flowvision-helps-north-creek-nursery-drives-a-lean-flow-culture-change/">https://flowvision.com/case-studies/flowvision-helps-north-creek-nursery-drives-a-lean-flow-culture-change/</a>
Company website	<a href="https://www.northcreeknurseries.com">https://www.northcreeknurseries.com</a>
Sector	Wholesale supply of propagation and starter plugs to the whole garden sector
Lean and Other Tools Used	Application of Lean to improve product flow and also improve the culture of the organisation Plan is now to apply 5S to the business as well
Area(s) of Business	Initial focus of Lean was shipping with plans now to roll out to the production processes
Benefits Realised	Rare weekend overtime and no more 7-day working weeks Improve productivity, reliability, predictability, optimize space utilisation, no need to transfer production staff to shipping at peak times
Support Used	Used FlowVision Consultancy to bring in an external impetus to help change the culture
Investment Made	Initial consultancy costs

## Key Lessons Learnt

- How Lean can be used to facilitate a culture change
- The need for external input in order to allow this
- That the changes will not be for everyone that some people may choose to leave along the way
- The need to take a long-term view
- To set long-term goals and stick to them

# Overview of Corso's Horticulture



## Short Overview of Business

Corso's Horticulture is a family-owned business operating out of Ohio since 1941. Today it consists of a 160,000 sq.ft glass house that supplies it's own flower shop, garden centre and landscaping division.

It also has a 200,000 sq.ft of growing area that supplies 10 million perennials into the wholesale sector in 7 US states

## Ability to Host

The business would be happy in conjunction with FlowVision to share its experience of lean to a degree (assume if not commercially sensitive, competitive or other reasonable constraints)



Key Information	
Size of business	160,00 sq.ft glass house and 200,000 sq.ft growing area
Case study page	<a href="https://flowvision.com/case-studies/rio-helps-corsos-optimize-loading-process/">https://flowvision.com/case-studies/rio-helps-corsos-optimize-loading-process/</a>
Company website	<a href="https://www.corsosperennials.com">https://www.corsosperennials.com</a>
Sector	Wholesale - perennials
Lean and Other Tools Used	End to end mapping of the business Introduction of pull systems (supermarket style) Future state design of a new shipping facility
Area(s) of Business	Despatch area Shipping utilisation Systems/Software for loading the Dannish trollies and trucks
Benefits Realised	Improved transport utilization by 70% 42% reduction in shipping costs 100% reduction in shipping errors
Support Used	Used FlowVision Consultancy to develop Supermarkets RIO software to optimise loading of trollies and trucks

## Key Lessons Learnt

- How to overcome the problems associated with shipping from multiple growing locations to a single shipping site
- How to reduce shipping costs
- How to improve truck and trolley utilization
- How to apply Lean to the design of a new facility
- How to improve upsell whilst increasing truck utilisation
- How to reduce overtime hours and improve work/life balance during peak

# Overview of James Greenhouses

## Short Overview of Business

James Greenhouses was founded in 1998 and based in Georgia. They produce and ship 10 million liners a year across North America

They are a rapidly growing business (at the the time of starting with Lean they were just 2 acres) with a focus on quality and customer service. They are innovative company that has invested in order to remain cost competitive

## Ability to Host

The business would be happy in conjunction with FlowVision to share its experience of lean to a degree (assume if not commercially sensitive, competitive or other reasonable constraints)



Key Information	
Size of business	50 people
Case study page	<a href="https://flowvision.com/case-studies/flowvision-helps-james-greenhouse-improve-productivity-and-throughput/">https://flowvision.com/case-studies/flowvision-helps-james-greenhouse-improve-productivity-and-throughput/</a>
Company website	<a href="https://www.jamesgreenhouses.com">https://www.jamesgreenhouses.com</a>
Sector	Wholesale supply of high quality plugs and liners to growers
Lean and Other Tools Used	Efficiency improvements Work standardisation and documentation Analysis of standard work times and customer requirements to improve calculations for labour requirements Lean Flow technique – Progressive Picking – division of labour
Area(s) of Business	Started in the production processes Improvement to the planning processes Shipping processes
Benefits Realised	Improved productivity by 30% Increases throughput by 25% Their Lean journey enabled the business to grow by 56% in 1-year
Support Used	Used FlowVision Consultancy and attending a 2-day Lean Flow Line Design Workshop
Investment Made	Initial consultancy costs and external courses

## Key Lessons Learnt

- How Lean can be used to improve labour productivity within short timescales and minimal capital investment
- Lean applies to start-up business as well large established organisations
- How standardisation can help improve consistency, ease of training, workforce flexibility and repeatability
- How documenting the new processes can help improve sustainability of the improvements made
- How improving process efficiency can support business growth

# Overview of Flowerwood Nursery Inc



## Short Overview of Business

Flowerwood Nursery is a family owned business started in 1946 with growing locations in Alabama, Florida and Georgia.

The business has gone through a tough transition having lost the majority of its seasonal labour through Alabama's new immigration law that was recently passed. Due to dilution in skills this has reduce labour productivity by 50%

## Ability to Host

The business would be happy in conjunction with FlowVision to share its experience of lean to a degree (assume if not commercially sensitive, competitive or other reasonable constraints)



Key Information	
Size of business	400 acre site
Case study page	<a href="https://flowvision.com/case-studies/flowvision-helps-flowerwood-nursery-reduce-discrepancies-and-increase-productivity/">https://flowvision.com/case-studies/flowvision-helps-flowerwood-nursery-reduce-discrepancies-and-increase-productivity/</a>
Company website	<a href="https://flowerwood.com">https://flowerwood.com</a>
Sector	Wholesale nursery
Lean and Other Tools Used	End to End mapping of the whole business Reduction in process waste and the amount of transportation time across the nursery (CI idea from one of the maintenance managers)
Area(s) of Business	Initial focus was on the shipping area IT/Planning processes
Benefits Realised	Improved productivity by 25% Reduce headcount requirements by 10% which reduce down the pressure to bring in seasonal staff Reduce down picking errors by 80 – 90%
Support Used	Used FlowVision Consultancy and attending a 2-day Lean Flow Line Design Workshop
Investment Made	Initial consultancy costs and external courses

## Key Lessons Learnt

- The importance of having buy-in from the the top management team at the start of the programme
- Initial involvement from all departments from across the business
- Focus of improvement activity was on shipping which had the most labour associated with it
- Improvement to the planning processes and generation of a pick list to eliminate errors – importance of getting quality right at the start of the process rather than at the end of the process
- Involving all areas of the business in the improvements to the shipping layout to ensure company wide buy-in

# Overview of Dark Heart

## Short Overview of Business

Based in California, Dark Heart is a producer of medicinal cannabis which, has seen rapid expansion

The business had become capacity constrained and saw Lean as a way of reducing these constraints

## Ability to Host

The business would be happy in conjunction with FlowVision to share its experience of lean to a degree (assume if not commercially sensitive, competitive or other reasonable constraints)



Key Information	
Size of business	20,000 sq.ft indoor
Case study page	<a href="https://flowvision.com/case-studies/flowvision-helps-dark-heart-nursery-improve-operating-margins/">https://flowvision.com/case-studies/flowvision-helps-dark-heart-nursery-improve-operating-margins/</a>
Company website	<a href="https://darkheartnursery.com">https://darkheartnursery.com</a>
Sector	Wholesale nursery
Lean and Other Tools Used	Four main tools used; Data collection, Calculations/analysis, Design and Implementation End to End process mapping Takt time and line balancing Weighted standard times
Area(s) of Business	Initial focus was on the existing warehouse Design of the new greenhouse facility with the aim of improving workflows to improve operational efficiency
Benefits Realised	Improved productivity by 50% Return on Investment of less than 3 months
Support Used	Used FlowVision Consultancy and attending a 1-day Lean Flow Workshop
Investment Made	Initial consultancy costs and external courses

## Key Lessons Learnt

- How Lean and improving operational efficiency can be used to reduce capacity constraints to support business growth
- How Lean can be used to support seasonal businesses that have concentrated peaks
- How Takt time and weighted standard times can be used accurately calculate current and future labour/equipment requirements based off customer demand
- Future state design/block diagrams to help design future layouts
- How multi-skilling of employees can be used to improve operational flexibility
- Design of shipping supermarkets
- Progressive flow lines/division of labour



## Short Overview of Business

Based in Oceanside California, Mellano are floral business that supplies Southern California and South Nevada

The business started in 1925 and is a family owned business that supplies bulbs and cut flowers into highly price sensitive markets. Productivity and cost reduction are essential to the profitability of the business

## Ability to Host

The business would be happy in conjunction with FlowVision to share its experience of lean to a degree (assume if not commercially sensitive, competitive or other reasonable constraints)

MELLANO & COMPANY

Key Information	
Size of business	375,00 acres
Case study page	<a href="https://flowvision.com/case-studies/flowvision-helps-mellano-company-improves-margins-by-making-lean-flow-a-way-of-life/">https://flowvision.com/case-studies/flowvision-helps-mellano-company-improves-margins-by-making-lean-flow-a-way-of-life/</a>
Company website	<a href="https://www.mellano.com">https://www.mellano.com</a>
Sector	Supply of cut flowers and bulbs
Lean and Other Tools Used	End to End process mapping, Identification of waste within the process, Root cause analysis, Use of Kanbans and optimum stock levels , Calculations and Minimum Order Quantities, Process flow charts and Standard Ops
Area(s) of Business	Initial focus was bulb processing – grade, sort, pack, and ship Next area was cut-flower picking and grading
Benefits Realised	Improved productivity by 30% Floor space utilization by 30%
Support Used	Used FlowVision Consultancy
Investment Made	Initial consultancy costs

## Key Lessons Learnt

- How Lean can be use to improve productivity and profitability of low margin products
- Like most horticulture businesses nearly half of labour costs are in the picking to shipping end of the business and this is the place to start with lean implementation
- Some larger business impact was achieved looking at the lower margin products where margins are very low and improving productivity of these
- How lean can increase capacity and improve space utilization at the same time
- How lean improvements can sometimes feel like they are slower but the data shows otherwise
- How improving accuracy and consistency of picking can improve productivity of operations
- How this in turn improve accuracy of inventory and reduces down the impact of sales having to keep checking inventory amounts and accounts having to deal with discrepancies
- How improving field estimations can help improve sales opportunities
- How by involving the crew chiefs it has encouraged them to identify more improvements



# Summary of benefits



- 56% - 200% increase in sales by eliminating a capacity constraint in operations
- Productivity improvement – 20% - 50%
- Eliminating the reliance on overtime and weekend working during peak (improving work/life balance)
- 70% improvement in transport utilization
- 42% reduction in shipping costs
- 80 - 100% reduction in shipping errors
- 25% increase in throughput
- 10 % headcount reduction in requirements for seasonal labour
- 3 month Return on Investment
- 30% improvement in floor space utilization

# Summary of tools used

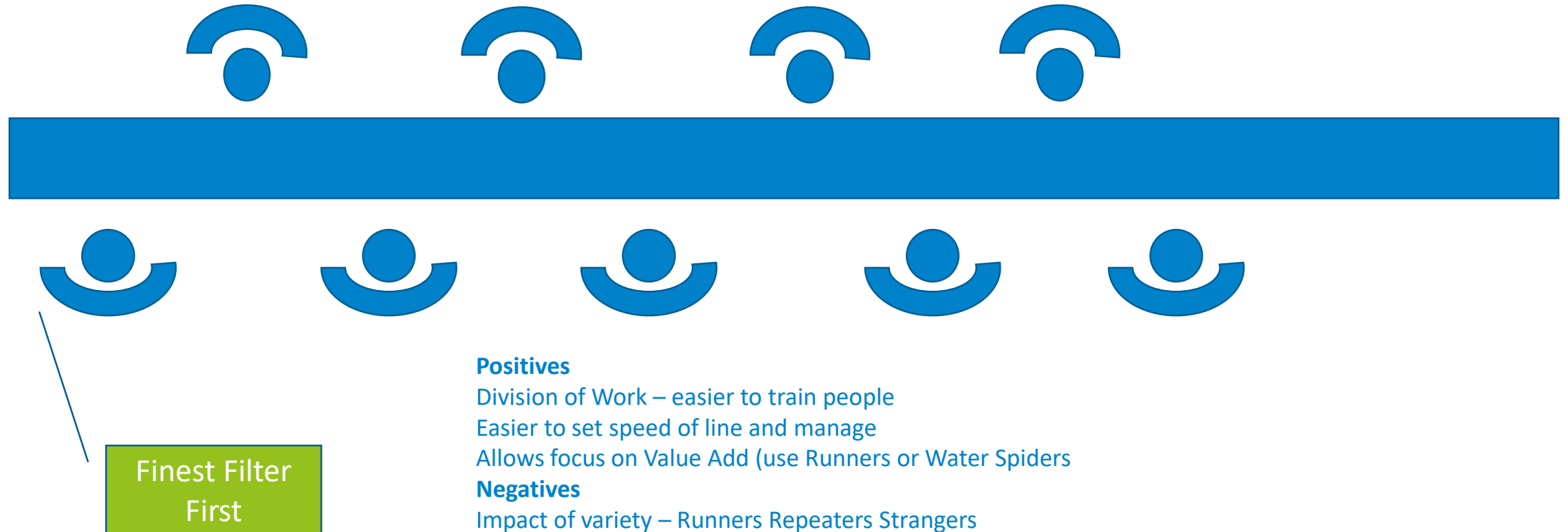


- End to End Process Mapping
- Supermarket Pull Scheduling utilising Kanbans
- Future State Design for new operational layouts
- Division of labour and flow processing (e.g. progressive picking)
- Takt time calculation and Line Balancing
- Deployment of IT for improved labour resource planning
- IT to help improve Danish trolley utilisation
- Continuous Improvement – employee led

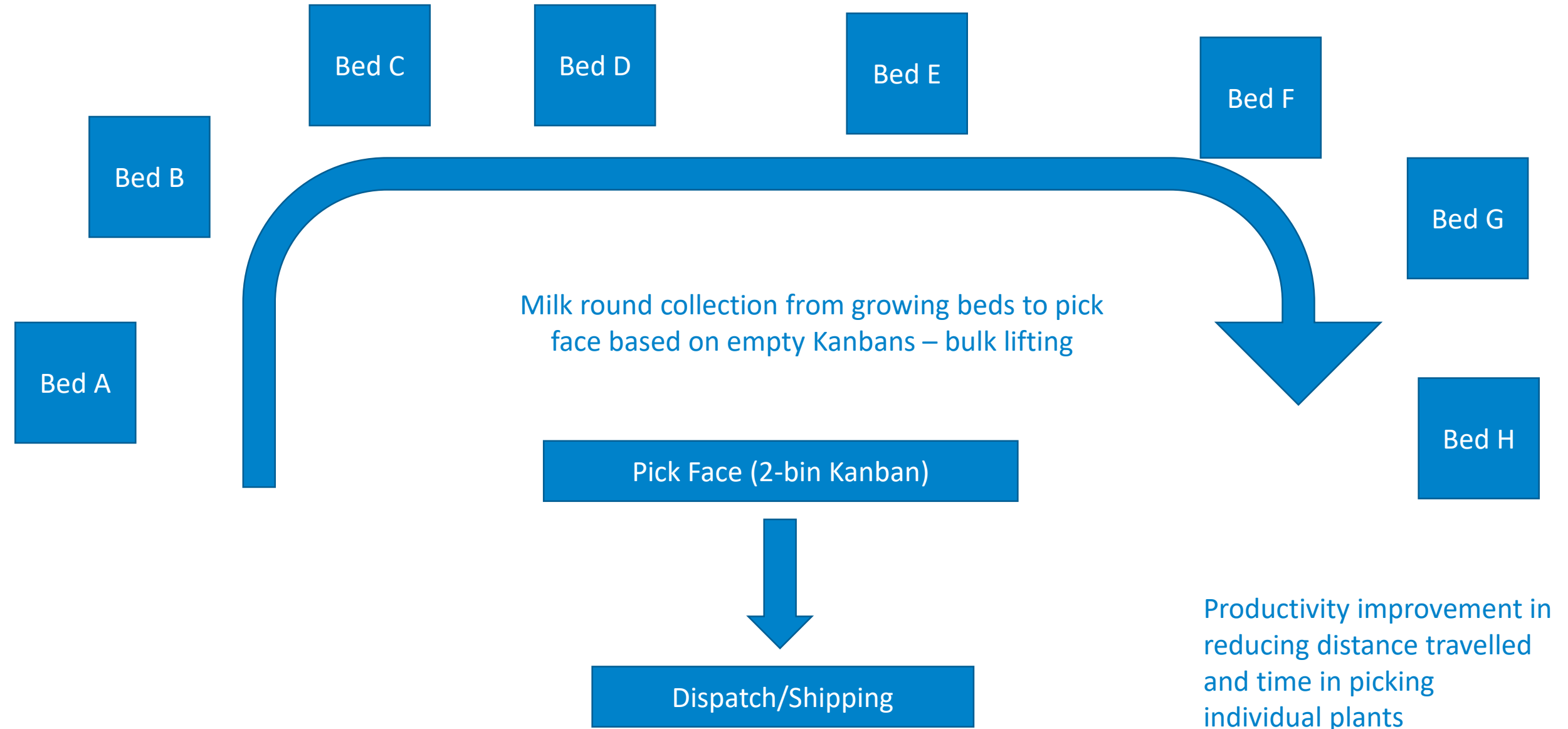
# Takt Time and Flow Processing

Customer requirement – 4,000 per day  
Working Time = 7.5 hours = 27,000 secs  
Takt Time = 1 product per 6.75 secs  
Recalculate weekly and adjust labour requirements

Work Content per Product – 60 secs  
No of people needed on flow line =  $60 \text{ secs} / 6.75 \text{ secs} = 8.88$  or 9 people  
Each person has 6.75 secs of work for line balance apart from last person who has only 6 secs



# Pull Scheduling using Supermarkets/Kanbans



- US growers are similar to the UK growers in that they differentiate on a wide range of products e.g. one stop shop vs. mono crop
- They experience similar shortage of labour and dilution of skills as to the UK
- The focus of cost control is labour which is concentrated on shipping/dispatch and has become the typical starting point for improvement activities
- Focus on reducing shipping costs for improving shipping utilisation
- The Lean support provided has been a combination of on-site consultancy & off-site training (not Government funded)
- Greater emphasis on Pull Scheduling and use of Supermarkets/Kanbans
- Greater emphasis on Flow Processing and balancing against Takt times
- Development of IT solutions to support implementation of Lean e.g. resource planning and shipping utilisation
- Training for senior management team to get their buy-in at the very start
- Problem solving and quality control at the start of the process – ‘Finest Filter First’
- Introduction of ‘Short Interval Control – hourly monitors to provide process control
- Focus on cultural change through in-house champions and wider awareness training
- Accept that the change might not be for everyone and some people may leave as a result
- The need to take a long-term view of Lean implementation
- The need to improve the full ‘End to End’ process rather than just point Kaizen

# Region 4

Rest of the World (ROW)



# Level 2 – Rest of World (ROW)



- Case Study
- Article
- Academic Paper

Search of literature was broadly based on

1. Countries where there appears to be a concentration of horticulture business
2. Indication of implementation of Lean and source of case studies

The literature search uncovered three types of published articles

1. Case studies (by company or consultant/support)
2. Articles in journals
3. Academic papers

Our approach was to find the above with real life examples



# Level 2 – Rest of World



- Case Study
- Article
- Academic Paper

1. Applying lean management principles to agriculture in Russia
2. Swedish Agricultural Businesses empirical study
3. Grow Sweden Case Study
4. Lean in Swedish agriculture: strategic and operational perspectives
5. Lean agriculture applied to South Africa
6. Developing a readiness index for Lean practices in agriculture
7. Application of Lean Six Sigma to Indian Farming Sector
8. Fertile ground for lean seeds
9. Techniques and tools of lean production: multiple case studies in Brazilian agribusiness units
10. Lean production assessment in a sugarcane agribusiness: a case study in Brazil
11. Implementing Lean in a seasonal horticulture sector: Theoretical and practical suitability in NZ pipfruit industry
12. Quality Based Pricing: A Catalyst for Collaboration and Sustainable Change in the Agrifood Industry
13. Ardmore Nurseries
14. Relationship Management and Lean Analysis in Maintaining Horticulture Supply Chains with Micro-businesses
15. Lean Flow Management for Production
16. Determining Factors Driving Sustainable Performance Through the Application of Lean Management Practices in Horticultural Primary Production
17. Scarborough Fare

# Overview of literature

No.	Name	Type	Synopsis	Region/ Location	Sector(s)	Link
1	Applying lean management principles to agriculture in Russia	Article	Interview with Anton Ulanov the CEO of one of the largest agricultural businesses in Russia. He talks about the application of lean at Agroholding Kuban, discussing the wider challenges and opportunities for lean in agriculture.	Southern West Russia (Krasnodar Region)	Beef and Lamb Cereals and Oilseeds Dairy Pork	<a href="https://planet-lean.com/russia-agriculture/">https://planet-lean.com/russia-agriculture/</a>
2	Swedish Agricultural Businesses empirical study	Academic Paper	The aim of this study is to explain how agricultural firms can use Lean as a way to work with leadership, by evaluating indicators which have potential to make Lean leadership successful.	Sweden	Dairy Pork Field Vegetables Cereals & Oilseeds Poultry	<a href="https://stud.epsilon.slu.se/7214/1/Andersson_et_al_140826.pdf">https://stud.epsilon.slu.se/7214/1/Andersson_et_al_140826.pdf</a>
3	Grow Sweden Case Study	Case Study	Grow Sweden case study of Lean implementation into Anders and Katrina Nilssons farm	Sweden	Dairy	<a href="http://intervju.med.andersnilsson.vxa.se">Intervju med Anders Nilsson (vxa.se)</a>
4	Lean in Swedish agriculture: strategic and operational perspectives	Academic Paper	The purpose of this article is to present and test a framework for lean implementation in the agricultural sector, addressing challenges from an operational and strategical perspective	South Western Sweden	Field Vegetables Hard Nursery Stock Beef and Lamb Dairy Pork	<a href="https://www.tandfonline.com/doi/full/10.1080/09537287.2018.1479784?scroll=top&amp;needAccess=true">https://www.tandfonline.com/doi/full/10.1080/09537287.2018.1479784?scroll=top&amp;needAccess=true</a>
5	Lean agriculture applied to South Africa	Article	Lean agriculture applied to South Africa to help farmers improve operational efficiency	South Africa	General with specific Dairy example	<a href="https://www.farmersweekly.co.za/agribusiness/agribusinesses/the-lean-farming-philosophy/">https://www.farmersweekly.co.za/agribusiness/agribusinesses/the-lean-farming-philosophy/</a>
6	Developing a readiness index for Lean practices in agriculture	Academic Paper	The first goal of this master thesis is to gauge how acquainted the farmers already are with the concept of lean and how high the interest and enthusiasm is towards lean practices. The second aim is to detect the readiness factors specific for farmers. This way they can assess if they are ready to commence the lean journey	Flanders, Belgium	Field Vegetables Soft Fruit Hard Nursery Stock Protected Ornamentals Beef and Lamb Dairy	<a href="https://libstore.ugent.be/fulltxt/RUG01/002/273/878/RUG01-002273878_2016_0001.AC.pdf">https://libstore.ugent.be/fulltxt/RUG01/002/273/878/RUG01-002273878_2016_0001.AC.pdf</a>

# Overview of literature

No.	Name	Type	Synopsis	Region/ Location	Sector(s)	Link
7	Application of Lean Six Sigma to Indian Farming Sector	Academic Paper	India is agricultural dominant economy with many challenges to farmers. The application of lean six sigma technique in the farming sector will motivate farmers to minimise the cost of production and optimize the profit gain through farming. The primary objective of this research is to minimise the farming cost of production and streamline the farming processes.	Maharashtra state, India	General	<a href="https://www.academia.edu/37363163/Application_of_Lean_Six_Sigma_to_Indian_Farming_Sector">https://www.academia.edu/37363163/Application_of_Lean_Six_Sigma_to_Indian_Farming_Sector</a>
8	Fertile ground for lean seeds	Article	Lean Institute Brasil is running pioneering lean experiments in agriculture. The authors reflect on the challenges of transforming traditional farming culture and the opportunities lean affords.	States of Mato Grosso and Mato Grosso do Sul in Brasil	Cereals and Oilseeds Beef and Lamb	<a href="https://planet-lean.com/lean-agriculture-brasil/">https://planet-lean.com/lean-agriculture-brasil/</a>
9	Techniques and tools of lean production: multiple case studies in Brazilian agribusiness units	Article	The article aims to conduct research through multiple case studies concerning the use of techniques and tools of Lean Production System in agribusiness organizations.	Brasil	Cereals and Oilseeds Pork	<a href="http://www.scielo.br/pdf/gp/v27n1/0104-530X-gp-27-1-e3252.pdf">http://www.scielo.br/pdf/gp/v27n1/0104-530X-gp-27-1-e3252.pdf</a>
10	Lean production assessment in a sugarcane agribusiness: a case study in Brazil	Academic Paper	The Brazilian sugarcane agribusiness has emerged as one of the main drivers of the economy. Over the past four decades, Lean Production has been recognized as a management model in efficiency and competitiveness, this article aims to evaluate the use of philosophy, techniques and tools of Lean Production System in a sugarcane agribusiness in State of São Paulo.	State of São Paulo, Brasil	Field Vegetables	<a href="http://www.ijmp.jor.br/index.php/ijmp/article/view/471/577">http://www.ijmp.jor.br/index.php/ijmp/article/view/471/577</a>
11	Implementing Lean in a seasonal horticulture sector: Theoretical and practical suitability in NZ pipfruit industry	Academic Paper	NZ pipfruit has challenging targets but has traditionally not performed well. One of governments strategies was to deploy Lean thinking, but the opportunity has not been taken up as hoped. The aim of the study is to research the concept of Lean and its theoretical fit and practical applicability in a horticultural setting, specifically the pipfruit sector in New Zealand	New Zealand	Tree Fruit	<a href="https://www.agriculturemorethanever.ca/from-the-team/lean-manufacturing-a-competitive-edge/#.Xp13fG5FyAg">https://www.agriculturemorethanever.ca/from-the-team/lean-manufacturing-a-competitive-edge/#.Xp13fG5FyAg</a>

# Overview of Literature

No.	Name	Type	Synopsis	Region/ Location	Sector(s)	Link
12	Quality Based Pricing: A Catalyst for Collaboration and Sustainable Change in the Agrifood Industry	Academic Paper	To establish learning points on how an alternative to traditional standard costing and inter-company transfer pricing mechanisms can be developed and implemented for non-engineered (agrifood) products such as primary farm produce that acts as a catalyst for inter-firm collaboration as a part of a supply chain-wide Lean change initiative	Australia	Soft Fruit	<a href="https://www.researchgate.net/publication/235303436_Quality-based_pricing_A_catalyst_for_collaboration_and_sustainable_change_in_the_agrifood_industry">https://www.researchgate.net/publication/235303436_Quality-based_pricing_A_catalyst_for_collaboration_and_sustainable_change_in_the_agrifood_industry</a>
13	Ardmore Nurseries	Case Study	A case study and article about Ardmore Nurseries Lean implementations	Auckland. New Zealand	Protected Ornamentals	<a href="https://nz.kaizen.com/news/ardmore-nurseries-progresses-with-kaizen.html">https://nz.kaizen.com/news/ardmore-nurseries-progresses-with-kaizen.html</a> <a href="http://admin.ips.org/uploads/IPPS-WR_2016_Watt.pdf">http://admin.ips.org/uploads/IPPS-WR_2016_Watt.pdf</a>
14	Relationship Management and Lean Analysis in Maintaining Horticulture Supply Chains with Micro-businesses	Academic Paper	A model for the generic application of relationship management to smaller enterprises is proposed in which the effects of continued adherence in inter-company relationships, and supply system configuration, are examined in relation to the effectiveness of collaborations	Wales	Field Vegetables Hard Nursery Stock Other (Veg Pie Production)	<a href="http://centmapress.ilb.uni-bonn.de/ojs/index.php/fds/article/view/832/717">http://centmapress.ilb.uni-bonn.de/ojs/index.php/fds/article/view/832/717</a>
15	Lean Flow Management for Production	Article	An articles about the application of Lean flow management at Hoffman Nursery to improve production efficiency	North Carolina, USA	Protected Ornamentals	<a href="https://aggie-horticulture.tamu.edu/syllabi/431/LeanFlow-EppsIPPS%20Vol%2059-2009.pdf">https://aggie-horticulture.tamu.edu/syllabi/431/LeanFlow-EppsIPPS%20Vol%2059-2009.pdf</a>
16	Determining Factors Driving Sustainable Performance Through the Application of Lean Management Practices in Horticultural Primary Production	Academic Paper	This study investigates the determining factors that drive sustainable performance through the application of lean methods in the primary production segment of the horticultural supply chain for apples and pears	Western Cape of South Africa	Soft Fruit	<a href="https://www.x-mol.com/paper/782897">https://www.x-mol.com/paper/782897</a>
17	Scarborough Fare	Case Study	How Scarborough Fare implemented Lean principles and techniques into their horticultural production unit growing premium grad, fresh-cut culinary herbs	New Zealand	Protected Edibles	<a href="https://www.kaizen.com/blog/post/2019/06/27/scarborough-fare-applies-kaizen-in-horticulture.html">https://www.kaizen.com/blog/post/2019/06/27/scarborough-fare-applies-kaizen-in-horticulture.html</a>

# Conditions driving need for improvement in agriculture and horticulture sectors

There were a number of common challenges for the sector across the world, providing a mixture of incentives to change and considerations when implementing Lean.

- Increased global and regional competition
- A general move towards large scale production, with bigger units and more employees. A challenge for more traditional farm owner/manager to manage
- Market prices change very rapidly and at short notice and are hard to predict
- Changing climate and weather conditions provide quality and variability challenges (drought, weather, attack by pests and diseases)
- Products are highly perishable and have a short shelf life
- High variability in production volumes
- Most crops have long lead times from planting to harvest and are seasonal
- A global need to increase food production without significant environmental and social burden



# Triggers or catalyst for improvement activity

Although the conditions the sector operates within, should be a catalyst or need for change it is not cited as the trigger for action. Often the triggers are:

- More immediate term operational issues (Improved labour productivity, maintaining quality, improving yield)
- Individuals read or hear about Lean and decided to find out more
- Making investments in production facilities and equipment. Benefits of which would not be realised without changes in process and employee mindset
- A desire for more order and control
- A need for more consistency in quality of product
- Improve the way that people work together

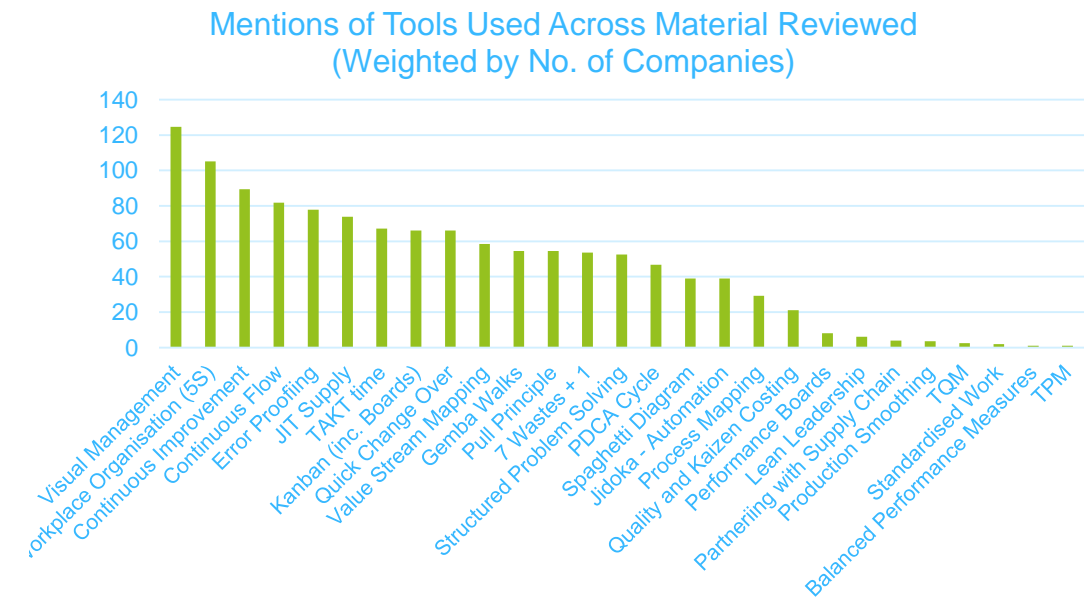
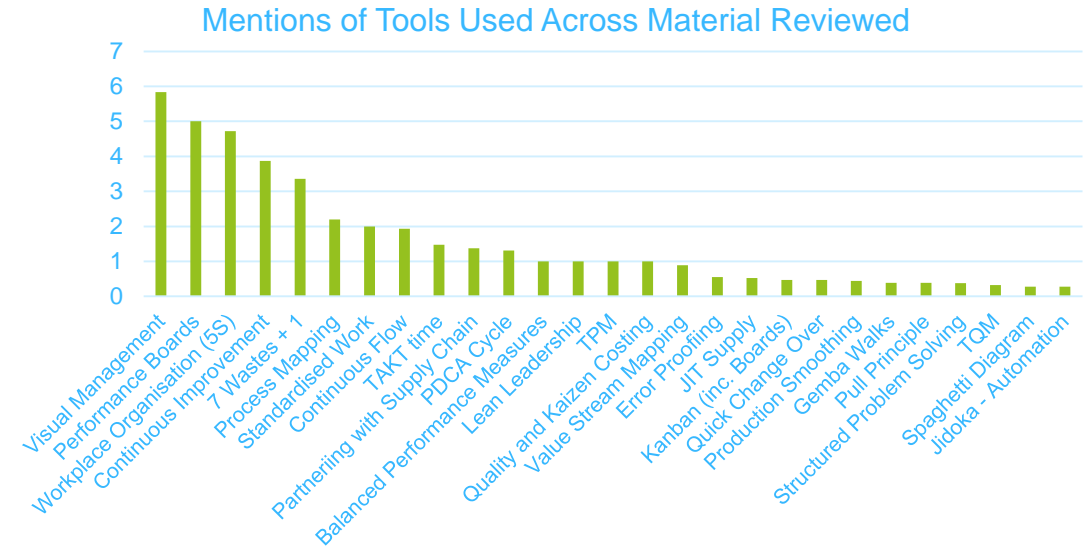
# What Tools/Methodologies are commonly adopted

As is often the case in reviewing material about Lean, there is a plethora of tools and terms (these are a mix of tools, principles and philosophies)

A high level analysis of the tools described in the review material, shows a number of tools that are more prevalent than others:

1. Visual Management (VM)
2. Workplace Organisation (5S)
3. Continuous Improvement (Kaizen)

Weighting the data by the number of businesses engaged in the case study, articles, and academic papers heavily weights the data to one detailed paper on research with 140 businesses





# What Tools/Methodologies are commonly adopted

Two themes appeared to emerge from the research:

1. The application of tools to reduce non value adding activity and improve efficiency fits well with a farmers desire to make improvements in the immediate term (e.g. 7 wastes, process analysis)
2. With farms often employing temporary multi language employees, and with a lack of formally trained managers, significant benefit in performance and well-being comes from tools that:
  - Assist managers in planning, managing and communicating (e.g. Performance Boards, Stand Up Daily Meetings/Huddles, Continuous Improvement, Visual Management).
  - Make the way that processes, work environments and ways of working clear and consistent for all with little need for constant supervision (e.g. Workplace Organisation, Visual Management, Standardised Work/Instructions)

# Benefits realised

The benefits cited in the material are summarised in the table.

These support the fact that a Lean system delivers improvements to both

- Tangible performance metrics (efficiency of operation, the quality of product and on time delivery)
- Softer benefits (improved communication, team work and morale)

More Specifically	Examples
Team Work	“employees at the farm work really well together as a team” “staff were involved and initiated more improvements 'making things simple'”
Communication	“it was easy for me to get into work – I see directly on the board what to do” “Staff are more engaged because they have a forum to put forward their ideas and see the progression from idea to implementation.”
Leadership	“data shows that employees experience that the leadership has in general improved”
Efficiency	“a 9% increase in milk production per cow, a 48% decrease in purchased feed cost, and a 52% decrease in feed cost/kg milk sold.” “faster weight gain for cattle with less cost” “Labour cost per carton improved year on year” “Increased efficiency of resource use in production”
Yield	“reduction of losses during crop plantation and harvest” “solid pack yield (a measure of effectiveness of the conversion of fruit to canned product) has increased by 20%” “the maximization of crop yield”
Quality	“improvements in management of calf weight” “better quality and availability of plants through timely production cycles”
Others	“sales have increased from 12 to 17 million” “Delivery in Full On Time with correct quality, has improved from 22% for the first quarter of 2004 to 78% in the first quarter of 2005” “shorter Lead Times, and making their information and work activities more transparent”

# Lessons learnt (1 of 2)

- **Adapt Lean** – the sector has some characteristics that don't fit completely with the Lean paradigm (product is pushed rather than pulled because of seasonal nature, long lead times from planting to packed and sold, large varieties of customer requirements). These need to be recognised and the Lean principles and techniques adapted appropriately
- **Time** – there are often quick wins, but implementation is an ongoing/long term and takes time and commitment. The materials show that implementations often fail because of lack of time and that committing and scheduling time to do improvements is a key to success
- **Employee Resistance** – as with any change programme, employee resistance is one of the key challenges. Their training in the principles and involvement in the change is crucial
- **Importance of knowledge and training all** – the importance between training and lean performance is well documented and the material supports the need to train all in the principles

“Embrace the concepts of discipline and habit”

“Take what works, and leave the rest

# Lessons learnt (2 of 2)

- **Leadership** – management engagement is seen as crucial to success but a challenge. The focus is often on short terms goals and they don't empower/engage the workforce. Lean needs to be a strategic programme not isolated and tactical
- **Perception of Lean** – there are several examples where early farmer's perception of Lean was not managed which led to issues and problems during implementation, for example perceptions are, Lean is just a set of tools rather than a total business system, it is short term process improvement not cultural and long-term strategy, it is about quick wins, it can provide “out of the box” processes, it can be implemented with passive engagement of staff.
- **Challenge preconception** - the sector needs to challenge some of the constraints it sees it has no influence over (for example nothing can be done about costs, no influence over customers, convoluted value stream and relationships)

‘You can't  
manage what you  
can't measure’,

‘you can't  
manage what you  
can't see’.

Be prepared to  
do the “small  
stuff” to get the  
show on the road;

# Rest of World – Findings against Level 3 hypothesis

Hypothesis	Is there evidence?	Does it support the hypothesis?	Notes
Businesses of a certain scale can more successfully implement improvement activities	Yes	No	The material covers a breadth of business sizes and scale, and one paper (Developing a Readiness Index for Lean Practices in Agriculture) describes the challenges between large and small organisation. To summarise small and large scale both have challenges and advantage but neither less or more on the whole.
Businesses that are more advance in the adoption of Lean see sustained improvements in their overall business performance (especially their bottom line)	Some	Yes	There is evidence that once organisations become more mature they are able to utilise the tools and techniques more extensively. Statistical analysis of this is contained in Implementing Lean in Seasonal Horticulture: Theoretical and Practical Suitability in NZ Pipfruit Industry
Businesses that produce at high volumes with low levels of variability are more successful in adopting Lean	Not Really	Yes	The challenges of seasonality, high levels of variability in customer requirements are cited in the material as making Lean implementation more difficult. So the assumption is that high volumes and low variability would be easier
There are common processes within a sector where Lean is predominantly applied	Some	Yes	There appears to be some consistency in that the core business processes are where Lean is predominantly applied (e.g. picking, packing etc.). Often it appear to be the areas of high labour content and/or volume

# Rest of World – Findings against Level 3 hypothesis

Hypothesis	Is there evidence?	Does it support the hypothesis?	Notes
Processes or areas where there is high volume with low levels of variability are where Lean is predominantly adopted	Some	Yes and No	As with the previous point it does appear that there is a preference for processes with high volume. As mentioned before variability is seen as a challenge but there is not significant evidence to say that it is adopted more in areas with less variability
There is correlation between the amount of effort put into Lean activity and the results it achieves	Yes	Yes	One of the lessons learnt in previous slides was that time and effort put into Lean is crucial to its success. In addition, the NZ Pipfruit study showed how over time adoption of Lean improved and also that with coaching/support or employment of experience practitioners, adoption is improved
Lean has relatively quick payback periods	No	-	There is indication that Lean delivers quick wins and that it is perceived as doing so but there is nothing really substance in this material
Support from outside the organisation accelerates the adoption of Lean and its associated benefits	Yes	Yes	As previously mentioned the NZ Pipfruit study showed how over time, adoption of Lean improved with consultancy support more than without. In addition, there is evidence that organisations supporting/representing the sector has introduced programmes of consultancy support

# Rest of World – Findings against Level 3 hypothesis

Hypothesis	Is there evidence?	Does it support the hypothesis?	Notes
There is a common set of Lean tools that used regardless of the level of adoption of Lean	Some	Yes	Even though there are a large variety of tools mentioned within the material (see slide on tools/methodology) there are some that are more common. Visual Management, Workplace Organisation (5S), and Continuous Improvement (Kaizen) being the most common
Agricultural and Horticultural business will generally have lower levels of adoption than the more traditional sectors where Lean is applied (e.g. manufacturing)	Yes	Yes	The challenges the sector faces across the world are similar, and there is evidence Lean can help. However it is also true to say that adoption is generally lower than in other sectors. Some of the reasons mentioned in previously slides may be the cause (seasonality, long lead times from planting to packed and sold, large varieties of customer requirements)
Companies implementing Lean come across similar barriers to success	Yes	Yes	These are summarised in the Lessons Learnt slides. Specially, time, employee resistance, perception of Lean and leadership capabilities
There are common things that go well and not well when adopting Lean	Yes	Yes	Again summarised in the Lessons Learnt slides.



# Scoping of Research

Presented in May 20



# Hierarchy for Research

Level 1 – International areas where there are concentrations of Agricultural and Horticultural Businesses

Level 2 – Within these concentrations the number of Agricultural and Horticultural Businesses who have implemented Lean to some degree and the number of Lean businesses outside of the sector within the concentrations defined above

Level 3 – For each business, an overview, their experience of Lean, how far they are on the Lean adoption scale, can they host visits.

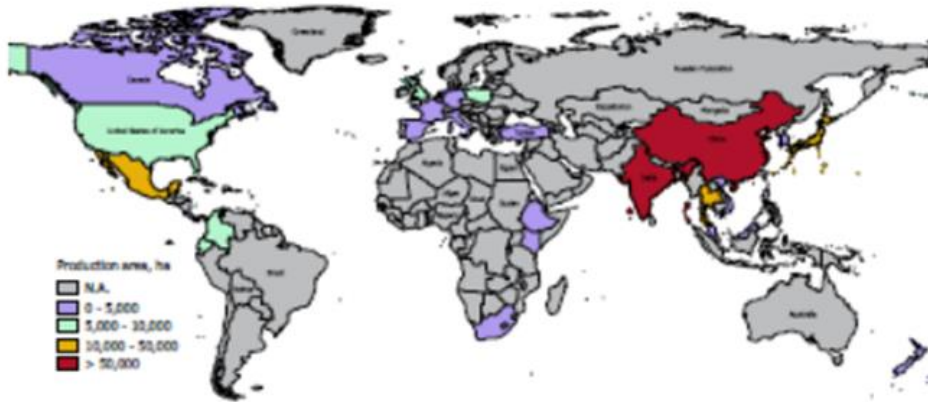
# Level 1 – International Hypothesis and Criteria for selection

- There are countries and sub regions where there is a higher concentration of horticulture and agriculture businesses and it is within travelling distance of other industries.
- Criteria for Selecting Countries and Regions
  1. A high concentration of Agricultural and Horticultural businesses
  2. Initial indication shows that there is some level of adoption of Lean in these areas
  3. There are other sectors who have potentially adopted Lean in the region
  4. It is relatively easy to undertake a study tour in the location (low language/cultural barriers, travel not prohibitive)
  5. The effort to undertake the research is not prohibitive (language/cultural barriers, identified local partners)

# Level 1 – International Heat Map

Important producers of cut flowers

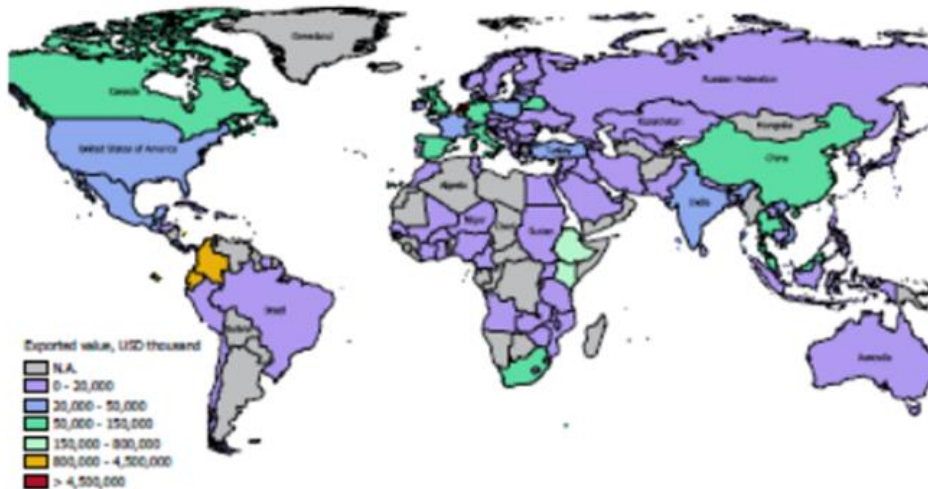
Production area in hectares



Source: ITC Trade map, 2019

Important export countries of cut flowers

Value in 1000 USD



Source: ITC Trade map, 2019

	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5
Area 1					
Area 2					
Area 3					
Area 4					
Area 5					

## Criteria

1. A high concentration of Agricultural and Horticultural businesses
2. Initial indication shows that there is some level of adoption of Lean in these areas
3. There are other sectors who have potentially adopted Lean in the region
4. It is relatively easy to undertake a study tour in the location (low language/cultural barriers, travel not prohibitive)
5. The effort to undertake the research is not prohibitive (language/cultural barriers, identified local partners)

# Level 2 – Hypothesis and Criteria for Selection

- For each sub region we can identify approximately 8 businesses within either horticulture or agriculture and 8 outside of the sector who appear to have adopted Lean
- Criteria for Sub Region Companies
  1. They are within in travelling distance of each other (assuming a study tour would visit two businesses per day)
  2. The 8 businesses are from horticulture or agriculture not a mix
  3. Through initial desk based research they appear to have adopted Lean