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INTRODUCTION

Every farmer sets out to be as efficient as possible and new technologies are one way to improve on-farm efficiency whether by improving performance, reducing costs, increasing the effectiveness by which tasks are carried out or a combination of these reasons.

Dairy farming has seen considerable technological advances in the past few years across all areas of the business with every development claiming significant benefits to any farmer wise enough to invest in it. The challenge is in deciding whether a specific technology will be appropriate to an individual business and how to get the best from the investment. But how do you make a decision on the potential value of an investment in new technology to your business?

This report sets out to provide help in the decision making process when considering new technologies for dairy farm businesses. It provides a method for considering how a technology might fit into a farm system and then evaluates some of the recent new technologies. In reviewing the available or new technologies, consideration has been given to profitability, practicality and their impact on cow welfare and the environment.

We hope this guide will help you to make the right decisions for the future and that you are able to make the best of the available new technologies. The principles in this guide can be applied to any new technologies as they come on stream.



HOW TO EVALUATE THE TECHNOLOGY ON YOUR FARM

Any decision about investing in a new technology should be made on the same basis as any other investment decision. The investment must make a significant contribution to farm performance and must be truly affordable. The difference with new technology is that the potential benefits may be less well understood and the approach will probably be new to the farm.

When assessing a new technology it is therefore important to follow a structured approach which can be summarised in five stages as follows:

- Consider the priority areas on your farm where you have an opportunity to make savings or generate more income – it is best to prioritise and focus on just one or two key areas. It is important that the investment tackles a fundamental as opposed to a minor aspect of business performance. Example areas might be:
 - Cow performance
 - Staffing efficiencies
 - Machinery savings
 - Cow fertility
 - Cow health
 - Record keeping
- 2. Consider what actions could be taken with no capital expenditure. These changes will usually be the most cost effective although the degree of return may be less. For example:
 - Dairy Hygiene Before investing in a new technology to try to reduce bactoscans and cell counts, consider whether changes to milking routine might have the same effect.
 - **Nutrition and feeding** Can you change the feeding system without a new machine? Can existing feeders be upgraded rather than replaced?
 - **Better records and heat detection** Instead of purchasing a new computer to keep cow records on would a circular breeding board be more useful for all staff involved in heat detection?



- More efficient labour planning or restructuring If your cowman has lost motivation in milking, will a new parlour be the answer or are there other issues that need resolving?
- **Cow health** Can better ventilation be achieved through improvement in air inlets and outlets rather than by purchasing a fan?
- 3. Assuming little can be done without capital expense, consider which technologies may help. Make sure that you fully understand how they work, that it makes sense and that the costings are feasible. Are there any other limiting factors that may reduce the performance of the new technology? For example, entering into any type of fertility improvement programme will only work if the ration is balanced without excessive protein and herd health is good.
- 4. Obtain quotes for the installation/supply of the technology on your farm and ask to visit at least one current user to discuss the benefits. It is important to include any building alterations and running costs. Use this information to establish what improvement in performance needs to be achieved to cover the running costs and the capital required to set up the new system. An example is shown below:

Item	£
Capital cost - £10,000 written off over 4 years	£2,500
Annual running costs	£500
Average interest costs	£350
Total annual improvements required	£3350

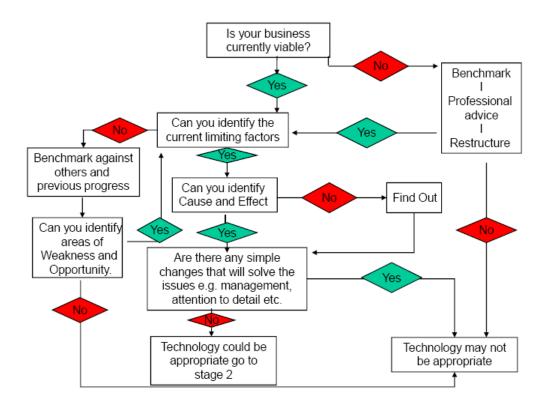
5. Consider what the risks would be if the technology did not work on your farm. How much money could you get back if you were to sell it? Can you afford it if it doesn't work?

Remember technology alone cannot solve all farm problems and more fundamental action may be more appropriate. Use the following decision tree to decide if technology is the appropriate approach for your particular business.



Figure 1. Is Technology the next step for me?

Is Technology the next step for me?



Once you have worked through the approach to decide if a technology might justify investment, the following Q&A list will help when looking at the potential of technology on your farm.

- 1. Is performance below average in the area affected? Is the area a high priority for attention?

 YES/NO
 - a. Benchmark your business against others
 - b. Identify how serious the problem is
 - c. Will the investment have a significant impact on farm performance and profitability?



- Do you understand how the technology works and is there independent research to support and justify the claims?
 YES/NO
 - a. Do not be 'blinded' by sales 'patter'
 - b. Use the internet
 - c. Seek independent advice ask your vet or consultant for their opinion
 - a. Don't be afraid to ask questions and don't be bullied into a purchase
- 3. Have you visited one or more farms and seen it working?

YES/NO

- a. Ask the farmer whether it has met his expectations?
- b. Think about how it would work on your farm. Are there any practical limitations?
- 4. Are the capital costs and running costs realistic and affordable?

YES/NO

- a. Think about how much you could afford to loose
- b. Include Quotes, finance, other costs e.g. building, labour, resale value
- 5. Is the anticipated level of target performance improvement high enough to justify the investment? **YES/NO**
- 6. Would you and your staff be motivated to make the technology work? YES/NO
 - a. Are there any hidden agendas that would reduce the effectiveness of the product on your farm?
- 7. Will it integrate well with current and future systems? For example, would the pedometers ID system work with your planned purchase of new feeders next year?
 YES/NO
- 8. Will the after-sales support be reliable and competitive?

YES/NO



- 9. If the product does not solve the problem, would it be easy and cheap for you to return to your original system?
 YES/NO
 - a. Identify the worst case scenario
 - b. Identify the second hand value and the likely capital lost

SELECTED TECHNOLOGIES

This booklet aims to summarise those technologies for which there is a proven benefit through research. The selected technologies have been divided in to 3 key headings.

- Fertility
- Cow Health
- Efficiency Enhancing Technologies

Inevitably there is a degree of overlap. For example technologies to improve fertility can also make claims to improve performance. Equally many technologies will be promoted on the basis that they save labour.

This section considers each technology in detail looking specifically at:

- 1. How the technology works
- 2. The key impacts it has on efficiency
- 3. The costs and benefits based on a partial budget for a typical dairy farm
- 4. Critical success factors the elements that will have a major bearing on the effectiveness of the technology
- 5. Risk what are the potential risk to your business from investing in the technology?



- 6. Welfare assessment how will the technology impact on animal welfare. Technologies have been assessed against the RSPCA five freedoms and ranged on a simple scale as follows:
 - a. + means the technology will potentially have a beneficial effect on welfare
 - b. = signifies that the technology has no effect on welfare
 - c. means that the technology will potentially have a detrimental effect on welfare
- 7. Environmental assessment. What impact if any will the technology have on the environment

Fertility Management Technologies

Effective fertility management is still at the heart of profitable dairy farming systems and over the past 15 years fertility performance, however measured, has been declining. A number of technologies have been developed to help with several aspects of fertility management.

Contracted Breeding Management

This technology involves a dedicated technician regularly visiting the herd and taking responsibility for fertility recording, heat detection and inseminations. As such it is more of a management practice than a technology, although the dedicated technician will make use of a variety of individual technologies to achieve the objectives

How does it work?

The technician will visit the farm each day to observe the cows, focussing on the cows that are due to be served and others which have not been confirmed pregnant. The technician is trained to observe cow behaviour that will give an indication of heat and tail paint is also used as an aid. At each visit the technician will inseminate the cows that are bulling and tail paint the cows that need to be observed further. All of the fertility information is recorded so that targets can be set and fertility performance monitored. The farm contracts the organisation to look after the fertility although all farm staff are encouraged to inform the technician if they see cows on heat.



Key impacts on efficiency

- Aims to optimise herd fertility and maximise pregnancy production
- Targets to improve heat detection rate by 15%
- · Labour savings as heat detection and AI are contracted out
- Releases herdsman to concentrate on other areas of herd management
- All fertility recording undertaken by the technician

Costs and benefits

The Partial budget in shown in Table 1 considers the costs and benefits that are derived on an average farm. The greatest impact will come where there is the poorest current fertility and where the farm operation does not allow a focus to be maintained on managing fertility.

Table 1 Partial budget contracted breeding management

Costs Saved/Ext	sts Saved/Extra Income per cow		ra Costs per cow
Costs Saved		Income Lost	
Current AI and Semen	28		0
Extra income		Extra costs	
Improved fertility*(1.)	94	Technician Fees	30
		Total Semen	25
<u>Total</u>	122	<u>Total</u>	55
Total Benefits Per Cow = £67			
200 Cow herd £13,400			

^{*1.)} Based on reducing Calving Interval from 410 Days to 380 days. Source: Table 1.1 MDC pd+ 2nd Edition Esslemont and Kossaibati, = £3.13/day



Critical success factors

To make this system work the following have been identified as critical:

- Commitment of herdsman to communication and team work
- Ensuring anticipated savings are realised e.g. reducing labour costs, maximising time use of current staff
- Nutrition and cow management to facilitate fertility
- Good environment for observation of oestrus and cow performance
- For the average cow above, the breakeven point is achieved when calving interval falls by 8.6 days

Risk

There is no capital involved in this technology, although there may be conditions regarding the use of semen from a specific supplier. Patience is required as the returns materialise in the second year of operation when the cows calve again for their next lactation. In the first year it is important to monitor the fertility information to quantify the improvements in pregnancies achieved.

Welfare and environmental assessment

Welfare - this technology, although encouraging greater productivity, will not work unless good welfare standards are in place. It is worthwhile ensuring that as much as possible is done in the following areas.

Table 2 The RSPCA 5 freedoms and impact on contracted breeding management

Freedom From	Effect	Detail
Hunger and Thirst	=	
Discomfort	=	
Pain, injury and disease	=	
Express normal behaviour	+	More flexible service times/location
Fear and Distress	=	



Environmental considerations

These systems allow for a greater productivity and in theory this could lead to less animals being kept to meet the production requirements. On a national scale one could argue that less cattle would have a positive impact in reducing green house gas emissions and waste.

CCTV

Camera systems are installed in housing sheds and calving barns to allow cows to be observed for heat or calving and can also be used for security.

How does it work?

The cameras can either be hard-wired or can be wireless. They can be linked up to a TV monitor or recording equipment. There are various different types.

- Static Cameras this can be placed to view certain specific areas
- Motion Sensing these cameras are activated by motion and will only record when motion is detected, limiting the amount of CCTV footage that is recorded
- Web cams these are improving in quality and can be accessed from any broadband Internet connection
- Night and day cameras some cameras are specifically designed to operate in low light situations
- Surveillance cameras these can be used to zoom in and move to allow the operator a broader view

Key impacts on efficiency

- Herdsmen can watch livestock from the comfort of their own home. It can be used to conduct night checks on calving cows
- It can provide added security for the farm
- It may encourage better work rates for farm staff



Costs and benefits

The costs of CCTV can vary greatly from £100 to several thousand pounds depending on the system. The benefits can be threefold:

- Peace of mind/security
- Observation of downer/calving cows
- Observation of oestrus

The use of this technology would have to be reviewed on a case by case basis. Greater benefits may be seen in management of a system with limited staff.

Critical success factors

To make this system work the following have been identified as critical:

- Commitment of herdsman and discipline to view the footage or observe animals when required
- Cameras need to be kept clean and out of harms way
- Cameras need to situated in areas where there is a good and complete field of vision

Risk

There is a capital cost in the set up of the CCTV system and the cameras. This risk would be reduced by their resale value.

Welfare and environmental assessment

Welfare - the CCTV system would hopefully allow welfare issues associated with calving cows etc to be identified quicker, allowing staff to respond more quickly particularly when there are fewer staff available.



Table 3 The RSPCA 5 freedoms and impact on CCTV

Freedom From	Effect	Detail
Hunger and Thirst	=	
Discomfort	=	
Pain, injury and disease	+	Potential reduction due to better monitoring
Express normal behaviour	=	
Fear and Distress	+	Potential reduction due to better monitoring

Environmental considerations

There are no environmental impacts

Sexed Semen

This is a relatively new technology, which greatly increases the prospects of heifer calves being born.

How does it work?

The sperm are sorted by a process called flow cytometry. This process involves marking the X (female) and the Y (male) chromosome with an electrical charge as the sperm flows past a laser beam. A further electrical charge then sorts them into male and female sperm. A sexed semen straw will contain 90% female sperm so in theory giving a 90% chance of producing a heifer calf

Key impacts on efficiency

- Fewer lower priced dairy bull calves are produced
- Easier calvings leading to more live calves and less subsequent post calving infections or veterinary intervention
- Minimises AI and semen costs as fewer dairy straws should be used
- Reduce disease risk from bought in replacements
- Maximise revenue from beef cross calves from remaining herd



Costs and benefits

The partial budget shown in Table 4 identifies the costs and benefits of using sexed semen.

Table 4 Partial budget sexed semen

Costs Saved/Extra Income		Income Lost/Extra C	osts
Costs Saved		Income Lost	
Extra income		Extra costs	
Calf Value (D-B/100	£38.45	Semen Cost and reduced	£21.2
animals)		Fertility (C-A /100	
		animals)	
<u>Total</u>	£38.45	<u>Total</u>	£21.2
Tot	al Benefits P	Per Cow = £17.25	
200 Cow herd = £3,450			
See table on the following page			



	Heifers required	50
	Conventional Semen	
	Number of animals that need to be served	100
	Number of conventional doses required	170
	Total cost of Black and White (£15)	£2,550
Costs	Number of extra cows served with beef semen	0
Cosis	Number of doses of beef semen required	0
	Cost of extra beef services (at £7 a dose)	0
	Cost of reduced fertility (at £3 a day)	0
	Total Cost (A)	£2,550
	Value of Black and White heifers (at £200 per calf)	£10,000
	Value of black and white bulls (at £20 per calf)	£1,000
Benefits	Value of continental heifers (at £80 per calf)	£0
	Value of continental bulls (at £130 per calf)	£0
	Total Output (B)	£11000
	Overall Margin (B-A)	£8,450
	Sexed Semen	
	Number of animals that need to be served	55
	Number of sexed semen doses required	102
	Total cost of Black and White (£35)	£3,570
Costs	Number of extra cows served with beef semen	45
00313	Number of doses of beef semen required	75
	Cost of extra beef services (at £7 a dose)	£525
	Cost of reduced fertility (at £3 a day)	£575
	Total Cost (C)	£4,670
	Value of Black and White heifers (at £200 per calf)	£10,000
	Value of black and white bulls (at £20 per calf)	£100
Benefits	Value of continental heifers (at £80 per calf)	£1,800
	Value of continental bulls (at £130 per calf)	£2,945
	Total Output (D)	£14,845
	Overall Margin (D-C)	£10,175
	Overall Benefit for 100 cow herd by using Sexed Semen	£1,725



Notes:

- As heifers generally have a higher conception rate, the table assumes that only heifers are served with sexed semen. Therefore for our 100 cow herd assume 55 heifers available to be served
- Assumed conception rates of 60% for conventional semen and 50% for sexed semen

Critical success factors

To make this system work the following have been identified as critical:

- Nutrition and cow management to facilitate fertility
- Good environment for observation of oestrus and cow performance to back up the sexed semen system
- Heat observation is necessary and cows should be checked at least 3 to 4 times daily
- For the best results, the service should be carried out 12 hours after the onset of standing oestrus
- Attention to detail is vital

Risk

Extended calving interval due to slightly reduced semen conception rate, and less than 90% heifers being born are the increased risks

Welfare and environmental assessment

Welfare - No welfare impacts with this technology.

Environmental considerations

The sexed semen allows for a greater chance of female calves being born.

However, the reduced number of males being born (on a national scale) may have a positive impact in reducing greenhouse gas emissions and waste.



Motion Sensors

This area of technology is an aid to herd management through better observation of cow behaviour in the following areas:

- 1. Bulling behaviour and standing oestrus (Fertility Observation)
- 2. Mobility and Locomotion (Lameness)
- 3. General lack of thriftiness (Early diagnosis of disease)

The following have been considered:

- Pedometers motion sensor attached to the cows leg
- Optical sensing the use of an optical infrared beam that can detect movement and identify the cows
- Necometers similar to the Pedometer but attached via a collar to the neck

Pedometers

This system comprises of an electronic pedometer, a reader located conveniently at a point that the herd passes regularly, and a control box/computer that analyses the information and puts it into a format that can be used by the herdsman.

How does it work?

These motion detectors are attached to the cows' leg via a plastic strap and count the number of steps that they take in any 24-hour period. The data is downloaded when the cow passes a base station. The number of steps (or activity) is then used to predict oestrus, based on that fact that there is likely to be more activity during bulling.

When a cow has been diagnosed as pregnant the pedometer can be removed and used on another cow.



Key impacts on efficiency

- The system should lead to a higher heat detection rate and hence better fertility and better performance
- The accuracy of the system means that there will be a reduction in the number of inseminations needed to ensure pregnancy, thus offering savings in semen costs
- It further offers the possibility of significant savings through shorter calving intervals and increased output per cow/year
- Pedometers generally are integrated with auto ID for feeding, milk recording and selection gates, so offering benefits over and above improved fertility

Costs and benefits

The Partial budget in shown in Table 5 considers the costs and benefits that are derived on a farm using pedometers.

Table 5 Partial budget pedometers

Costs Saved/	Costs Saved/Extra Income		Extra Costs
Costs Saved		Income Lost	
Extra income		Extra costs	
	00.4		040.45
Improved Fertility	£94	Equipment Costs	£16.45
(1.)		(2.)	
<u>Total</u>	£94	<u>Total</u>	£16.45
Total Benefits Per Cow = £77.55			

²⁰⁰ Cow herd = £15,510
*1. Based on reducing Calving Interval from 410 Days to 380 days. Source: Table
1.1 MDC pd+ 2nd Edition Esslemont and Kossaibati. = £3.13/day



^{*2.} Total costs for a 200 cow herd are £14,000 written off over 5 years with interest charged at 7% on half the total capital = £3,290 total costs per year

Critical success factors

To make this system work the following have been identified as critical

- The system will only work where poor heat detection has been identified as the root cause of fertility and there is no opportunity for staff to increase the time spent observing the cows
- A good locomotion score of the herd as a whole is required, lame cows will not express heat well
- Safe loafing areas for cows to express natural behaviour with confidence
- Accuracy of the heat detection. Research has shown an accuracy of heat detection between 51% and 87%
- A positive result does not necessary mean that the cow is on heat, other signs will also be needed to dictate whether the animal is served
- A plan is still required to detect those cows that are not picked up by this system e.g. cows showing silent heats. Action must be taken as soon as the cow is flagged up as being on heat
- For the average cow above the breakeven point is achieved when calving interval falls by 5.25 days

Risk

The cost of installation is £2,000 for the server and sensor and each collar (with battery) costs about £60. Generally these systems are used for Auto ID as well as activity recording, therefore all cows need a collar. For a 200 cow system this would cost around £14,000.

Welfare

Welfare - Pedometers will not work unless good welfare standards are already in place, particularly with regard to lameness. The cows must be allowed to express their normal behaviour to enable this to work.



Table 6 The RSPCA 5 freedoms and impact of pedometers

Freedom From	Effect	Detail	
Hunger and Thirst	=		
Discomfort	=		
Pain, injury and disease	+	Potential reduction due to better monitoring	
Express normal behaviour	=		
Fear and Distress	+	Potential reduction due to better monitoring	

Environmental

There are no environmental issues

Optical Sensing

Optical sensing uses infra-red cameras to monitor the heat activity of the herd. Cameras are usually positioned in the housing shed. The information is then delivered automatically to a computer each day so the farmer knows exactly which cows have been bulling etc.

How does it work

Optical sensors in the cow shed and loafing areas are used to accurately identify which cows are displaying primary and secondary signs of heat. This recorded image is then automatically checked against a cow reference image held on a database.

The fully-automated system then feeds this information back to a computer screen in the farm office that highlights which cows need serving and when to serve them. It also gives information on cows that are showing primary or secondary signs of oestrus, the exact start time of oestrus activity, which cows to serve, when to serve these cows and also highlights cows which require more specialist veterinary attention.



Key impacts on efficiency

- 24 hours a day, 365 days a year heat detection in dairy cows that are housed all year round or until confirmed in calf so the farmer doesn't have to get tied up watching the cows all the time for signs of heat. However the system will not be suitable for grazed herds
- Where sweeper and stock bulls are used, it detects quieter bulls so farmers know if they are doing their job properly or not
- It identifies non cycling cows for vet investigation so the farmer knows exactly which cows could be barren
- The overall herd performance can be improved by managing calving intervals, reducing culling and planning milk production
- Staff can spend more time on other tasks

Costs and benefits

The Partial budget in shown in Table 7 considers the costs and benefits that are derived on an average Farm. The greatest impact will of course come where there is the poorest current fertility and performance. The system can be installed for total housing coverage or it can be incorporated into a post calving "maternity ward" area.



Table 7 Partial budget for optical sensing systems

Costs Saved/Extra Income		Income Lost/Extra Costs		
Costs Saved		Income Lost	0	
			_	
Extra income		Extra costs		
Extra income		EXITA COSIS		
Improved	£94	Annual Fee*(2.)	£70	
Fertility*(1.)				
<u>Total</u>	£94	<u>Total</u>	£70	
Total Benefits Per Cow = £24				
	200 Cow herd = £4,800			

^{*1.} Based on reducing Calving Interval from 410 Days to 380 days. Source: Table 1.1 MDC pd+ 2nd Edition Esslemont and Kossaibati. = £3.13/day

Critical success factors

To make this system work the following have been identified as critical

- Farmer/herdsman must be computer literate
- Reliable Broadband Connection required
- System is aimed at large herds where they are predominantly housed all year round. Not suitable in grazing conditions
- Relatively open plan loafing/lying area
- Assumes cows show a standing heat at oestrus
- Ability of system to match image recorded at bulling to reference image on database
- Nutrition and cow management to facilitate fertility



^{*2.} In addition to the annual fee (£50/animal/year) there is a set up fee to pay for the sensors and computer equipment. This set up fee can either be added to the annual fee (3 or 5 year agreement) or paid up front. The manufacturer did not wish to disclose this figure. An assumed figure of £20 cow/annum has been used.

 For the average cow above the breakeven point is achieved when calving interval falls by 22.4 days

Risk

There is an initial cost in the set up of the system. The contract is then reviewed yearly. The farmer must consider their current calving interval and decide whether the system would provide a helping hand in improving the calving interval.

Welfare and environmental assessment

Welfare - this technology although encouraging greater productivity will not work unless good welfare standards are in place.

Table 8 The RSPCA 5 freedoms and impact on optical motion sensing

Freedom From	Effect	Detail
Hunger and Thirst	=	
Discomfort	=	
Pain, injury and disease	+	Potential reduction due to better monitoring
Express normal	=	
behaviour		
Fear and Distress	+	Potential reduction due to better monitoring

Environmental considerations

This system allows for a greater productivity, in theory this could lead to less animals being kept to meet the production requirements. On a national scale one could argue that fewer cattle would have a positive impact in reducing green house gas emissions and waste.

Necometers

This is a system based around a motion-sensing tag, which is fitted to a collar and sited close to the top of the cow's neck. It picks up on the oestrus activity, like mounting or being mounted as well as head movements. The motion-sensing collar is a stand-alone system so there is no requirement for any complex parlour systems or even a computer although the system can easily link into more sophisticated PC-based herd management systems.



It enables producers to monitor cows 24 hours a day, identifying immediately those that are bulling and therefore ready for insemination and also those that are not cycling.

The system comprises of an electronic neck collar, a reader located conveniently at a point that the herd passes regularly, and a control box that analyses the information.

How does it work

The system uses infrared technology, which reveals exactly when a cow should be inseminated.

In the first 10 days, the collar monitors the cows movements to see what her normal routine is e.g. shaking her head when she eats silage. By monitoring the cows movements, it prevents inaccurate information being recorded. It starts working properly around day 10 and it signals the base station when it is ready.

When a cow has been PD'ed and is definitely in calf, the collar can be taken off and put on another cow. It then takes 10 days to be ready to monitor the next cow.

Key impacts on efficiency

- The accuracy of the system means that there will be a reduction in the number of inseminations needed to ensure pregnancy, thus offering savings in semen costs
- The farmer does not need to spend as much time observing the cows for oestrus.
 The farmer knows exactly when to AI the cow
- Barren cows will be identified quickly to allow remedial action to be taken

Costs and benefits

The Partial budget in shown in Table 9 considers the costs and benefits that are derived on a farm which uses the Motion Sensing Collars.



Table 9 Partial budget motion sensing collars

Costs Saved/Extra Income		Income Lost/Extra Costs	
Costs Saved		Income Lost	
Extra income		Extra costs	
Improved Fertility	£94	Equipment Costs	£7.35
(1.)		(2.)	
<u>Total</u>	£94	<u>Total</u>	£7.35
Total Benefits Per Cow = £86.65			
200 Cow herd = £17,330			

- *1. Based on reducing Calving Interval from 410 Days to 380 days. Source: Table 1.1 MDC pd+ 2nd Edition Esslemont and Kossaibati. = £3.13/day
- *2. Total costs for a 200 cow herd are £6,256 written off over 5 years with interest charged at 7% on half the total capital = £1,470 total costs per year

Critical success factors

To make this system work the following have been identified as critical

- Proficient monitoring of cows is still required by the herdsman
- Accuracy of heat detection
- Action must be taken as soon as the cow is flagged up as being in heat
- For the average cow above the breakeven point is achieved when calving interval falls by 2.4 days

Risk

There is a cost to the system. The cost of installation is £1,456 for the box and each collar costs about £60. With some products, there is a 6-year warranty and if the collar stops working in that time, a free replacement is provided. For an all year around calving pattern it is assumed that 40% of the cows need monitoring so the cost is £2,400 for the collars. For a block calving system collars for 80 - 100% of the herd will be required.



Welfare and environmental assessment

Welfare - the Motion Sensing Collar will not work unless good welfare standards are already in place. Cows therefore need to be able to express their natural behaviour such as shaking their head when drinking.

Table 10 The RSPCA 5 freedoms and impact on the motion sensing collar

Freedom From	Effect	Detail	
Hunger and Thirst	=		
Discomfort	=		
Pain, injury and disease	+	Potential reduction due to better monitoring	
Express normal behaviour	=		
Fear and Distress	+	Potential reduction due to better monitoring	

Environmental considerations

The Motion Sensing Collar allows for a greater productivity, in theory this could lead to fewer animals being kept because farmers are unsure if they are barren.

Cow Health Technologies

The prevention and treatment of animal health problems has been an area where technological advances have resulted in significant and sustained improvements. For example the development of effective teat disinfectants, the use of intramammary antibiotics, vaccination programmes, systems to improve building ventilation and environment and the development of foot-bathing systems have all allowed farmers to reduce the incidence of common problems, treat them more effectively and so increase output and often profits.

It is still an area where new developments are being made, spearheaded by the desire to improve animal welfare as part of the cross-compliance requirements. Furthermore, as the losses associated with disease and poor animals health are well understood, farmers are focussing on reducing these losses to improve output, margins and profits.

Dry Cow Teat Plugging

These are sterile, non-antibiotic intramammary infusions in the form of a viscous paste which form a plug in the teat canal. This plug helps prevent new intramammary infections throughout the dry period by acting as a physical barrier to bacteria.



How does it work?

New mastitis cases arising during the dry period are most likely to occur as a result of bacterial ingress via the teat canal. The internal sealant infusion works by mimicking the cow's natural first line of defence, the keratin plug, providing a safe, physical barrier between the cow and the environment. The teat canal seal is created immediately after infusion and is maintained throughout the dry cow period. The sealant is compatible with conventional dry cow management practices.

However care has to be taken with mastitis prone cows as this product can also trap bacteria within the cows udder resulting in an infection at calving.

Key impacts on efficiency

- A 20% reduction in new mastitis infections at calving is claimed
- A 26% reduction in clinical mastitis between drying off and 60 days in milk is claimed
- A 19% reduction in cell count after 6- 8 days in milk
- This product can be used by organic farmers as it is approved by the regulatory bodies

Costs and benefits

The partial budget in shown in Table 11 considers the costs and benefits that are derived from using the technology on an average farm. The greatest benefits will be gained in situations where there is a high incidence of mastitis and where it is difficult to focus on managing dry cow udder health.



Table 11 Partial budget for dry cow teat plugging

Costs Saved/Extra Income		Income Lost/Extra Costs		
Costs Saved		Income Lost		
Reduction in	£17			
mastitis cases per				
cow. *1				
Extra income		Extra costs		
Improved health of		At £6 per cow	£6	
dry cows		tubed.		
<u>Total</u>	£17	<u>Total</u>	£6	
Total Benefits Per Cow = £11.				
000 0 h l 00 000				

200 Cow herd = £2,200.

Critical success factors

To make this system work the following have been identified as critical

- Sealant should only be used on low cell count cows it is essential to know which are your high and low cell count cows
- High hygiene standards are essential to ensure no bacteria enter the teat canal when sealant is inserted
- For the average cow above the breakeven point is achieved when mastitis cases fall by 3.4 cases per 100 cows per year

Risk

There is no capital required for this technology so there is no risk of losing capital. The risk is from increasing infection levels due to unhygienic drying off routines.

Welfare and environmental assessment

Teat plugging should improve the welfare of the cows receiving treatment.



^{*1.} Current average mastitis cases are 48 per 100 cows per year. Trial work suggests a reduction in these cases of 20% = 9.6 cases less per 100 cows. Work by Esslemont suggests a cost per case of £177. Therefore, on a per cow basis savings are 0.1 cases of mastitis per year = £17

Table 12 The RSPCA 5 freedoms and impact on dry cow teat plugging

Freedom From	Effect	Detail	
Hunger and Thirst	=		
Discomfort	+	Less Intra Mammary Infections	
Pain, injury and disease	+	Less Intra Mammary Infections	
Express normal	=		
behaviour			
Fear and Distress	=		

Environmental considerations

Environmental considerations appear to be minimal.

Udder Singeing

Hair from the cows udder, belly and tail (after clipping) is singed with a low temperature flame. The aim is reduce the amount of dirt and organic matter around the udder and teats, which could end up in the milk or result in mastitis infections.

How does it work?

A specialist burner is adjusted so that there is a yellow flame of about 12 - 15cm high which is then moved in a free flowing movement under the cow to singe the hairs. The cows must be clean from dirt and muck and must be dry.

Key impacts on efficiency

- The lack of hair makes cleaning the udder and teats at milking time easier and therefore will speed up the milking routine
- There is a reduced risk of contamination of the milk with dirt and muck from the udder
- There should be a lower risk of mastitis as the cows udder can be kept cleaner
- The effectiveness of pre and post milking dips should be improved
- Milking claws and shells should remain cleaner as should the milker's hands
- Fewer towels are needed to dry the teats



Costs and benefits

Although this technology looks practical there is no evidence available to evaluate the financial benefits.

An udder singeing lance using Propane will cost around £100. The process takes around one minute per cow and may need to be done two to three times per annum.

Critical success factors

To make this system work the following have been identified as critical:

- The process needs to be carried out two to three times a year
- It needs to be done in a well-ventilated area as the smell can make cows reluctant to come in. Singeing must be carried out away from flammable material
- It is necessary to remove dried on dirt from the udders which need to be dry before singeing can be undertaken

Risk

There is a small amount of capital required for this technology. Farmers may find that they gain more benefit from adopting a more thorough pre and post dipping routine.

Welfare and environmental assessment

If done correctly the process does not cause the cow any discomfort and may make milking easier.

Table 13 The RSPCA 5 freedoms and impact on udder singeing

Freedom From	Effect	Detail
Hunger and Thirst	=	
Discomfort	=	Provided it is done correctly
Pain, injury and disease	=	
Express normal behaviour	=	
Fear and Distress	=	



Environmental considerations

No impact

Barrier Teat Dips

These are teat disinfectants which in addition to attacking harmful bacteria as soon as the teat is immersed also covers the teat and forms a flexible film, which unlike other teat dips lasts for the 12 hours between milkings.

How does it work?

Barrier dips have a double action formulation, which provides up to 24 hour antibacterial protection for cows teats. Unlikely conventional teat dips, barrier teat dip flow like a liquid when teats are immersed, but thicken instantly when applied to cover all the natural contours of the teat like a second skin.

They often contain lanolin as an emollient, which stops moisture from leaving the teats and so prevents them from drying and cracking. The moisturiser helps reduce cracked, dry and sore teats, therefore reducing harmful bacteria and infection.

When it is time for milking, the barrier teat dip can be easily removed during any premilking cleansing routine.

Key impacts on efficiency

- There will be a reduction in the number of cracked teats saving the milker time.
 Reducing teat skin damage will lead to fewer udder infections
- The product should reduce the incidence of mastitis and lead to improved performance

Costs and benefits

There is no published data as to the reduction in mastitis or cell counts due to the use of these barrier teat dips.

Critical success factors

To make this system work the following have been identified as critical.

Hygienic milking routine to stop cross contamination of cows during milking



Risk

There is no capital involved in this technology and it is something that farmers could just try for a while to evaluate the effect on the cows

Welfare and environmental assessment

The produce has no impact on welfare other than a potential reduction in mastitis cases and a reduction in the incidence of teat skin damage. There is no environmental impact.

Table 14 The RSPCA 5 freedoms and impact on barrier teat dips

Freedom From	Effect	Detail	
Hunger and Thirst	=		
Discomfort	+	Less Intra Mammary Infections	
Pain, injury and disease	+	Less Intra Mammary Infections	
Express normal behaviour	=		
Fear and Distress	=		

Somatic Cell Count Measurement

This section looks at four options available for individual Somatic Cell Count measurement, namely Optical Cell Counting, Conductivity, California Mastitis Test (CMT) and Reagent strips. Accurate and fast results are essential in helping combat sub-clinical and clinical mastitis.

Optical Cell Counting

This is the same test that is used in the main dairies and laboratories for assessing the cell count in bulk milk samples. The system can now be bought to use on farm.

How does it work?

A milk sample is drawn into a fine capillary tube held within a disposable cassette. The cassette is then placed in a Cell Counter. A LED is then directed through the milk sample onto a camera which counts the number of white blood cells and provides a result within one minute.



Key impacts on efficiency

- The system is very accurate. Results are 93% accurate where milk has more than 1 million cells/ml, and 92% accurate for samples around 400,000 cells/ml
- The results are available in one minute, which enables a suspect quarter to be checked and treated during milking
- Used in conjunction with individual bacteriological analysis where the high cell count cows are identified, the system will allow the specific quarter to be isolated and treated with the most appropriate antibiotic
- It could be used daily on a bulk milk sample to determine the bulk tank cell count to pre-empt any problems with the customer
- Using this as a tool to keep on top of sub clinical mastitis will improve cow performance and reduce any milk wastage
- Any suspect cows can be tested prior to their milk going into the tank to ensure that the cell count bonus is achieved

Costs and benefits

The partial budget in shown in Table 15 considers the costs and benefits that are derived on a Farm with 200 cows. The greatest impact will be seen where this technology is used to reduce the overall farm cell counts to enable a milk premium to be paid.



Table 15 Partial budget optical cell counting

Costs Saved/Extra Income		Income Lost/Extra Costs		
Costs Saved		Income Lost		
	0		0	
Extra income		Extra costs		
Improved cell	£37.5	Cassette and	£10.40	
count band (5.)		battery costs (2. –		
		4.)		
		Machine write off	£1.47	
		(1.)		
<u>Total</u>	£37.5	<u>Total</u>	£11.87	
Total Benefits Per Cow = £25.63				
200 Cow herd £5 126				

200 Cow herd £5,126 1. Purchase costs of machine are £1,200 this equates to £293 per annum if

- written off over 5 years @ 7 % interest

 2. The Disposable cassette costs are £1 each
- 3. Battery life span is 500 tests and costs £20 = 4p test
- 4. Assume 10 tests per cow/lactation
- 5. Assume yield 7,500 litres and cell count band benefit is 0.5p = £37.5

Critical success factors

To make this system work the following have been identified as critical

- The basics in term of good milking routines and general cow husbandry need to already be in place
- The strain of bacteria causing the problem still needs to be identified so that the most appropriate antibiotics can be used
- For the 7,500 litre cow above, the breakeven point is achieved when cell count reductions benefit the milk price by 0.16p per litre.

Risk

The initial capital cost per cow increases dramatically in smaller herds. For a 75 cow herd the costs per cow rise from £1.47 cow/year to £3.91 cow/year.



Welfare and Environmental Assessment

Welfare - The system should allow earlier and better treatment for mastitis therefore improving the welfare of the cow.

Table 16 The RSPCA 5 freedoms and impact on optical cell counting

Freedom From	Effect	Detail
Hunger and Thirst	=	
Discomfort	+	Quicker Identification and treatment of Intra Mammary Infection (IMI)
Pain, injury and disease	+	Quicker Identification and treatment of Intra Mammary Infection (IMI)
Express normal behaviour	=	
Fear and Distress	=	

Environmental considerations

There are no environmental considerations

Conductivity

This system measures the electrical conductivity of a milk sample to give an indication of somatic cell count. It can identify immediately any cows that have high conductivity during milking, and then alert the milker prior to the milk entering the bulk tank. The equipment can be incorporated into a parlour to allow constant checking.

How does it work?

One of the effects of a mastitis infection is an increase in the concentration of sodium and chloride ions within a milk sample. This affects the electrical conductivity of the milk with the extent of the increase directly related to the level of infection. This approach simply measures the conductivity of the milk sample to predict its somatic cell count. However, research has shown low accuracy for detecting sub-clinical mastitis.



TECHNOLOGY AND YOUR BUSINESS

Key impacts on efficiency

- Fast results Either in-line testing, or hand held machines can give you an instant result
- Used in conjunction with individual laboratory analysis for identification of the bacteria involved, the high quarter may be identified and treated

Costs and benefits

The Partial budget below considers the costs and benefits that are derived on a farm using a hand held conductivity meter. The greatest impact will of course come where there is a cell count problem on farm.

Table 17 Partial budget hand held conductivity meter

Costs Saved/Extra Income		Income Lost/Extra Costs		
Costs Saved		Income Lost		
	0		0	
Extra income		Extra costs		
Improved cell	0			
count band				
		Machine write off	£0.31	
<u>Total</u>	£0	<u>Total</u>	£0.31	
Total Benefits Per Cow = -£0.31				
Benefit for 200 Cow Herd = -£61				
1. Purchase costs of machine are £250 this equates to £61 per annum if written				



off over 5 years

Critical success factors

The authors feel that this system is unlikely to benefit farmers given the research data available.

- Research (Norberg et al) has shown that conductivity is 80.6% accurate for the identification of clinical mastitis cases, but only 45% accurate for sub-clinical infections
- Good milking routine to stop cross contamination between cows and the adoption of the mastitis five point plan
- Correct antibiotics for the treatment of the causal bacteria

Risk

The capital cost of a hand held meter would be very low. However, the fundamental risk is that it is not accurate for the identification of cases of sub-clinical mastitis potentially missing up to 55% of cases.

Welfare and environmental assessment

Welfare - The system will not improve cow welfare.

Table 18 The RSPCA 5 freedoms and impact on milk conductivity

Freedom From	Effect	Detail
Hunger and Thirst	=	
Discomfort	-	Poor – fails to detect 55% of sub-clinical cases
Pain, injury and disease	-	Poor – fails to detect 55% of sub-clinical cases
Express normal behaviour	=	
Fear and Distress	=	

Environmental considerations

This system will not help the environment.

California Mastitis Test (CMT)

This test uses a chemical reagent to test for the presence of white blood cells in a milk sample.



TECHNOLOGY AND YOUR BUSINESS

How does it work?

Milk from each quarter is drawn onto a plastic tray with four individual compartments (one for each quarter). Equal quantities of a reagent are added to each of the compartments and the tray is swirled for 20/30 seconds. A high cell count is indicated by a viscous gel forming within 60 seconds.

The principle is that the CMT is a detergent which dissolves the outer fat wall of the white blood cell. DNA is then released and coagulates, forming the viscous gel. The thickness of the gel is an indication of the somatic cell count:

100,000 cells = No thickening

300,000 cells = Slight thickening

900,000 cells = Distinct thickening

2,700,000 cells = Immediate thick gel level in tray

8,100,000 cells = Gel with central peak above the mass

Key impacts on efficiency

- The results are available in one minute, so enabling a suspect quarter to be checked and treated at the same milking
- Research suggests the test is 82.4% accurate. However it is only useful in determining cases above 500,000 due to the subtle changes in viscosity at low levels
- Due to the low price of the test all quarters can be tested acting as a control for each other
- Used in conjunction with individual bacteriological laboratory analysis the high cell count quarter can be identified and treated

Costs and benefits

The Partial budget in Table 19 below considers the costs and benefits that are derived on an average Farm using the CMT. The greatest impact will come where there is a cell count problem on farm.



Table 19 Partial budget CMT

Costs Saved/Extra Income		Income Lost/E	Extra Costs
Costs Saved		Income Lost	
	0		0
		Reagent Cost (2.	£1.00
		& 3.)	
Extra income		Extra costs	
Improved cell	£37.5		
count band (1.)			
<u>Total</u>	£37.5	<u>Total</u>	£1
	Total Benefits	Per Cow = £36.5	
	200 Cow h	erd = £7.300	

- 1. Assume yield 7,500 litres and cell count band benefit is 0.5p = £37.5
- 2. The Kit costs £25 for 250 tests = 10p per sample.
- 3. Assume 10 tests per cow per lactation.
- 4. Assume yield 7,500 litres and cell count band benefit is 0.5p = £37.5

Critical success factors

To make this system work the following have been identified as critical.

- Good milking routine to stop cross contamination between cows and between quarters once sampled
- High levels of hygiene are essential to avoid cross contamination between samples from different quarters
- Do not test cow until at least three days after calving
- Once a high cell count has been identified it is essential to use the correct antibiotics for the specific mastitis causing organism
- For the 7,500 litre cow above, the breakeven point is achieved when cell count reductions benefit the milk price by 0.02p per litre

Risk

Due to the low costs and high accuracy with which high cell count quarters are identified the risks are very low.



Welfare and environmental assessment

Welfare - The system should allow earlier and better treatment for mastitis therefore improving the welfare of the cow.

Table 20 The RSPCA 5 freedoms and impact on CMT

Freedom From	Effect	Detail	
Hunger and Thirst	=		
Discomfort	+	Quicker Identification and treatment of Intra Mammary Infection (IMI)	
Pain, injury and disease	+	Quicker Identification and treatment of Intra Mammary Infection (IMI)	
Express normal behaviour	=		
Fear and Distress	=		

Environmental considerations

Lower culling for mastitis can reduce the number of youngstock that need to be reared and therefore reduce the stocking rate and help reduce slurry output NVZ compliance.

Reagent Strip Tests

This test uses a chemical reagent to test for White Blood Cells.

How does it work?

The test involves a reaction with esterase, an enzyme on the cell wall of the somatic cell. The more cells present, the more enzyme. When the enzyme reacts with the reagent on a test strip, it turns blue. The deeper the blue, the more enzyme, and therefore cells present.

A sample of milk is placed on a test strip followed by 3 drops of an activator. The strip can then be viewed for colour change after 40 minutes or placed into a digital reader for a more accurate reading.

The reader is a reflectometer that measures the intensity of blue and translates it into a somatic cell count reading.



Key impacts on efficiency

- The results are more accurate at lower levels of infection (250-500,000cell/ml) than the CMT test
- Research suggests that the test is 87% accurate
- Ability to treat a suspect case at the next milking rather than waiting for postal results
- The milk sample must be fresh and tested within 8 hours as the enzyme breaks down over time and older samples will give an inaccurate and lower reading
- Used in conjunction with individual laboratory bacteriological analysis the high quarter can be identified and treated

Costs and benefits

The Partial budget in 21 considers the costs and benefits that are derived on an average Farm. The greatest impact will of course come where there is a cell count problem on farm.

Table 21 Partial budget reagent test strip SCC milk test

Costs Saved/Extra Income		Income Lost/E	xtra Costs
Costs Saved		Income Lost	
	0		0
Extra income		Extra costs	
Improved cell	£37.5	Machine Write off	£0.19
count band (1.)		(2.)	
		Test Strip (3. & 4.)	£12.50
<u>Total</u>	£37.5	<u>Total</u>	£12.69
п	Total Benefit	s Per Cow = £24.81	

200 Cow herd = £4,962

- 1. Assume yield 7,500 litres and cell count band benefit is 0.5p = £37.5
- 2. Electronic Reader cost £152 written off over 5 years = £37
- 3. Test strip = £1.25 each
- 4. Assume 10 Tests per cow per lactation



Critical success factors

To make this system work the following have been identified as critical.

- Good milking routine to stop cross contamination between cows
- Proper use of the pipette to avoid cross contamination and over/under deliver of correct volume of milk
- The milk must be fresh (less than 8 hours) because the enzyme breaks down over time
- Once a high cell count has been identified it is essential to use the correct antibiotics for the specific mastitis causing organism
- For the 7,500 litre cow above the breakeven point is achieved when cell count reductions benefit the milk price by 0.17p per litre

Risk

Due to low costs and high accuracy the risks are very low.

Welfare and environmental assessment

Welfare - The system should allow earlier and better treatment for mastitis therefore improving the welfare of the cow.

Table 22 The RSPCA 5 freedoms and impact on reagent test strip SCC milk test

Freedom From	Effect	Detail
Hunger and Thirst	=	
Discomfort	+	Quicker Identification and treatment of Intra Mammary Infection (IMI)
Pain, injury and disease	+	Quicker Identification and treatment of Intra Mammary Infection (IMI)
Express normal behaviour	=	
Fear and Distress	=	

Environmental considerations

Lower culling for mastitis can reduce the number of youngstock that need to be reared and therefore reduce the stocking rate and help reduce slurry output NVZ compliance.



Automatic Dipping and Flushing

This section covers two similar types of system to automate the milking process. Automatic dipping and flushing and automatic flushing only

Automatic Dipping and Flushing

These systems automatically apply a teat dip to cows immediately after milking and before the Automatic Cluster Remover (ACR) detaches the cluster from the udder. An adjustable dose of teat dip is sprayed directly onto the teat while the liner is still in place. After the cluster is removed, the liners are flushed automatically. No milk residues remain in the liners after the flushing programme has finished.

How does it work?

The system operates with an iodine based teat dip, compressed air, and potable water. The teat dip/air and water/air are injected into the liner via a patented injection concept. Teat dip is sprayed onto the upper end of the teat at the end of milking which then drips downwards.

Within a second, the cluster is removed from the cow and the programme goes into a rest period. This period allows the recommended teat dip chemical time to effectively kill any bacteria inside the liners. After the delay, the Control Box operates a water valve to rinse any chemical out of the liners, followed immediately by a shot of compressed air. This sequence will operate a minimum of six times. When the cycle is completed, the milking unit is ready to attach to the next cow.

The system operates automatically and can be individually controlled at each milking point. The system can be installed in all milking parlours with ACR systems.



TECHNOLOGY AND YOUR BUSINESS

Key impacts on efficiency

- Aims to reduce somatic cell counts and mastitis infections
- No interruption of working routine during milking
- Economic and effective use of dipping agent
- Up to a 10% reduction in worker routine time spent in the parlour due to no longer having to dip teats manually
- Automation removes chances of human error and improves consistency of application of teat dip
- Animal health will be improved which will lead to a save in veterinary fees and loss of milk production from animals infected with contagious mastitis from previously milked cows

Costs and benefits

The partial budget in Table 23 considers the costs and benefits that are derived on an average farm using ADF. The greatest impact will come where there is the highest level of mastitis and a high somatic cell count.

The system costs about £660 per point in the parlour to install plus the cost of a control box £4,700.



Table 23 Partial budget for ADF

Costs Saved/Extra Income		Income Lost	/Extra Costs
Costs Saved		Income Lost	
10% Labour saved @£10/hr (2.)	£9.13		
Extra income		Extra costs	
Improvement of cell count band (3.)	£37.5	Capital costs (4.)	£17.93
<u>Total</u>	£46.63	<u>Total</u>	£17.93

Total Benefits Per Cow = £28.7 200 Cow herd £5,740

- 1. Assume 16 Point Parlour installed average 79 Cows per hour throughput (MDC Survey)
- 2. Milking Time 2.5 hrs/milking = 1825 hrs year for a 200 cow herd
- 3. Assume yield 7,500 litres and cell count band benefit is 0.5p = £37.5
- 4. At £660 point capital costs = £10,560 + £4,700 for control box = £15,260. Assume write off capital over 5 years + average interest = £3,586 p.a

Critical success factors

To make this system work, the following have been identified as critical:

- The herdsman must use hygienic practices alongside the ADF system in order to facilitate the reduction of somatic cells and mastitis infections
- Will you really see a 10% saving in labour costs or will this time be spent on other things?
- Will your cowman accept a reduction in overtime pay? Or can you put on extra cows?
- Would a 10% improvement in cell counts improve your milk quality payment band?
- Based on the above scenario labour saving alone would not justify the investment. A cell count/mastitis improvement would need to be seen of around £7 per cow to reach break even.



Risk

There will be a large amount of commitment required from the herdsman when using this technology. The farmer needs to make an accurate assessment of whether other products could reduce the number of mastitis cases/cell counts

The use of the recommended chemical and complicated parts mean running costs could be very high.

The ADF system will have very little if any effect on infections caused by environmental organisms.

Research shows that this type of system had the following effects when compared to manual teat dipping with the same teat dip.

- An average reduction in Intra-mammary Infections of 10%
- No change in teat skin or teat end condition
- No difference in iodine content of milk

Welfare and environmental assessment

The ADF technology encourages the reduction of somatic cell counts and the number of mastitis cases but this will not work unless good welfare standards are in place.

Table 24 The RSPCA 5 freedoms and impact on ADF

Freedom From	Effect	Detail
Hunger and Thirst	=	
Discomfort	+	Potential Reduction in Intra Mammary Infections (IMI)
Pain, injury and disease	+	Potential Reduction in Intra Mammary Infections (IMI)
Express normal behaviour	=	
Fear and Distress	=	



Environmental considerations

The ADF system may allow for greater mastitis control as human error is taken away from the system. It ensures that every cow is dipped at the correct time. Therefore, it is possible that the system will decrease cell counts and increase cow longevity.

Automatic Cluster Flushing

These systems automatically flush the cluster and liner out with either water or peracetic acid between cows.

How does it work?

These systems clean the unit after every cow is milked, being triggered by the ACR. When the unit is released the vacuum is automatically reapplied to sweep out any residual milk. Plain or sanitised water is then gravity fed through the long milk tube to the cluster. This is followed by a blast of compressed air to force out the water. The whole process is then repeated, taking around 30 seconds from the time the cluster is removed so has no significant impact on milking times. The system can work with water or a solution of peracetic acid.

Key impacts on efficiency

- Aims to reduce somatic cell counts and mastitis infections
- Reduction in bacterial counts of 99% pre and post flushing
- No interruption of working routine during milking
- Use of your own preferred cleaning agent or peracetic acid
- System will use original clusters and liners
- System can be switched off with no effect on milking system
- Animal health will be improved which will lead to a save in veterinary fees and loss of milk production from animals infected with contagious mastitis from previously milked cows



Costs and benefits

The partial budget in Table 25 considers the costs and benefits that are derived on an average farm using automatic cluster flushing. The greatest impact will come where there is the highest level of mastitis and a high somatic cell count.

The system costs about £475 per point in the parlour to install plus the cost of a control box £500.

Table 25 Partial budget for automatic flushing

Costs Saved/Extra Income		Income Lost/E	Extra Costs
Costs Saved		Income Lost	
Extra income		Extra costs	
Improvement of	£37.5	Capital costs (3.)	£8.96
cell count band			
(2.)			
<u>Total</u>	£37.5	<u>Total</u>	£8.96
Total Benefits Per Cow = £28.54			
200 Cow herd £5,708			

- Assume 16 Point Parlour installed average 79 Cows per hour throughput (MDC Survey)
- 2. Assume yield 7,500 litres and cell count band benefit is 0.5p = £37.5
- 3. At £475 point capital costs = £7,125 + £500 for control box = £7,625. Assume write off capital over 5 years + average interest = £1,792 p.a

Critical success factors

To make this system work, the following have been identified as critical:

- The herdsman must use hygienic practices alongside the automatic cluster flushing system in order to facilitate the reduction of somatic cells and mastitis infections
- Would a 10% improvement in cell counts improve your milk quality payment band?



Risk

There will be a large amount of commitment required from the herdsman when using this technology. The farmer needs to make an accurate assessment of whether other products could reduce the number of mastitis cases/ cell counts.

Welfare and environmental assessment

The automatic cluster flushing technology encourages the reduction of somatic cell counts and the number of mastitis cases but this will not work unless good welfare standards are in place.

Table 26 The RSPCA 5 freedoms and impact of automatic cluster flushing

Freedom From	Effect	Detail
Hunger and Thirst	=	
Discomfort	+	Potential Reduction in Intra Mammary Infections (IMI)
Pain, injury and disease	+	Potential Reduction in Intra Mammary Infections (IMI)
Express normal behaviour	=	
Fear and Distress	=	

Environmental considerations

The automatic cluster flushing system may allow for greater mastitis control as human error is taken away from the system. It ensures that the cluster is thoroughly cleansed after every cow is milked, greatly reducing the cross contamination between cows. Therefore, it is possible that the system will decrease cell counts and increase cow longevity.

Vaccines For Dairy Farms

Vaccines may be dead or inactivated organisms or purified products derived from them. Their purpose is to encourage the immune system into producing antibodies to protect against the effect of the disease, which can be a virus bacteria or parasite.



There are four types of traditional vaccines:

- Dead Vaccines containing the micro-organisms that have been killed with chemicals or heat but which still however create the immune response
- Live Vaccines live, micro-organisms that have been cultivated under conditions that disable their virulent properties
- Toxoid these are inactivated toxic compounds from micro-organisms in cases where these (rather than the micro-organism itself) cause illness
- Subunit rather than introducing an inactivated or attenuated micro-organism to an immune system, a fragment of it can be used to create an immune response

The immune system produces antibodies to the vaccine agents and the white blood cells destroy them. The antibodies remain in the blood stream so when the animal is subsequently challenged by the virulent version of the disease the immune system is prepared to respond. Response is by either neutralizing the target agent before it can enter cells, or by recognising and destroying infected cells before the agent can multiply.

Vaccines do not guarantee complete protection from a disease. Sometimes this is because the host's immune system simply doesn't respond adequately due to poor response to the vaccine or a change in the nature of the disease.

All vaccines need to have licences for their use in different countries, so the use of vaccines therefore varies across the world.

It should be remembered that the use of all vaccines will require a labour input to carry out the vaccination as well as time to separate stock etc. Staff will need to be trained to vaccinate animals.

The following vaccines have been considered for dairy farms.

Bovine Viral Diarrhoea

How does it work?

Severe cases of BVD cause a bloody scour, severe illness, milk reduction, and abortion. Around 70% of the UK herd have natural antibodies to the virus, indicating a prior exposure to the disease.



Immunity from this virus can be gained in one of two ways:

- Natural Infection this can be relatively harmless especially if the disease is caught by maiden heifers before pregnancy, although it can lower immunity to other diseases. This immunity lasts for life. If the infection is contracted between days 1 - 100 of pregnancy the calf may become 'persistently infected' i.e. they may be a carrier and a risk to itself and others
- 2. Vaccination Two doses are given at four weeks and one week before service. An annual booster is required

Key impacts on efficiency

- Immunity to BVD will allow the animal to fight other infections and will improve the biological efficiency of milk production
- Vaccinating animals is time consuming
- A UK trial has suggested that vaccination improved conception rates from 51% to 68%

Costs and benefits

The partial budget in Table 27 considers the costs and benefits that are derived on an average farm using a BVD vaccine.

Table 27 Partial budget for BVD vaccination

Costs Saved/Extra Income		Income Lost/E	xtra Costs
Costs Saved		Income Lost	
Extra income		Extra costs	
Improved fertility	£94	Vaccine (average	£3.75
(1.)		cost per year 2.)	
<u>Total</u>	£94	<u>Total</u>	£3.75
	Total Benefits	s Per Cow = £90.25	

- 200 Cow herd = £18,050
- 1. Based on reducing Calving Interval from 410 Days to 380 days. Source: Table 1.1 MDC pd+ 2nd Edition Esslemont and Kossaibati, = £3.13/day
- 2. Based on a cost of vaccination £3 injection (2 in year 1 and 1 in each subsequent year)



Critical success factors

To make this system work, the following point has been identified as critical:

- BVD must provide a serious threat to the herd and productivity
- For the average cow above the breakeven point is achieved when calving interval falls by 1.2 days

Risk

There is always the possibility that a small percentage of the herd will not respond to the vaccine.

Welfare and environmental assessment

The vaccines will not work unless good welfare standards are in place. Misuse of these vaccines may encourage resistance and so animals become susceptible more easily.

Table 28 The RSPCA 5 freedoms and impact on BVD vaccination

Freedom From	Effect	Detail
Hunger and Thirst	=	
Discomfort	+	Fewer symptoms of BVD
Pain, injury and disease	+	Fewer symptoms of BVD
Express normal behaviour	=	
Fear and Distress	=	



Leptospirosis

This is a bacterial infection that can cause the following symptoms:

- High Temperature
- Mastitis
- Milk yield drop
- Abortion
- Reduced conception rates

How does it work?

This bacterium (L. Hardjo) is estimated to be present in 60% of the herds in the UK and is responsible for around one third of all abortions. It is possible for humans to contract the disease via cattle urine and the symptoms range from headaches to meningitis.

Immunity from this disease can be gained from one of two ways:

- 1. Natural immunity this lasts between one and two years
- Vaccination Two doses of a dead vaccine are required four weeks apart, along with an annual booster

Key impacts on efficiency

- Vaccination is time consuming and expensive
- Immunity to Leptospirosis will allow the animals to fight other infections and will improve the efficiency of milk production
- Work by ADAS showed vaccinated cattle give 50 litres per lactation more than non-vaccinated animals and have an abortion rate of 0.85% compared to 5%

Costs and benefits

The partial budget in Table 29 considers the costs and benefits that are derived on an average farm using a Leptospirosis vaccine.



Table 29 Partial budget for leptospirosis vaccination

Costs Saved/I	Extra Income	Income Lost/Ex	ctra Costs
Costs Saved		Income Lost	
Extra income		Extra costs	
Improved fertility	£94	Vaccine (average	£3.75
(1.)		cost per year (2.))	
Improved Milk	£8		
Yield (3.)			
<u>Total</u>	£86	<u>Total</u>	£3.75

Total Benefits Per Cow = £82.25 200 Cow herd = £16,040

- Based on reducing Calving Interval from 410 Days to 380 days. Source: Table
 1.1 MDC pd+ 2nd Edition Esslemont and Kossaibati, = £3.13/day
- 2. Based on a cost of vaccination £3 injection (2 in year 1 and 1 in each subsequent year), assuming a 4 lactation life span
- Based on ADAS research yield increases of 50 litres per lactation were a direct result of vaccination. 50 Litres @ 24p/litre – 8p litre feed costs = additional margin of £8 cow/year

Critical success factors

To make this system work, the following point has been identified as critical:

- Leptospirosis must be a problem in the herd
- It is very difficult to test for Leptospirosis as antibody levels drop very quickly after an abortion. Milk sampling appears to be the most reliable indicator
- For the average cow above the breakeven point is achieved if yield rises 23 litres or calving interval falls 1.2 days

Risk

There is always the possibility that a small percentage of the herd will not respond to the vaccine.



Welfare and environmental assessment

The vaccines will not work unless good welfare standards are in place. Misuse of these vaccines may encourage resistance and so animals become susceptible more easily.

Table 30 The RSPCA 5 freedoms and impact of leptospirosis vaccination

Freedom From	Effect	Detail
Hunger and Thirst	=	
Discomfort	+	Fewer symptoms of Leptospirosis
Pain, injury and disease	+	Fewer symptoms of Leptospirosis
Express normal behaviour	=	
Fear and Distress	=	

Lungworm (Husk)

Husk is caused by a small worm Dictyocaulus viviparous. The damage is done by the adult lungworm which lives in the trachea and bronchi (lungs). Eggs are released through the infected animals' faeces and onto pasture land where they are ingested by other animals providing a cycle of infection.

Treatment can be via anthelmintics which kill the lung worms. However the dead worms can fall back into the lung air sacs and cause pneumonia.

How does it work?

Vaccination is via two doses of dead larvae, which give lifetime immunity. The doses are given to youngstock prior to their 1st turnout.

Key impacts on efficiency

- Vaccination is time consuming
- Immunity to Husk will allow the animal to fight other infections and will improve the efficiency of milk production
- It is lifetime immunity from the disease



Costs and benefits

The partial budget in Table 31 considers the costs and benefits that are derived on an average farm using a Husk vaccine.

Table 31 Partial budget for husk vaccination

Costs Saved	Extra Income	Income Lost	/Extra Costs
Costs Saved		Income Lost	
Extra income		Extra costs	
		Vaccine (average	£2.25
		cost per year 1.)	
<u>Total</u>		<u>Total</u>	
Total Benefits Per Cow = -£2.25			

200 Cow herd = -£450

- 1. Based on a cost of vaccination £4.5 x 2 oral doses prior to 1st season turnout, over 4 year life time
- 2. There is no research as to the benefits of lifetime immunity from Lungworm in either milk or fertility. However, calf performance and growth rate typically improve while mortality is reduced

Critical success factors

To make this system work, the following point has been identified as critical:

- Husk must be a serious problem in the herd.
- Ventilation in the buildings must be adequate
- Good rotation grazing systems should be maintained

Risk

There is always the possibility that a small percentage of the herd will not respond to the vaccine.



Welfare and environmental assessment

The vaccine replaces the need for routine worming for husk.

Table 32 The RSPCA 5 freedoms and impact on lungworm vaccination

Freedom From	Effect	Detail
Hunger and Thirst	=	
Discomfort	+	Fewer symptoms of Lungworm
Pain, injury and disease	+	Fewer symptoms of Lungworm
Express normal behaviour	=	
Fear and Distress	=	

E-Coli Mastitis

How does it work?

Coliforms are a significant cause of mastitis and are responsible for approximately 20% of all cases. Coliform mastitis affects milk production immediately and if the disease persists, the likelihood of cows being lost through death or culling increases substantially.

E.coli bacteria are present on every dairy farm and even the strictest hygiene standards will not thoroughly eliminate them.

The vaccine works by boosting a cow's immune system to produce antibodies active against coliform bacteria. This is especially important at times of stress, such as before calving and early lactation when the immune system is weakest. A vaccine containing inactivated *Escherichia Coli J-5 strain* has been shown to bring about an 80% reduction in coliform mastitis cases.

To ensure effective mastitis control, this product should be used in conjunction with acceptable good management practices.

Heifers and cows should be vaccinated with a dose of 2ml S/C over a three course vaccination schedule. Heifers and cows should be vaccinated at drying off and then again at 28 days after drying off. A third dose should then be given two weeks post-partum.



Key impacts on efficiency

- Vaccination is time consuming
- E coli mastitis must be a significant source (above 20%) of the mastitis within the herd

Costs and benefits

The partial budget in Table 33 considers the costs and benefits that are derived on an average farm using a mastitis vaccine.

Table 33 Partial budget for E coli mastitis vaccination

Costs Saved/Extra Income		Income Lost/Extra Costs	
Costs Saved		Income Lost	
Extra income		Extra costs	
Less cases of	£13.6	Vaccine course	£12
Mastitis (1.)			
<u>Total</u>		<u>Total</u>	

Total Benefits Per Cow = £1.6 200 Cow herd = £320

Critical success factors

To make this system work, the following point has been identified as critical:

- E coli mastitis must be a significant source (above 20%) of the mastitis within the herd. The key aim must be to check which are the common causes of mastitis on your farm by way of a bacteriology test
- Good hygiene in both the parlour and lying areas are essential



^{*1.} Current average mastitis cases are 48 per 100 cows per year. E coli represents 20% of these = 9.6 cases per 100 cows. Vaccination should reduce this to 1.9 cases per 100 cows. Work by Esslemont suggests a cost per case of £177. Therefore, on a per cow basis savings are 0.077 cases of mastitis per year = £13.6

Risk

There is always the possibility that a small percentage of the herd will not respond to the vaccine.

Can reduction in E coli mastitis be achieved in other ways i.e. removing the source of infection through better bedding management/use of barrier teat dips/dry cow therapy?

Welfare and environmental assessment

The vaccine should help reduce the effect of E coli mastitis, which will improve cow welfare. It does not make up for shortfalls in bedding or milking routines.

Table 34 The RSPCA 5 freedoms and impact on E coli vaccination

Freedom From	Effect	Detail	
Hunger and Thirst	=		
Discomfort	+	Fewer E Coli Intra Mammary Infections	
Pain, injury and disease	+	Fewer E Coli Intra Mammary Infections	
Express normal behaviour	=		
Fear and Distress	=		

Automated Footbaths

These footbaths perform a variety of tasks automatically such as filling, dosing, flushing and then replenishing. With some systems, a flexible controller means that farmers can choose to run one or two footbaths simultaneously.

How does it work?

The system automatically empties and refills the footbath once the chemical concentration levels are too low.



TECHNOLOGY AND YOUR BUSINESS

Key impacts on efficiency

- The overall aim is to make foot bathing more effective and therefore reduce lameness. This is achieved by the maintenance of effective levels of active ingredient in the bath
- Improves worker safety by limiting the amount of contact with chemicals
- Reduced labour required as the footbath operates automatically
- Pre-cleaning footbaths reduce the muck and soil contamination more effectively as the water is regularly replenished

Costs and benefits

It is difficult to justify the expense of these systems as they are in the region of £5,000 and will show no improvement over and above a properly operated standard footbath system .

Critical success factors

To make this system work the following have been identified as critical:

- Nutrition and cow management to facilitate the prevention of lameness
- Attention should be drawn to any physical areas where lameness is caused e.g. worn concrete, stony tracks, poor building design, excessive slurry etc. Footbathing will not alleviate these causes of lameness. It will help reduce lameness resulting from infection but not physical damage

Risk

The risk will be due to the additional running costs of the system, in terms of maintenance, write off of the system and purchase of the specific chemicals.

Welfare and environmental assessment

There should be no difference in Welfare standards between a well set up standard footbath and an automated footbath.



Automated Ventilation

Automated ventilation and air circulation products are designed to take away the moisture, heat and odours generated by dairy herds, replenishing the oxygen supply by bringing in cooler, drier air from outside the building. By improving the cow environment they can help reduce disease spread.

How does it work?

By providing the necessary air exchanges required, automated ventilation removes harmful gasses including ammonia, methane and hydrogen sulphide. Automatic ventilation systems provide dairy farm buildings with the right amounts of fresh air needed for the cow, thereby reducing heat stress and disease risks.

Automated ventilation and air circulation equipment helps to ventilate the whole dairy farm housing facilities, whether this will be milking parlours, calf housing, bull accommodation or other housing.

Key impacts on efficiency

- Reduced heat stress, which leads to an increase in milk production
- With improvements in ventilation and air circulation, farm buildings will last longer, reducing rot, mildew, and electrical problems created by higher humidity levels in the building
- · Better ventilation can result in better herd health

Costs and benefits

Before considering this type of technology it is important to confirm that there are no other options for increasing natural ventilation, such as:

- Removing Yorkshire boarding or making openings in the walls of the shed
- Removing solid gates and barriers, replacing them with open gates and barriers
- Opening of the ridge of the roof
- Cutting ventilation slots in the roofing material



Finally consideration should be given to whether the shed is in fact fit for purpose and whether it would be more effective to consider using an alternative system or building other housing.

Critical success factors

To make this system work the following have been identified as critical

- Building must have poor ventilation
- Building must be capable of accommodating the system and have electricity

Risk

There is a capital cost involved in the initial set up of the system as well as running costs.

The existing building needs to be of a design to facilitate airflow once the system is installed.

Performance issues need to be directly linked to poor ventilation to guarantee the improvements required to finance the installation and running costs.

Welfare and environmental assessment

Animal welfare will generally improve if ventilation is improved.

Table 35 The RSPCA 5 freedoms and impact on automated ventilation

Freedom From	Effect	Detail	
Hunger and Thirst	=		
Discomfort	+	Potential Reduction in heat and humidity levels	
Pain, injury and disease	+	Potential Reduction in heat and humidity levels	
Express normal behaviour	=		
Fear and Distress	=		

Environmental considerations

Natural ventilation would be more eco-friendly.



Efficiency Enhancing Technologies

A great many technologies are now available that claim to improve the efficiency of a specific operation. As dairy farm profits have been squeezed over the last 15 years, so the focus has been on the relentless pursuit of increase efficiency and reduced production costs.

At the same time, legislative and political changes have forced farmers to look at improving the best use of all resources at their disposal while paying closer attention to the effect farming practices have on the environment.

Farmers have always sought ways to do jobs more effectively and labour saving devices have been central to increased productivity on farms.

Over the last 20 years, the UK dairy industry has been typified by a drive towards expansion with larger units and herd sizes. At the same time all costs have been assessed and many farms have made the decision to reduce labour levels and operate with more cows per person. Equally some farms have reduced costs by deskilling the workforce, reducing skilled employees with less well-skilled workers.

These developments have increased the demands on farm staff and fuelled an increased interest in technologies that offer the prospect of reductions in time and labour costs. Consequently many developments are available claiming to reduce labour and increase productivity.

Slurry Injection

This system involves slurry being injected under the soil surface. There are a number of different types of injector but each fits into one of two categories: either open slot shallow injection, up to 50mm deep; or deep injection over 150mm deep.

How does it work

A slurry injection system works by pumping the slurry into slots that have been cut in the soil surface with a disc. The depth of injection can vary between 40 and 150mm deep and should place the slurry within reach of the grass roots.

The optimum time to inject grass is from February until September (throughout the growing season).

Shallow injection is a viable option for many farms. These machines cut narrow slots 4-6cm deep and 3-5cm wide.



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Key impacts on efficiency

- Slurry injection reduces the risk of pollution of the aquatic environment from runoff
- The use of injection equipment can reduce ammonia emissions (and increasing nitrogen available) by between 40 - 90% when compared to surface spreading of farm slurries
- The use of injection equipment in conjunction with slurry testing and a manure or nutrient management plan can significantly reduce fertiliser costs
- The slurry can be spread at the time of crop need (spring/summer), without causing contamination to the grass
- Improves grass growth rates
- The slurry produced over winter by one dairy cow is worth approximately £40

Costs and benefits

Table 36 considers the costs and benefits that are derived on an average farm using a slurry injection system. The greatest impact will come where there is the poorest current soil nutrient content and where the farm operation does not allow a focus to be maintained on managing slurry.



Table 36 Partial budget slurry injection

Costs Saved/Extra Income		Income Lost/	Extra Costs	
Costs Saved		Income Lost		
Current spread	£320		£0	
technique (1.)				
Fertiliser saved	£192			
(£6 acre x 32				
acres) (2 4.)				
Extra income	0	Extra costs		
		Umbilical with	£400	
		shallow injection		
		(1.)		
<u>Total</u>	£512	<u>Total</u>	£400	
	Benefit per 100,000 gallon tank = £112			
Benefit per cow (2.) = £2.85				
Total Benefits Per Cow = £2.85				
200 Cow Herd Margin = £570				

- 1. This is based on emptying a 455 Cubic Metre (100,000 gallon) tank via umbilical (with splash plate) at a cost of £320, versus the same system with shallow injection costing £400
- 2. This is based on 11.58 Cubic Metres of slurry/cow/winter, and an average stocking rate of 1.7Cows/Ha
- 3. IGER research suggests that there will be a saving of £5 to £6 per acre from injection compared to spreading in the surface
- 4. In a normal application of 30m³/ha (2700gl/acre) this would mean a saving of 45kgN/ha (36 units/acre). At current fertiliser prices of £240/t for 34.5%N this is worth £21/ha or £8.50/acre

Critical success factors

To make this system work the following have been identified as critical

- If using the deep injector, the correct soil type is vital e.g. fields with a significant number of stones are impractical
- Steep fields cannot be used as the slurry runs along the incision
- The equipment is heavier and slower than conventional splash plate spreading so ground conditions need to be good to travel



Risk

There is little risk for this system as the extra cost (whether it is contractor or purchased equipment) should be covered by the extra nitrogen available.

Environmental considerations

Applying slurry by injection will reduce the amount of gaseous loss to the atmosphere and the amount of surface run off. It will provide significant benefits in terms of reducing nitrate leaching and.

Table 37 The RSPCA 5 freedoms and impact on slurry injection

Freedom From	Effect	Detail
Hunger and Thirst	=	
Discomfort	=	
Pain, injury and disease	+	Slight reduction in disease risk
Express normal behaviour	=	
Fear and Distress	=	

Nitrogen Testing Meters

The nutrient value of manure varies greatly due to: type of farm animal/feeding regime/bedding system/and dilution with water. Nitrogent testing meters are ained at improving the accuracy of manure nutrient assessment, which leads to improved fertiliser planning.

How does it work?

The nitrogen testing meter's use a chemical reaxtion to measure the nitrate content of the slurry. Each kit comes with a reagent, containers and measuring device.

The process may look like this:

- 1. The scale is selected depending on the type of manure to be measured;
- 2. The manure sample, water and a chemical reagent are then added;
- 3. The lid is attached and the contents are stirred for about 6 minutes;
- 4. The result for plant available nitrogen is then read directly on the scale



Key impacts on efficiency

- Fertiliser planning results in savings on inorganic fertiliser;
- Helps to comply with rules in Nitrate Vulnerable Zones;
- In some situations, organic manure can supply the total requirements for phosphate and potash;

Cost and benefits

The benefits from testing for nitrogen in slurry will be seen in reduced purchase of nitrogen fertiliser. Two systems available cost between £200 and £400, therefore the breakeven point is saving 1-2 tonnes of nitrogen fertiliser over the lifetime of the equipment without losing any crop performance. Providing farmers make changes to their fertiliser regime it is extremely likely that they will benefit from the purchase of the kit.

Critical success factors

Key factors of successful implementation of a Nitrogen Testing Meter include:

- Once the results are known the nutrient value must be taken into consideration when planning fertiliser applications to ensure crop requirements are met and not exceeded
- Regular testing to check for nutrient changes for each slurry/FYM pile do not assume they will be similar to the last test

Risk

There are few risks to the system but the benefit will only be seen when either more crop output is achieved or fertiliser savings are made.

Welfare and environmental assessment

- Reduced groundwater and surface water pollution from nitrate leaching and phosphate run-off;
- Utilisation of manure as a resource rather than environment disposal of a waste product.



Environmental considerations

The nitrogen testing meters can provide farmers with reliable data, which will help them conform to the new NVZ requirements.

Silage Trailer/Forage Wagon

An alternative system to move grass from field to clamp.

How does it work?

The grass is first mown and then the forage wagon uses a normal pickup wheel to feed the swath into a chopping mechanism. The chopped material is then loaded into a trailer installed with a moving bed, which moves the material into the wagon. When full the back of the silage trailer opens and the material can be discharged. Although it is a lot more time consuming that traditional forage harvester and trailers, it requires less equipment and can be done as a one man system when time is available.

Key impacts on efficiency

- These systems tend to give a longer chop length than conventional forage harvesters. This can help promote better rumination
- A high performance unit can be operated by just one person which reduces labour requirement or utilises labour available between milking
- Grass can be harvested at the right time rather than when the contractor can fit the job in
- Costs can be less than with a contractor as it can utilise the staff and machinery already available on the farm
- Lower diesel consumption e.g. 500hp instead of 800hp, 10 litres of diesel/ha instead of 16 litres/ha
- Can allow a flexible approach to cutting and grazing to maximise the conserved forage as well as freshen up pastures
- Suits smaller farms where grassland is close to the farm
- The whole silage harvest would take longer than using a conventional forage harvester



Costs and benefits

The Partial budget in Table 38 considers the costs and benefits that are derived on a farm using a forage wagon.

Table 38 Minimum \pounds saving per year required to justify the capital cost of a Silage trailer

Capital Costs	£10,000	£15,000	£20,000	£25,000	£30,000
Write off period					
5 Years	£2,350	£3,525	£4,700	£5,875	£7,050
10 Years	£1,350	£2,025	£2,700	£3,375	£4,050
15 Years	£1,017	£1,525	£2,033	£2,542	£3,050

Complete capital write-off assumed and average interest @ 7%.

Table 39 Work out our own costs for a silage trailer system

Costs Saved/	Extra Income	Income Lost	:/Extra Costs
Costs Saved (A)		Income Lost (C)	
Contractor Fees or			
Depreciation on			
old machine			
HP on old			
machine			
Labour saved			
Fuel/Repairs			
saved			
Extra income (B)		Extra costs (D)	
Better Silage?		Extra Fuel/Repairs	
		Additional Labour	
Total (=A+B)		Total (= C+D)	

If your total savings in the table above (that is (A+B) - (C+D)) outweigh the capital write off costs in Table 38, then it is worth considering this system.



Critical success factors

To make this system work the following have been identified as critical

- The fields need to be fairly close to the silage clamp to minimise transport time
- Spare labour on the farm that can be utilised between milkings
- Good silage clamp management is required during the harvest period to ensure a fast and effective fermentation as the filling time will be slower

Risk

The forage wagons do not cost as much as the precision chop harvesters but it does take longer to complete the process.

There is a slightly higher weather risk with using a forage wagon compared to a precision chop harvester because the operation tends to take longer.

The efficiency of using a forage wagon diminishes as transport distance increases. There is a risk that the crop is not picked up within the weather available.

The difference in chop length means a farmer using a forage wagon will require a 15% larger clamp to store the same tonnage of crop.

Welfare and environmental assessment

The system may reduce acidosis.

If set up efficiently less fuel will be used.

Table 40 The RSPCA 5 freedoms and impact on Forage Wagons

Freedom From	Effect	Detail
Hunger and Thirst	=	
Discomfort	+	Potential reduction in acidosis through longer chop length
Pain, injury and disease	=	
Express normal behaviour	=	
Fear and Distress	=	



Backing Gates

Backing gates are used in collection yards to encourage cows to move towards the parlour. The backing gates can be operated either manually or electronically and the following types are available.

- Linear backing gates Ideal for rectangular or square collecting yards
- Circular backing gates used with circular collecting yards
- Scraper backing gates integrates an automated scraper system
- Up and over backing gates This can be lifted over a subsequent group of cows that are next to be milked

How does it works

For the up and over backing gate, the gate is fixed to a rigid beam which runs along two tracks at both sides. The operator may (at the touch of a button) easily lift the backing gate up and over a second group of cows. The gate is then lowered behind the group.

Modern backing gates usually have a safety feature built into them. The gates will detect an object that is not moving i.e. a stubborn cow. If a cow is unwilling or slow to move in front of the gate, the gate will stop and the gentle pressure of the gate on the cow will make the cow move.

Whether electric, manual or automatic the concept is the same in that it encourages the cows to move up to the entrance of the parlour. This can speed the milking time by reducing the time it takes to feed cows into the parlour.

Key impacts on efficiency

 Reduces the time it takes to milk the cows because the milker doesn't have to keep going into the collecting yard to bring the cows into the parlour

Costs and benefits

Costs will range dependent on the size and type of backing gate selected. Costs start at around £2750 for manual and £3500 (excluding any building work that may be required). Table 41 shows the hours that need to be saved per annum to recoup the capital investment depending on the anticipated life of the gate.



Table 41 Minimum saving in man hours per year required to justify capital costs of backing gates

Capital Costs	£2000	£3000	£4000	£5000	£6000
Write off period					
5 Years	40	60	80	100	120
10 Years	20	30	40	50	60
15 Years	13	20	27	33	40
20 Years	10	15	20	25	30

[£] based on £10 per hour labour, no allowance has been made for interest charges.

Critical success factors

To make this system work the following have been identified as critical

- A rectangular collecting yard is necessary, unless the farmer is willing to convert their current yard
- Labour costs must be reduced as a result

Risk

The capital costs can only be recouped if the backing gates reduce time and thus reduce labour charges.

Welfare and environmental assessment

Welfare - the backing gates are welfare friendly although farmers should avoid electrifying the gates. Care should also be taken not to push the cows with gates as damage could occur to hocks.

Environmental considerations

There are no environmental considerations.

Automatic Calf Feeding

Automatic Calf Feeders work by dispensing small portions of calf milk, at the correct concentration and at the optimum temperature. The set quantity per day is consumed in several feeds throughout the day to allow the milk to be digested properly so reducing the risk of scour. Depending on the age of the calf, the animal is allocated a pre-set portion of milk according to a pre-programmed feed curve, which ensures a gradual changeover to roughage and concentrates.



How does it work

Integrated controls and software regulate the powder mixing process and milk temperature. In combination machines, the variable proportions of powder to fresh milk can also be controlled.

Feed curves are used to regulate calf intakes on a group or individual basis. In most circumstances, concentrate feeders can be connected to give a controlled transition from milk to solid feed as calves near weaning.

Automated washing systems help keep the preparation and delivery systems clean and hygienic, either up to the teat or including the teat.

Some feeders have an integral feeding teat whereas others operate with one, two or up to four separate feed stations. Some feeders have draw-off taps so that milk can be fed to calves separately by bucket or multi-teat feeders. Many machines can be adapted to contain liquid/powder applicators for additives or medicines.

Reduction in intakes can be spotted early to help early diagnosis of disease.

Key impacts on efficiency

- Time is saved as calves do not have to be fed manually
- There is likely to be less human error as the correct amount of milk is given to each calf
- If calves are not routinely feeding the farmer will be informed automatically
- There is more control as the farmer doesn't have to mix the milk powder by hand
- Calf pens can be more flexible as space is not required for every calf to be able to reach a bucket
- Calf health can be improved as the feed is delivered over time and hygiene is maintained
- Round the clock feeding and accurate control over quantity and quality improve calf performance and health

Costs and benefits



Table 42 Minimum saving in man hours per year required to justify capital costs of automatic calf feeding systems

Capital Costs	£2000	£3000	£4000	£5000	£6000
Write off period					
5 Years	40	60	80	100	120
10 Years	20	30	40	50	60
15 Years	13	20	27	33	40
20 Years	10	15	20	25	30

[£] based on £10 per hour labour, no allowance has been made for interest charges.

Critical success factors

To make this system work the following have been identified as critical

- The machine must be washed thoroughly, preferably 3 times per week
- · Calves/printouts must be checked daily for inconsistent drinkers
- Automatic feeding requires a high level of management including the discipline to clean and maintain equipment correctly
- The machine is not a substitute for good husbandry, which still needs to be excellent to gain the most from the system
- Calves that do not adapt to the system may still have to be reared by hand
- The calf housing must be of adequate size and ventilation to make efficient use of the machine

Risk

The system has capital and running costs. Consideration needs to be given to the number of calves being reared at any one time to justify the equipment. For small numbers feeding by hand may be as quick bearing in mind the time required to check, and clean the machine.

Welfare

Welfare - the automatic feeding system will not work unless the calves are provided with high welfare standards such as not overstocking and removing the shy feeders.



Environmental considerations

There are no environmental considerations.

Automatic Selection Gates

Automatic selection gates divert cows to the areas they need to go to. They are generally located at the exit/entry of the parlour, the feeding area, and fields.

They are used for:

- Running more than one group together for milking but split for feeding
- Encouraging cows to come in for robotic milking and then go to the fresh paddock
- Diverting cows for Vet, A.I. etc

How does it work

The gates identify each cow by the use of Auto ID and they are controlled pneumatically. The identification unit is built into the frame of the gate, and this is connected to the computer system which determines which cow should be where.

Key impacts on efficiency

- Reduces labour requirement due to:
 - Cows sorted by a command from the parlour making it more of a one-man system
 - Allows highs and low to be allowed out to graze or be milked as one group and then split again for feeding
 - Improves cows returning to be robotically milked when out at grass

Costs and benefits

The partial budget, shown in Table 43 considers the costs and benefits that are derived on an average farm automatic selection gates. The main benefit is that it will reduce labour costs as the farmer is not letting out/bringing cows in manually.



It costs around £3,500 per gate installed.

Table 43 Minimum saving in man hours per year required to justify capital costs of selection gates

Capital Costs	£5000	£7500	£10000	£12500	£15000
Write off period					
5 Years	100	150	200	250	300
10 Years	50	75	100	125	150
15 Years	33	50	67	84	100
20 Years	25	38	50	63	75

[£] based on £10 per hour labour, no allowance has been made for interest charges.

Critical success factors

To make this system work, the following have been identified as critical:

- A building/field layout that allows cows to be sorted quickly
- The system will not work where cows have to cross roads to get to grazing
- The cow ID system needs to be consistent with other uses i.e. activity monitoring, parlour ID, individual feeding system

Risk

The system can function very well, however capital costs can be high the cheapest auto ID is £20 per collar = £4,000 for a 200 cow herd and £3,500 per gate.

Contingencies need to be built into system for when Auto ID is not functioning.

Welfare and environmental assessment

There is little Welfare or Environmental impact.

Environmental considerations

Environmental impact is minimal.



Automatic Milking Systems

In an automated milking system (AM-systems) cows are milked by a robotic milking system without human supervision. AM-systems can either be single stall systems or multi stall systems. Single stall systems have an integrated robotic milking system whereas multi-stall systems have a transportable robot device. Each stall has its own milking device, similar to a milking parlour.

How does it work?

A single stall AM-system is able to milk 55-60 cows up to 3 times per day on average. Multi-stall systems have 2-4 stalls and are able to milk a herd of 80 to 150 cows three times per day.

Once a cow has been identified and enters the stall, all units go through udder preparation. This involves the application of teat cups (laser guided), monitoring milk flow, teat cup removal and post milking teat spraying.

The main motive for a cow to visit the AM-system is the supply of concentrates. All AM-systems are equipped with concentrate dispensers. An automatic milking system has to act as a substitute for a milker and therefore these systems should have electronic cow identification, cleaning and milking devices as well as computer controlled sensors to detect abnormalities, either in cow health or the functioning of the machine.

Some systems allow farmers to change over to manual at the touch of a button.

Low quality milk (high conductivity, antibiotic, freshly calved) can be diverted away from the main bulk tank.

Auto ID is essential either via tags, collars or pedometers.

Key impacts on efficiency

- Physical labour savings of 30-40% compared with conventional milking systems are quoted, although someone has to be continually on call
- Running costs are high due to the amount of automation and the need for regular servicing to make sure that the best milking performance is kept
- Difficult to fit grazing into farming system so there is more reliance on zero grazing
- Provides flexibility in terms of milking times and frequency
- The level of herd information is greater than that of conventional parlours
- The milking process does not require permanent supervision. Work is also less time bound compared with the milking parlour system, thus enabling a more flexible input of labour
- Due to the milking process being changed into a 24-hour process, system failures can occur for 24-hours per day. There should always be a person on duty to react to system failures
- The system may not be suitable for all cows due to udder shape and teat position, or behaviour. The culling rate for automatic milking is said to be 5-10% higher
- A 15-20% increase in milk yield effectively achieved by three times a day milking
- In some circumstances cows will not be able to graze in the summer, as the
 animals will have to walk too far. Also, for cows, which need to cross a road to
 get between the milking system and the field, an AM-system will not be viable

Costs and benefits

As each farm and system will be set up differently it is difficult to use "an average". Therefore, you will need to get quotes for your circumstance and then put them in the table below. It is assumed that you need a new parlour and therefore you only need to justify the extra costs of the robotic system over and above a conventional parlour.



Table 44 Establish your own costs for a robotic milker

	Example	Your Farm
New Robot	£110,000	
Alternative Parlour	£50,000	
Difference	£60,000	

Once you have established the additional costs of the AMS system look at the table below. Chose the column that is closest to your additional costs and also the period you want to write it off over i.e. if the additional cost was £40,000 and you wanted to write this off over 10 years the figure is £5,400. These are the additional savings you need to make in labour or other savings for it to be a good investment.

Table 45 Minimum £ saving per year required to justify the additional capital cost of an automatic milking system

Capital Costs	£20,000	£40,000	£60,000	£80,000	£100,000
Write off period					
10 Years	£2,700	£5,400	£8,100	£10,800	£13,500
15 Years	£2,033	£4,066	£6,099	£8132	£10,165
20 Years	£1,700	£3,400	£5,100	£6,800	£8,500
25 Years	£1,500	£3,000	£4,500	£6,000	£7,500

Complete capital write-off assumed and average interest @ 7%.

To justify the additional costs of the robot quantify what benefits will it make:

- 1. Labour
- 2. Yield?

Also quantify your additional costs:

- 1. Higher culling rate
- 2. Greater use of chemical cleaners
- 3. Higher repair and maintenance



Critical success factors

Key factors of successful implementation of AM-systems include:

- · Ability to work with computers
- The "fit" of the automatic milking system with existing buildings and fields
- 24 hour availability of experienced operator to fix faults
- Cows that are happy with this system

Risk

There are risks with this high capital system as running costs and returning to another system of milking cows will be expensive. Therefore, you need to be confident that it is the right system for you.

Will it really give you the flexibility to leave the farm for a 12 hour period? Or will you still need to be within 1 hours drive to fix the system as the number of cows needing to be milked starts backing up and you have no other way of milking them?

Does it allow a small increase in herd size or do you need to double everything up to allow expansion?

Welfare and environmental assessment

The AM-system allows the cow to choose when she is milked. If cows already suffer from mastitis, the AM-system will not reduce the problem – it is more likely to make it worse. It is normally expected that approximately 5-10% of any herd are not suitable for automatic milking systems for various reasons i.e. temperament and udder confirmation. These cows will have to be culled.

Day/Night Lighting

This system works by exposing lactating cows to more light and as a result, increases yield.

Research trials show that "Long Day Lighting" (i.e. giving lactating cows a light supplement to achieve 16-18 hours of light in a 24 hour period) can increase milk yields by between 5- 16%, when compared to cows receiving 13 hours of light or less (e.g. the whole winter period for the UK). If housing is naturally dark there may be



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ways of improving the light from natural sources such as windows or transparent roof lights.

How does it work?

The longer lighting hours stimulate an increase in insulin growth factor -1, which lowers blood glucose level, and this in turn stimulates cow food intake.

Ideally, 18 hours of light, with a 6 hour dark period will stimulate a typical summer day length. The duration of the light period is critical, as the effects are not triggered until 16 hours of light have elapsed. The milk response will occur gradually over a period of weeks.

However, dry cows are the other way round, that is, with an 8 hour light period, followed by a 16 hour dark night – as winter days are anyway. It seems that the dry cow needs this break from the "Long Day Lighting" in order to respond to the light stimulus when in milk.

The pineal gland in most mammals is controlled by the amount of light seen through the eyes each day. This includes both the intensity of light and the duration of light exposure. When activated by light, there is a "light signal" sent from the eyes to the hypothalamus and from there to the pineal gland which activates pineal secretion. The pineal secretion includes melatonin. Increased amounts of light exposure actually decrease the amount of melatonin synthesis and release from the pineal gland. In all species studied, melatonin has been found to reach peak concentrations in darkness – in cerebral spinal fluid, blood and urine.

Key impacts on efficiency

- Milk yields can increase by between 5-16% in lactating cows
- Brighter environment for herdsman to work in
- Easier to identify bulling animals
- Less stress, bullying and trodden on cows
- Improved feed intakes by heifers and shy feeders
- For herds where there is currently no significant night lighting on the silage feeding and lying areas, the benefits could be double



Costs and benefits

A 5 -16% increase in milk yields would have the following benefits for an average 200-cow herd achieving 7,500 litres. Flood lights 500w to 1000wcan be purchased from between £100 to £300 each excluding fitting.

Table 46 Partial budget day/night lighting

Costs Saved/Extra Income		Income Lost/Extra Costs			
Costs Saved		Income Lost			
			£0		
Extra income	0	Extra costs			
Milk Income (1)	£49.5	Electricity (180	£4.32		
		day winter)			
		Capital write off (2) £2.16			
		Extra Feed	£14.76		
<u>Total</u>	£49.5	<u>Total</u> £21.24			
Total Benefits Per Cow = £28.26					
<u>Total</u>		£14.76			

w Herd Margin = £5,652

- 1. Assume 6% (see MDC 21st Century cow) increase in output from 7,500 litres (for half the year) = 225 litres, at 22p = £49.5
- 2. Capital cost of sodium lights £3,200 for 200 cow herd written off over 10 years average interest. = £432

Critical success factors

To make this system work the following have been identified as critical

- Commitment of herdsman communication and team work to make sure that the lighting is consistent
- The dry cows need to be housed away from the lactating cows because they need the opposite amount of light (e.g. 8hrs of light followed by 16 hrs of dark)
- Nutrition and cow management to facilitate yield
- A minimum of 6 hours of darkness per day is needed otherwise the cows will not benefit



Risk

The risk relates to the capital cost of the lighting as if the technology does not work then running costs can be reduced to zero.

Other factors such as nutrition need to be managed to facilitate an improvement.

Welfare and environmental assessment

Providing adequate night rest periods are provided there will be no welfare issues.

Environmental considerations

The extra lighting will use extra electricity so steps should be taken to maximise the use of natural light as a primary objective and ensure that the artificial lighting is turned off when not required. Energy efficient lighting is recommended and will reduce running costs.

Light pollution affecting neighbours may also be an issue.

Energy Efficiency

On dairy farms milk cooling and water heating account for about one third each of the energy consumption with the remaining third being used for lighting, heating and ventilation. This section looks at technology relating to water heating and milk cooling as this is where there are greatest gains however when looking at any new opportunity you should consider the following in relation to energy efficiency:

- Is the system a necessity, i.e. will there be a genuine return from the energy expended?
- With rising energy costs will the system still be economic to run in the future
- Can the results be achieved through natural means e.g. by increasing natural light rather than electric lighting, natural ventilation rather than fans, insulation to retain heat etc.
- Is the system as energy efficient as it could be? Does it use low energy components e.g. light bulbs, motors etc.
- Can the technology run with its own standalone energy source e.g. Photo-voltaic, solar or wind power?



Milk Cooling

How does it work?

Plate coolers are heat exchange modules i.e. the milk (34°c) and water (12°c) pass either side of a thin metal division, the heat is passed form the milk to the water hence reducing the temperature of the milk. They usually work on a ratio of 2 litres of water to 1 litre of milk. The milk enters the bulk tank at a significantly lower temperature and hence the cooling requirement in the tank is reduced.

The water is normally discharged into a water trough for cows to drink after milking.

It remains the cheapest way to cool milk so long as the water can be re-used, especially in the case of mains as opposed to bore hole water.

One of the key issues is to have the capacity of the plate cooler matched with the milk volume to be treated. This may need to reviewed periodically as milk volumes have increased over the years.

Key impacts on efficiency

- Cools milk quickly from 34°c to 15°c
- Reduces the costs of cooling by the bulk tank
- Quickly reduces bacterial multiplication due to quick cooling

Costs and benefits

The Partial budget in Table 47 considers the costs and benefits that are derived from fitting a properly matched plate cooler.



Table 47 Partial budget plate cooler

Costs Saved/Extra Income		Income Lost/Extra Costs			
Costs Saved		Income Lost			
Electricity from cooling (3.)	£9.17		0		
Extra income		Extra costs			
		Capital cost of £0.51			
		plate cooler (1)			
		Water usage (2) £8.6			
<u>Total</u>	£9.17	<u>Total</u> £9.11			
	Total Benefits Per Cow = £0.06				
	200 Cow herd = £12				

- 1. Assume £750 fitted and written off over 10 years average interest of 7%
- 2. Assume 1:1 milk to water ratio and temp drop of 15 degrees. 115p cubic metre. 7,500 litre cow
- 3. Assume 131 Kwh to reduce 7,500 litres by 15 degrees @ 7p Kwh

Critical success factors

To make this system work the following have been identified as critical

- The plate cooler must be matched to the flow rates of the milk coming from the parlour and the bulk tank. Maximum milk cooling efficiency is achieved when exit milk temperature is no more than 2°c higher than the water temperature
- Delay switches should be fitted to allow water flow to be matched with milk flow, a
 delay is required to allow the water to run slightly after the milk has stopped
- Mains water must not be wasted or the cost of the water will exceed the savings from milk cooling

Risk

There is no risk with this system other than the initial outlay of capital if water is reused

Welfare

There are no welfare issues with this technology



Environmental considerations

This system reduces the amount of energy required for milk cooling so has an environmental advantage.

Technical Dairy Management Programmes

This is meant as a guide to show what is potentially available in the marketplace today.

Fertility Management Programmes

This section looks at the ways to improve fertility via both better record keeping and also planning your breeding program via:

- Identifying critical records
- Managing block calving
- Herd nutrition

How do they work?

There are many different types of fertility management programmes available, many of these are suitable for large cow units. Some programmes include experienced fertility technicians who are paid to visit the herd (often daily), to take responsibility for heat detection and insemination.

Genetic Management Programmes

The cost of inbreeding is expensive. If a farmer increases inbreeding in any mating by 1% it will have the following consequences:

- Reduces cows productive life by 13 days
- Reduces the first lactation milk by 37kg
- Increases first calving interval by 0.26 days
- Reduces total lifetime milk by 348kg



These programmes work on the basis of reducing the chances of inbreeding in the herd. The programmes can also be used to remove undesirable recessives to ensure the animals only have the traits that are most important to the farmer. These traits may include production, udder health, locomotion, lifespan and many others. With some programmes, the farmer can even emphasise the milk type. The main aspects of these systems include:

- Extensive inbreeding protection
- Improved management traits
- · Herd percentile ranking
- Reliability restrictions

Manuals are often available and some are supported by programmes and workshops, designed to help UK dairy farmers improve their herd profitability though better breeding. The subject areas include:

- Planning
- Sire selection
- Breeding cows and heifers

Statutory Recording Programmes

How do they work?

These systems can reduce farm record keeping duplication by fully integrating with APHIS/BCMS and Holstein UK. They can also look after farm quality assurance records including vet treatment. The systems can also improve dairy cow fertility with breeding management by providing action lists.

Dairy Costing Programmes

How do they work?

These programmes are used to analyse farmer's on-farm data on a monthly basis. Each month, clients enter their stock numbers, milk details, concentrate and forage use, and are instantly able to monitor their progress over the year and look at the variances compared to the last 12 months.



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This is a simple form of benchmarking and targeting business performance using the key out puts and key variable costs. Annual rolling figures may show average results over the year, with graphs to illustrate performance in key areas such as butterfat, protein %, milk yield etc.

The farmer may also be able to:

- View comprehensive individual cow records
- Keep milk production on target with accurate Quota predictions
- Import milk records from QMMS, CIS and NMR
- Notify BCMS via CTS to apply for passport Applications and notify Movements
- Access cow records outside at any time on a palmtop
- Prepare action lists for the vet to assist with pre-visit planning
- Record and report for Dairy Herd Health Planning
- Print off NOAH format Medicine Book for both Purchases and Treatments
- Check bloodlines do not cross over with relations report



IT software

How do they work?

- A direct link to the CTS website when creating movements and passports
- A PDA link
- Facility to record fallen stock numbers
- A farm assurance module
- Facilities for quick data entry
- Conformation screens to check accuracy of data
- Ability to import HFS Type Classification data
- Automatic linkages between health events and treatments
- Provision of reports on individual and group production histories
- Introduction of comprehensive medicine book, formatted to NOAH (National Office for Animal Health) standards

Note: Some of these systems suit PDA use.

PDA (Personal Digital Assistants)

How do they work?

A PDA (Personal Digital Assistant) is a generic term which covers a range of small hand help PC's made by various manufacturers, with a touch sensitive screen and stylus. They are small enough to fit into a pocket and contain cut down versions of the main Microsoft products including Word, Excel, PowerPoint etc. They can also act as diaries and address books, linking with Microsoft outlook.

It is recommended that before the farmer purchases a PDA, they should contact the software provider which they wish to use to make sure they buy the correct spec to run the chosen software.



Data can be presented on a PDA in a way that farmers can use to make management decisions. The animal's name and ID, ancestry, progeny, lactation records, event details and treatments can all be shown. Events can be logged on the PDA.

Online updates are often available online which means that it is faster to produce amendments to the programme as developments are made.

This system is a miniature version of a home computer and can perform most of the simple office tasks which a farmer is likely to need. At a basic level, farmers are able to copy existing spreadsheets containing crop information from their PC onto their PDA. The PDA can be linked to software packages currently running on the farm computer so that farmers can carry enterprise information with them in their pocket and access and update their records while on the move. Any information keyed during the day will automatically be updated onto the farm PC once the PDA is connected, meaning there is no need to retype the information.

Fertiliser Management

How do they work?

Organic manures are a valuable source of plant available nitrogen. However, using either too much/too little N can adversely affect crop yields and quality. By integrating manure and inorganic fertiliser, nitrogen additions, crop yields and quality will be optimised and pollution risks will be reduced.

There are decision support systems that can be used to accurately predict the fertiliser nitrogen value of organic manures on a field specific basis. These systems can sometimes estimate the amount of plant available nitrogen supply by accounting for:

- Ammonia loss to air
- Nitrogen leeching losses to water
- Organic N release

There is also a computerised version of DEFRA's industry standard 'Fertiliser Recommendations RB209' book. The system provides farmers with a quick and easy way of obtaining RB209 recommendations for arable and grassland crops in each field, each year, taking account of the crop nutrient requirement as well as the nutrients supplied from organic manures, soil and fertilisers. It will allow the user to



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develop a nutrient and manure application plan for a group of fields covering the use of nitrogen, phosphate, potash, magnesium, sulphur, sodium and lime.

Grassland improvement programmes are available for farmers and consist of a comprehensive manual supported by a series of extension programmes and workshops specifically designed to help GB dairy farmers make the most of their grass. Chapters include:

- planning and managing grazing
- · supplementing grazing
- planning and managing silage making
- optimising N fertiliser practice
- grazing high yielding cows

Advantages

- Allows the farmer to have their fingers on the pulse
- Can save time

Disadvantages

- Farmer's should not always believe what it says
- "Rubbish in rubbish out" concept



APPENDIX 1 – CONTACT DETAILS FOR SUPPLIERS OF SPECIFIC TECHNOLOGIES

This table contains contact details for suppliers of the technologies outlined in this report.

Fertility Manag	ement Technologies		
Type Of Product	Trade Name	Telephone Number	Website Address
Contract	Genus Breeding Ltd	0870 162 2000	cs@genusbreeding.co.uk
Breeding Management			www.genusbreeding.co.uk
CCTS	Alarms For Farms	01573 440761	www.alarms-for-farms.com
	Mobile Alarms	07787 961035	www.mobile-alarms.com
			sales@mobile-alarms.com
	Bates Security Systems Ltd	01708 346777	info@batessecurity.co.uk
			www.batessecurity.com
	AES – Advanced Electronic Solutions	028 8676 7878	www.aes-ni.co.uk
			sales@aes-ni.co.uk
	Intershape Trading Ltd	01858 880830	webinfo@intershape.com
			www.intershape.com
	Abel Tek	0870 1996868	www.abletek.co.uk
Sexed Semen	Cogent	01244 622000	www.cogentuk.com
			ingo@cogentuk.com
	Genus Breeding Ltd	0870 1622000	cs@genusbreeding.co.uk
			www.genusbreeding.co.uk
Motion Sensors	S		
Pedometers	DeLaval Ltd	029 2077 5800	gb.info@delaval.com
			www.delaval.co.uk
	Fullwood Ltd	01691 627391	www.fullwood.com
			sales@fullwood.com
Optical	4sight	07711 759825	b.newell@btinternet.com
Sensing			www.cowfertility.com
Necometers	Semex ai24	0800 868890	www.semex.co.uk
	Fabdec Ltd	01691 627200	www.fabdecv2.remotenewmedia.c
			o.uk
			info@febdec.cpm



Cow Health Techn	ologies		
Dry Cow Teat Plugging	Pfizer Ltd –Orbeseal	01737 331333	www.orbeseal.com
Udder Singeing	Healthy Cows	01454 321352	mike.hobbis@healthycows.co.uk
			www.healthycows.uk
Barrier Teat Dips	Genus Breeding Ltd	0870 1622000	cs@genusbreeding.co.uk
			www.genusbreeding.co.uk
	Johnson Diversey	0800 0130789	www.johnsondiversey.com
	Evans Vanodine	01772 322200	www.evansvanodine.co.uk
	Ecolab		www.ecolab.com
Somatic Cell Cour	nt Measuring		
Optical Cell	DeLaval Ltd	029 2077 5800	gb.info@delaval.com
Counting			www.delaval.co.uk
Californian Mastitis Test	Promar International	01829 731731	enquiries@promar-
(CMT)			<u>international.com</u>
Reagent Strip	Fullwood	01691 627391	sales@fullwood.com
Tests			www.fullwood.com
Automated	DeLaval Ltd	029 2077 5800	gb.info@delaval.com
Footbaths			www.delaval.co.uk
	WestfaliaSurge UK Ltd		www.westfalia.com/uk
Automated	Hydor	01725 511422	Info@hydor.co.uk
Ventilation			www.hydor.co.uk
	DeLaval Ltd	029 2077 5800	gb.info@delaval.com
			www.delaval.co.uk
	Royal De Boer Barn Equipment	058 233 2000	www.deboerstal.com
Automatic	ADF	01243 641441	info@ad-f.com
Flushing Of Teat Liner			www.ad-f.com
	Vaccar	01600 716216	info@vaccar.com
			www.vaccar.com
		i contraction of the contraction	



Vaccines For Dair	y Farms		
Type Of Product	Trade Name	Telephone Number	Website Address
Bovine Viral Diarrhoea (BVD)	Local Vets		
Leptospirosis	Local Vets		
Lungworm (husk)	Local Vets		
E-coli mastitis	Local Vets		
Performance Enha	ancing Technologies	•	
Type Of Product	Trade Name	Telephone Number	Website Address
Slurry Injection	Abbey Farm	0353 6731278	www.abbeymachinery.com
	Equipment Ltd		abbeyfe@iol.ie
	Spreadwise	01270 623566	info@spreadwise.com
			www.spreadwise.com
	Local Contractors		
Forage Wagons	Strautmann UK	01524 784930	www.strautmann.co.uk
			info@strautmann.co.uk
	LandMec Pottinger	01752 891291	info@landmecpottinger.co.uk
			www.landmecpottinger.com
	Schuitemaker	0548 514 125	www.schuitemaker-machines.nl
			sales@sr-schuitmaker.nl
Automated Calf Feeding	Lely UK Ltd	01480 226800	ag.sales@lely.co.uk www.lely.co.uk
	DeLaval Ltd	029 2077 5800	gb.info@delaval.com
			www.delaval.co.uk
	Foerster Technik		www.foerster-technik.de
	NWF Calm Calf System	0800 262397	www.nwfagriculture.co.uk
Selection Gates	Lely UK Ltd	01480 226800	ag.sales@lely.co.uk www.lely.co.uk
	Fullwood	01691 627391	sales@fullwood.com
			www.fullwood.com
	DeLaval Ltd	029 2077 5800	gb.info@delaval.com
			www.delaval.co.uk



Automatic	Lely UK Ltd	01480 226800	ag.sales@lely.co.uk
Milking System			www.lely.co.uk
	Fullwood	01691 627391	sales@fullwood.com
			www.fullwood.com
	DeLaval Ltd	029 2077 5800	gb.info@delaval.com
			www.delaval.co.uk
Milk Cooling	Fabdec	01691 627200	info@fabdec.com
			www.fabdec.com
	DC Engineering		
Water Heating	Fabdec	01691 627200	info@fabdec.com
			www.fabdec.com
Technical Dairy	NMR	0870 162 2547	www.nmr.co.uk
Management Programmes			customerservices@nmr.co.uk
Genetic	Cogent	01244 622000	info@cogent.com
Management Programmes			www.cogentuk.com
riogrammes	Genus Breeding Ltd	0870 162 2000	cs@genusbreeding.co.uk
			www.genusbreeding.co.uk
Statutory	BCMS	0845 050 1234	ctsonline@bcms.rpa.gsi.gov.uk
Recording Programmes			www.bcms.gov.uk
	Farmplan	01594 545011	enquire@farmplan.co.uk
Dairy Costing	Promar International	01829 731739	enquiries@promar-
Programmes			<u>international.com</u>
			www.milkminder.co.uk
			www.promar-international.com
			www.dairymanager.net
	Kingshay	01458 851555	www.kingshay.com
			contact.us@kingshay.com
	The Dairy Group	01832 444488	enquiries@thedairygrop.co.uk
			www.thedairygroup.co.uk
	Kite Consulting	01785 713166	Sue.spillard@kiteconsulting.com
	Most Feed Companies		
IT Software	ATL Agriculture	01638 731212	info@atlagri.com
	Technology Ltd		www.agricultural- technology.co.uk
	Farmplan	01594 545011	enquire@farmplan.co.uk
	ι απημαπ	01084 040011	enquire@iaimpiam.co.uk



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PDS – Personal	Farm Wizard	02890 930057	info@farmwizard.com
Digital Assistant	NMR	0870 162 2547	www.nmr.co.uk
			customerservices@nmr.co.uk
Nitrogen Testing	Qualex	01249 890317	www.qualex-analysis.co.uk
Meter			robert@jpainting.freeserve.co.uk
Fertiliser	Planet Nutrient		planet.admin@adas.co.uk
Management	Management		www.planet4farmers.co.uk
	ADAS Gleadthorpe Research Centre (Manner)	01623 844331	www.adas.co.uk

Note: This appendix is believed to contain contact details of all companies supplying the specific technologies at the time the list was updated. We take no responsibility for any omissions from the list which will be updated periodically.

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