



**A Nuffield Farming Scholarships Trust  
Report**

*Award sponsored by*

**Worshipful Company of Butchers**



**Facilitating change within the red meat  
chain through knowledge transfer,  
feedback and technology uptake**

**Jonathan Birnie**

**July 2015**

**NUFFIELD UK**

## **NUFFIELD FARMING SCHOLARSHIPS TRUST (UK)**

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# A Nuffield (UK) Farming Scholarships Trust Report



Date of report: July 2015

*"Leading positive change in agriculture.  
Inspiring passion and potential in people."*

Title	"Facilitating change within the red meat chain through knowledge transfer, feedback and technology uptake."
Scholar	Jonathan Birnie
Sponsor	The Worshipful Company of Butchers
Objectives of Study Tour	The study of current methods of knowledge transfer to the farming supply base, and the understanding of factors which encourage or discourage understanding and implementation.
Countries Visited	New Zealand Australia USA Canada China UK Ireland
Messages	<ol style="list-style-type: none"><li>1. Failure to implement latest farm practice is seriously damaging the UK livestock industry.</li><li>2. Gathering and interpreting farm data is the most pressing need in UK livestock farming.</li><li>3. The use of new technology is essential in gathering and assisting with the interpretation of the data.</li><li>4. Delivering information and training in several different ways is crucial, as is the involvement of 'leader farmers' in demonstrating successful implementation.</li><li>5. Creating confidence in a manager's ability to deliver change is a vital component of successful implementation of new practice. Ongoing advice and repeated follow up accelerates this process.</li></ol>

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## **DISCLAIMER**

The opinions expressed in this report are my own and not necessarily those of the Nuffield Farming Scholarships Trust, or of my sponsor The Worshipful Company of Butchers, or of any other sponsoring body.

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## 1. Personal Introduction

I currently work as Head of Agriculture and Research for Dunbia, a large UK meat processor serving the retail, food service and export trade with beef, lamb, pork and added value product. My career has spanned farming (primarily dairy and beef), research (I gained a PhD in ruminant metabolism at the Agricultural Research Institute of Northern Ireland), lobbying/representation (National Farmers Union), retailing (Sainsbury's) and meat processing (Dunbia), all within the UK agricultural sector.

My current role involves the development of the supply base to meet customer and farmer requirements, focusing on product quality, production efficiency and ongoing economic sustainability. I undertook my Nuffield Scholarship because I observed the huge range of farm performance in the UK and wanted to understand why this is the case which it should so demonstrably not be so. I wanted to understand what I (and my company) could do to increase uptake of best practice, hence improving the whole supply chain.



The author, Jonathan Birnie



## 2. Change, and why it is needed

***“It is not the strongest or the most intelligent who will survive, but those who can best manage change” – Leon Megginson.***

The red meat industry in the UK is relatively traditional, with a wide spread of performance on different farms. The UK’s top farmers are as good as any in the world, but the study of available benchmarking figures reveals that there is a very wide spread and a long tail of underperforming farms (AHDB, HCC, QMS, DARDNI).

World supply of meat versus demand is expected to fall, increasing competition for the product (GIRA). However, many of the markets which will become available will, at least in the short to medium term, provide lower returns than the UK market. Consumers demand value for money and, in the UK, have demonstrated that they are unwilling to substantially raise the amount they are prepared to pay for meat within a short timeframe.

Meat is an important component in the diet of the majority of UK households, but there is a variety to choose from and, where buyers have alternatives, they make judgements based on a range of criteria, including price, convenience, taste and consistency. Value is one of the key criteria, and if, for example, the consumer judges beef to be better value than chicken, pork or lamb, he/she is likely to purchase. This mechanism provides an element of internal price regulation for meat sales in the UK.

*It is essential that the UK industry addresses issues that are restricting profitability and hence the sustainability of individual farms.*

In summary this means that, while we can expect a gradual and ongoing rise in the price which consumers pay for meat, we should not expect large jumps in price over short time periods in order to maintain supply volumes and avoid a price crash. On the basis that consumers will not pay more for red meat in immediate response to the removal of support payments, it is essential that the UK industry addresses issues that are restricting profitability and hence the sustainability of individual farms.

Many factors affect farm sustainability, with a proportion outside of the control of the individual farmer. Some other factors can be influenced but the level of effort required outweighs the benefits on offer. A third class of change, however, includes those factors that are within the control of the farmer and offer benefits which outweigh the effort required to achieve them. The frustration of many industry observers is that many farm managers ignore the potential to improve because they either do not understand the benefits on offer or lack the technical expertise or knowledge to implement them.

Practical observation of beef and lamb production in the UK reveals high levels of inefficiency in many businesses. As a general rule, animal husbandry is of a high standard but in many cases, the level of business management and the implementation of new technologies and latest practice fall well below ideal levels.



In the UK and Ireland much of the inefficiency appears to have been permitted and encouraged by the levels of farm support from the EU. Essentially this has provided a safety net which has enabled businesses to substantially ignore or avoid best business practice. There is going to be an ongoing reduction in the amount of support available from the EU, and it is therefore essential that managers ensure that their businesses are not dependent on a high level of support from the EU and instead derive the majority of their income from the market place.

There has been a focus by many farmers on 'single issue' solutions to improvement of business profitability (usually in the form of a price rise!). However, the real solution is one made up of very many small details. This type of change is difficult because it demands a high level of attention to detail, and many are either not aware of the changes which can be made or are not willing to expend the effort necessary to make them.

It was frustrating to see how much good research and development work is completed but not implemented

As I continued my Nuffield Farming studies I became increasingly interested in the principles behind effective extension and data flow. It was frustrating to see how much good research and development work is completed but not implemented. While there can be a number of extraneous factors which prevent implementation, the most usual reasons are associated with low awareness of the findings, and a lack of confidence or knowledge about how to apply these in a commercial context.

This report is focused on summarising the need for improvement and the best methods of assisting and enabling farmers to implement the necessary change.



### 3. Global farm performance and practice

Climate, available markets, legislation, support networks and tradition all influence farming practice. As a result, farm practice and performance differs throughout the world and there is much that we can learn and apply in the UK.

#### 3.1. Farm structure

Farm structure and attitude to land differs strongly between the countries I visited. I visited the USA, Australia and Canada (where farm size is much bigger) and New Zealand, where the size difference is lower. The greatest contrast in attitude I observed however, was between UK and NZ producers, and this was more stark because of the relative similarity of the two countries.

Unlike usual practice in the UK, many NZ livestock farmers have to buy their land from their family and as a result, the agricultural sector is much more transactional and less emotive. The farm has to make money because it is carrying debt and there is no safety net. This has been the case for over thirty years, and has meant that a generation of farmers has grown up understanding the ongoing need for application of best practice. As a result they tend to keep abreast of new developments and, even more importantly, attempt to implement them.

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Many NZ farmers expect to sell their land to fund their retirement and consequently tend to treat the farm as a disposable asset, focusing on maximising output rather than maintaining traditional practices. Many producers in NZ tried to convince me that there were also high levels of traditionalism and poor practice in NZ, but it is evident that the incidence of this is much lower than in the UK and Ireland.

It was also interesting during this study to compare the attitudes and practice of farmers in the pig and poultry sector in the UK. Generally speaking, pig and poultry farmers are more intensive, more progressive, much more aware of best practice and much more inclined to implement it. I came to the conclusion that this was primarily due to lower land dependency which in turn permitted entrepreneurs to achieve a return on investment and continue to develop without the difficulty of obtaining additional land and the high overhead cost of acquiring it.

#### 3.2. Uptake of science and technology

***“Increased production is essential, therefore increased use of science is vital” – Peter Kendall, NFU***

I found that the uptake of science and technology differs more substantially between the different meat sectors than between countries. Farms which are intensive in nature tend to take up new findings much more quickly, and I concluded that this happens because the intensive sectors collect



more data and can measure the effect of any changes made. This in turn generates a virtuous circle in which change generates a positive effect which in itself encourages further change.

In one sense, the poultry sector is driven to the implementation of science by the vertically integrated nature of the industry, where information is clearly fed back from the processor on both technological developments and customer requirements. However, the same sense of enterprise is demonstrated by the pork sector where, by and large, there is little vertical integration. Perhaps crucially, neither of these sectors has had the safety net of support payments and they are more self-reliant accordingly.

Many of the higher performing sectors have experienced substantial drop-out rates at some stage over the last 20-30 years, usually due to a collapse in market price. This has certainly been the case in the lamb sector in New Zealand, the dairy sector in the UK and the pig sector in Northern Ireland. It seems that high attrition rates under extreme financial challenge leave a legacy of producers who are progressive and open to ongoing change and development.

A key to driving progress is through better control of the breeding herd/flock. The poultry, pork and dairy sectors all have strong control of their maternal lines and as a result, significant genetic progress has been made. As the performance of the dams improves, better systems are required to manage these higher performing animals, almost forcing the uptake of new practice and technology. Producers in these sectors with whom I met were highly aware of the benefits of good genetics, as well as the necessity of improved systems and management. This was in considerable contrast to a large section of the beef and sheep sectors.

### 3.3. Market awareness

As my study progressed and I interviewed more farmers, I came to the strong conclusion that there was a relationship between technical competence and market awareness. A large majority of the higher performing farmers in every sector was very aware of what their key markets needed, and their businesses were focused around this.

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In general, those with the most regular contact with (and possibly involvement or investment in) their major markets were consistently among the higher performing farmers or sectors. In New Zealand several different people highlighted the difference between Fonterra (Dairy) and Alliance and Silver Fern (Beef and Lamb). Conor English (CEO of Federated Farmers, NZ) felt that because those who are involved with Fonterra have a high level of financial investment in the company, they are, as a result, very responsive to customer- or efficiency-led requests from the business, whereas those involved in the beef and lamb sectors have a very low level of investment in the farmer co-operatives and as a result tend to have a more short term focus which centres mainly around price and not long term sustainability.



### 3.4. Farm financial performance

A review of published farm performance figures from around the world reveals major differences in practice and in financial performance. Probably the most concerning aspect of figures from the UK is those displaying the extent of the differences in animal performance and the fixed cost components. There is substantial room for improvement, made all the more essential by the anticipated changes to the Common Agricultural Policy. In all the countries which I visited and in which I interviewed farmers and industry professionals, farm financial performance was very closely related to attention to detail in the management of the farm.

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## 4. The type of change required in the UK and Ireland

*“The best businesses don’t focus on their strengths, they focus on their weaknesses and improve them”*

- Allan Wilkinson, Head of Agriculture, HSBC.

Each farm is different and it is dangerous to make sweeping generalisations, but in my opinion there are several key aspects of UK production which need to improve. I list the key ones below.

### 4.1. Improved collection of management information

Throughout the UK, many farms perform well and are comparable with any in the world. I was reminded of this regularly throughout my farm visits on different continents. However, it was increasingly clear from conversations with farmers, farm advisors and processors that variation in the UK and Ireland is greater than in many other countries. There are a number of causes of inefficiency in the red meat chain in the UK. I believe that one over-riding factor is at the root of the majority of underperformance.

This single factor is data collection, or more specifically the lack of it. I visited many different businesses in the course of this study and, broadly speaking, their success was related to how well they gathered information and acted on it. The failure to collect adequate management information is associated with some or all of the following; poor livestock selection policy, poor grassland management, poor or high cost nutrition, poor health management, poor selection of finished stock and inadequate profit margins.

#### Case study: Eric Reid

Eric Reid has built his own version of a model farm close to Richill in Armagh, NI. The farm is set up for easy management and monitoring of the animals. At the time of my visit he was trialling Bonus Software which monitors animal body temperature. He has found that, on average, he gets four days’ early warning of impending illness in animals, allowing early treatment and early recovery, greatly reducing the degree of disease transmission and impact on subsequent growth rates.

#### Case study: Isaac Crilly

Isaac Crilly runs a high performing sheep unit near Castleberg in Northern Ireland. His unit is very different from many others due to its size and intensity. The farm is small, at around 80 acres, but it supports 500 ewes producing between 900 and 1000 lambs per year. All areas of the business are well above average and there is a key focus on data recording. Isaac has improved flock output to 592kg/ha through recording ewe performance and selecting against the lowest performing ewes.

### 4.2. Improved control of fixed costs

In any business fixed costs or overheads exist which are either independent of or only loosely related to the quantity of output. This includes such factors as building costs, staff costs, machinery costs, breeding herd costs and many others. One key to profitability is in maximising output and so diluting the cost of the overhead which is attributed to each unit of output. Industry figures for the UK



demonstrate clearly that many farms in the UK have lost control of their fixed costs. The industry is heavily mechanised, but often at too high a level or in the wrong area.

I observed dramatic differences between countries in terms of cost control, with New Zealand among the leaders in this. Mechanisation on a typical New Zealand farm is at a much lower level than in the UK, and the reliance on contractors is much higher. It is debatable if mechanisation in the UK could ever be reduced to the level observed in New Zealand due to differences in climate and farming systems, but it is unquestionable that much could be done to reduce the proportion of machinery costs in the final cost of the animal. The failure of farms to benchmark and analyse their financial performance leads, in many cases, to an over-reliance on machinery and a cost base which is higher than necessary.

#### **Case Study: NZ farming**

I visited a large number of NZ farms and spoke to many more NZ farmers and industry professional during the course of this study. All felt that while the industry had some way to go, control of fixed costs was a strength in NZ, particularly in lamb and beef. Machinery costs are low (in comparison to the UK), building investment is low and animals are bred to minimise labour requirements.

### **4.3. Improved customer and market focus**

***“Tolerances in engineering are tight – a variation of 0.3% would be rejected, but we have variation of up to 40% in the livestock supply chain”***

***– David Rutley, Thomas Foods.***

As indicated earlier, strong technical competence seems to be generally linked to high customer and consumer awareness and an understanding of what the marketplace requires. The proportion of producers who displayed this high level of knowledge varied considerably with the type of enterprise, with pork and poultry producers generally more aware of the marketplace. I came to the conclusion that a major influencing factor in this was the regularity of contact with the processor they supply. The intensive sectors have much more frequent contact, driven through their regular output of finished pigs, chicken or milk. This often means that they are also more attuned and responsive to market changes. Beef and sheep producers often have long gaps in their contact with their sales outlets and this reduces the amount of information flow and customer awareness. However, I met many beef and sheep producers who were very aware of their market, despite a lower level of contact with their primary market. One concern expressed by several people (mainly referring to beef) was that the economic signals being received from livestock markets were misleading because they were often frequented by buyers for more specialist markets and as a consequence do not fully reflect the buying habits of the UK consumer.

Financial feedback strongly influences responsiveness to market conditions. Intensive sectors are characterised by constant production flows with regular cash flow, providing a high level of financial feedback. In addition, these sectors are characterised by shorter production cycles. The beef and sheep sectors are different. Small farms, and irregular supply patterns, mean that months can pass without financial feedback. This pattern is particularly prevalent in the sheep sector, but is also widespread in the beef sector. In general larger finishers are very focused on market requirements (something which was obvious in both the UK and Ireland), but the downstream producers of calves (dairy and suckler farms) are almost completely detached and tend to produce what sells well in the livestock market, which itself is not always reflective of the final value of the animal. In many ways, this is understandable, because the majority of purchasing farmers have virtually no idea of the



breeding or previous rearing system of the animals which they buy. In an ideal world, calves, reared calves or store animals should come with figures which would indicate their likely future performance, but in reality, this type of system is still some distance away.

It is essential that no matter what production system a farm (or a business) operates, it is vitally important to understand what the market wants and to focus production on it (a point highlighted by the case study below).

#### **Case Study: Jane King/Farmers Weekly**

Jane King is well known across the UK farming industry as the former editor of the Farmers Weekly. She was brought in to engineer change in the magazine as, although it was still market leading, it was continually losing readers.

Jane realised that the magazine could not rely on past strengths to meet future demand and initiated a large farmer survey to determine what farmers wanted from a trade magazine. This revealed that the FW could afford to take a proactive, educative approach, providing management information and guidance in addition to the more traditional news led agenda.

This new style struck a chord with the readership and sales strengthened. On the back of this success the magazine continued to plan for the future and has invested heavily in new media formats and farmer training as well as highlighting good practice on leading edge farms on a weekly basis.

This change was not comfortable or easy and carried a considerable risk of alienating the loyal readership, but it was actually less of a risk than doing nothing because the magazine would have continued to gradually lose readership, before eventually fading into obscurity.

Customer and market-focused change saved the Farmers Weekly, and keeps it in robust health.

#### **4.4. Improved farm structure**

The UK industry has a structural problem, with many small farms and the inability to expand. I spoke to leaders of various farming organisations and this highlighted a strong emotional attachment to land, resulting in people farming land which in reality should be farmed by someone else with a bigger farm and the need to expand. There is a real need (particularly in Northern Ireland, but also elsewhere in the UK) for a much larger number of Farm Business Tenancies and long term land let agreements to become available. This would appear unlikely without intervention of some sort, possibly in the form of tax breaks or other incentives to facilitate land amalgamation and ultimately improve farm efficiency.

#### **4.5. Improved integration and organisation throughout the food chain**

The fragmented nature of the beef industry (and to some extent the sheep sector) is responsible for much of the limited progress. Intensive beef finishers have very little contact with or influence on those who produce the calf, and because there is no feedback mechanism on price, other than what



the calf looks like, producers tend to breed for animals which look good, but may not actually perform effectively.

A mechanism for providing information on the finished animal back to the original breeder would represent a basic building block for improvement throughout the chain. This could be done through the development of the UK cattle databases to permit the original calf breeder to receive information on the animal when it is eventually slaughtered. The development of totally integrated systems which control the genetics of the animal and its nutrition and management would allow the effect of genetics on lifetime animal performance to be measured, valued, fed back and influenced.

#### 4.6. Improved beef and sheep genetics.

Genetic progress in the beef and sheep sectors lags well behind the poultry and pork sectors. In the beef sector this is the result of a very mixed suckler cow population (which has not been adequately selected for high performance) and the fact that the dairy herd represents the source of over half of beef production in the UK. Control of the breeding herd is lacking, and this inhibits the use of optimum genetics. Much remains to be done in understanding the interaction between dairy and beef genetics in order for us to maximise the value of beef coming from the dairy herd. We need to find a way of encouraging positive selection pressure on typical suckler herds in the UK to improve the overall genetic base and also to identify a method of identifying the best beef genetics to use on the dairy herd.

*We need to find a way of encouraging positive selection pressure on typical suckler herds in the UK to improve the overall genetic base and also to identify a method of identifying the best beef genetics to use on the dairy herd.*

The sheep sector struggles for a different reason. The lack of effective artificial insemination means that the widespread distribution of high performing genetics is difficult, and hence the rate of genetic progress is slow. However, I came across many producers on both sides of the world who

*It is vital however, that producers realise that, if they are breeding their own replacements, they need to utilise two different lines of ram, one with maternal characteristics and another with terminal characteristics.*

had made very substantial progress by focusing strongly on ewe selection. This was only made possible, however, by robust record keeping and a clear selection policy. The development of larger sheep genetics organisations such as Innovis is, in my view, very positive because they make available large number of high genetic merit rams which will, in turn, improve the overall performance of the UK sheep flock. The move towards a focus on genetic improvement rather than breed improvement is highly important. It is vital, however, that producers



realise that, if they are breeding their own replacements, they need to utilise two different lines of ram, one with maternal characteristics and another with terminal characteristics.

Poor livestock selection policy ultimately results in poor genetic stock and built-in underperformance. The highest performing sectors have gained control of the breeding herd and have used data to eliminate underperforming stock and to improve overall performance.

#### 4.7. Improved diet management

Observation of many farms in the UK reveals that only a proportion has adequate control of animal nutrition. Good genetics cannot express if the diet is inadequate or imbalanced.

Non-optimal nutrition is associated with either high costs or poor animal performance. Many advisors in the UK highlighted particular difficulties on many farms in the production of silage of a high enough quality. Many farmers seem to have the attitude that forage is a filler used to maintain rumen health, and that real performance is driven through high intake of concentrate feed. Specialists are clear that the production of high quality grass and silage is vitally important to a low cost of production on cattle and sheep farms. High ME silage can more than halve the requirement cattle have for concentrate feeding, substantially reducing costs without sacrificing performance. The majority of farms do not record feed intakes and do not accurately assess animal performance on the diets offered and therefore do not really know if they are achieving high or low performance, resulting in costs which are higher than they should be.

*Many farmers seem to have the attitude that forage is a filler used to maintain rumen health, and that real performance is driven through high intake of concentrate feed.*

#### 4.8. Improved grassland management

Grass can offer very low feed costs, and a number of the farms I visited during the study demonstrated very high performance from grass. A considerable degree of management is, however, required to effectively grow and utilise the grass. Again the majority of farms in the UK operate at a level below the ideal, and I strongly believe that among beef and sheep farmers, this is one of the more crucial areas to address, and one which potentially offers large benefits.

*Poor grassland management is associated with high fixed costs per unit of production and higher than necessary feed costs*

A key starting point is to regularly record grass levels in individual fields, along with the growth stage of the grass. This allows a quick assessment of the available fodder and can be used to ensure that animals always receive the maximum amount of high quality forage at a relatively inexpensive cost. Taking external advice from an independent grass specialist is highly recommended.



Poor grassland management is associated with high fixed costs per unit of production and higher than necessary feed costs. Large increases in farm production are available through correct grassland management. Increases in stocking rates of up to 300% have proved possible, greatly increasing the profit per hectare which a farm can make. Gareth Davies (a former Nuffield Farming Scholar who has set up his own grassland advisory business) has extensive experience of assessing grassland and explained in some detail the range of growth patterns and field performance which he encounters on an almost daily basis. He stated that some of this can be assessed by eye, but that a more systematic (but still simple) approach can bring much more effective results.

#### 4.9. Improved health management

Animal health impacts on performance substantially. Both clinical and sub-clinical disease carry large financial penalties. Acute disease is much easier to detect, but can actually have less of an overall impact than undiagnosed low level infection.

The importance of an active animal health programme must not be underestimated. A farm should monitor disease levels and impact and should respond accordingly. Adequate recording of disease incidence and treatment can be used to prevent the reoccurrence of the disease in subsequent batches of cattle, but the failure to record and analyse this data means that disease can go unchecked, damaging performance and farm sustainability. Much improvement is needed in this area and meat processors and government inspectors have a part to play in this, through ensuring accurate and rapid feedback on disease detected in slaughtered animals.

#### 4.10. Improved use of external advice

***“Life experience makes a huge difference to farming practice”***  
**– Athol Economou, Australian Journalist**

Perhaps the most shocking statistic which I encountered during my study was Anderson’s estimate that while 50% of dairy farmers use an external advisor regularly, only about 5% of beef and sheep farmers do the same. I believe that there are a number of reasons for this, the most important being that (1) beef and sheep farms tend to be smaller and less intensive than dairy farms, and external advice is much more costly as a proportion of turnover, (2) more immediate results are seen in milk yields (as compared to meat yield), proving the value of advice and (3) achieving the benefits offered by external advice will usually demand a higher level of data recording, which can be difficult on some livestock farms and which many farmers are unwilling to do.

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All businesses benefit from the use of specialists. In large businesses, such as milk and meat processing, there is the opportunity to fully employ these specialists and the business benefits from



their ongoing guidance. With smaller businesses such as farms, there is a real need to continually bring in advice and guidance because it is not possible to keep on top of all new developments and legislation internally. Professional advisors have an inbuilt advantage in that they bring experience and knowledge gained from many other businesses and are able to offer an external (and less emotionally involved) view on business structure and practice. Phil Hadley from EBLEX (now AHDB Beef & Lamb) commented that farm accountants should really be seen as part of the business team, but very rarely are, leading to serious failings in financial planning and decision making. I believe this is reflected right across the production cycle in beef and lamb. Much expertise can be cost-effectively bought in, but is not.

*With smaller businesses such as farms, there is a real need to continually bring in advice and guidance because it is not possible to keep on top of all new developments and legislation internally*

It is not surprising that those businesses which employ external advisors are, on the whole, much more successful than those which do not. In any form of change, someone who can suggest change (either new or tried and tested on other businesses with which they are involved) and then help guide people through it, will deliver good results more quickly. During the interview with Gayle Manning (educational psychologist) she emphasised the effectiveness of one-to-one advice in driving behavioural change.

*Farm accountants should really be seen as part of the business team, but very rarely are*

As European financial support in the livestock sector continues to decrease, the traditional measure of farm viability (cash in the bank at the end of the year) will have to change. Banks will place more focus on enterprise viability and will require viability assessments for the continuation of overdraft facilities or the sanctioning of new loans. The use of ongoing external farm advice may become part of the loan conditions, and I believe that in most cases this would prove to be extremely beneficial.

**The beef and sheep sectors in the UK must wake up to the usefulness of external advisors and make use of their services either at an individual farm or a discussion group level.**



## 5. Learning and how we do it

*“I hear and I forget, I see and I remember, I do and understand.”*

In the extensive livestock industry top level research can take between 15 and 20 years before full uptake. This is clearly unacceptable, and is particularly frustrating because of the amount of useful information which is available and the relative ease with which it can be accessed. In an effort to understand why simple changes and improvements are frequently ignored, I spent some time with change management specialists and those in the education sector.

Gayle Manning is a Senior Education Psychologist who works across a number of areas in child and adult programmes. What she had to say was

enlightening and explained to me some of the reasons for slow progress in the industry. There were two main points which underpinned most of what she said, basic information which must be understood before we attempt to educate or inform. Firstly, the fact that different people learn in very different ways and secondly (and perhaps obviously) that education does not always change behaviour, and that training programmes should be combined with implementation programmes in order to make effective progress.

### **Educational methods in farming study**

There is no doubt that some methods of education and training are much more effective than others. Researchers in Massey University in North Island, New Zealand, have recognised this fact and initiated a project on producer education and development in conjunction with an educational psychologist, scientists, and a group of farmers. This study highlighted the importance of ‘facilitated learning’, with facilitators taking a specialist role.

They concluded that farmers value knowledge delivered by persons rather than roles (i.e. who the deliverer is very important), they value farming experience highly (suggesting extension needs to involve many more high performing farmers) and they value proven ability rather than theory – in other words they are more likely to take it up if they have seen it in practice.

The study can be found in *Agricultural Systems* 125, 63-73  
*Allison Sewell*

### **5.1. Overcoming the fear of learning**

*“Fear of learning is a real problem in agriculture”*

*– Phil Hadley (AHDB Beef & Lamb)*

Many people genuinely fear the process of education and as a result struggle to learn. For the vast majority, this is an unfounded but often self-reinforcing fear. Gayle stated that predictability is much more important to all of us than we realise and often predictable bad outcomes are subconsciously preferred to the unknown, meaning that we tend to behave in such a way as to confirm our predictions or expectations. An advisor or educator must account for this. If, for instance, someone sees themselves as practical, but unable to learn academically, presenting required change as a practical change is much more likely to get results. There are a number of steps which can be used to overcome someone’s fear of learning and these are covered in the following paragraphs:



## 5.2. Learning systems

In order for people to change their behaviour, they have to learn, but it is vitally important to recognise that people learn in different ways. This has relevance for one-on-one training where it is important to tailor the learning to the individual, but is particularly important when training a group. Gayle emphasised that a group will not usually have a single learning style and an effective training programme should include multiple teaching methods. The following were highlighted as important:

- **Interactive learning:** An interactive learning approach suits many of those who view themselves as 'practical' and therefore has considerable relevance for a farming audience. This type of learning is often carried out in a social context (such as on-farm) and has the added benefit of facilitating incidental learning from the participants in conversations they have during tasks or breaks. This is important for farmer education programmes. The use of 'planted' or 'leader' farmers within a group may be able to accelerate the pace of change within an organised programme.
- **One to one advice:** Many people learn best in a one to one situation, dealing with individual problems in an interactive way. However, this method is resource hungry and minimises the pace of information spread, although it often makes up for this in its effectiveness. The effectiveness of one to one advice is enhanced with regular contact because this carries with it the expectation of change, the monitoring of change and assistance with the process of change.
- **Discussional learning:** Discussional learning is useful for many, and is actually one of the main tools driving change in the industry. Farmer groups, when operating correctly can quickly spread good practice, but it often takes time and commitment to build enough trust within this type of group for it to become effective. A good discussion leader is highly important, and his or her skill can make or break a group.
- **Visual learning:** Demonstrating a practice visually can be a very effective tool. This can be done as a live demonstration or as a video presentation (with a preference for the live demonstration). People are generally better at remembering the visual and this method is effective as a result.
- **Spoken/Verbal:** This is one of the more traditional methods of teaching, but while a lot of information can be conveyed in a short space of time, the retention rate for information is relatively low. It is also difficult to gauge understanding following a verbal presentation, unless this is followed up by some sort of questionnaire or assessment.



### 5.3. Education, enforcement and engineering

***“Education does not necessarily change behaviour”  
– Gayle Manning, Senior Educational Psychologist***

It is crucially important to recognise that ‘education doesn't necessarily change behaviour’. In other words, knowing that change is needed does not necessarily mean that the change is going to happen. The example of speeding is often used to illustrate this. We all know that simply being told not to speed does not mean that we will not. As a result, speeding is addressed in three ways: (1) Communication of the information ‘Do not speed’, (2) Enforcement of the speed limit through monitoring, fines and prosecution and (3) On the basis that not all speeding can be enforced (and that speeding is not responsible for all accidents), roads are designed to be safer to reduce the impact of any accident. Applying this thinking to the agricultural sector, I interpreted this to mean that we must focus strongly on three aspects:

#### **The provision of information (education)**

- Ensuring information reaches farmers in a range of relevant ways.
- Ensuring that the information is relevant and timely.

#### **Awareness of the incentives and disincentives for good and poor performance (enforcement)**

- Ensuring that farmers collect information through demonstration of the benefits on offer.
- Following up the information which is distributed to encourage participation.
- Interpreting the information which is being collected and providing clear advice to enable the business manager to implement change with confidence.
- Providing testimonials from those who have already implemented change.

#### **Making life easier (engineering)**

- The development of methods for making it easier to collect data.
- The development of methods which demonstrate how to interpret the data and its implications for individual farms.
- The development of methods to clearly demonstrate what changes are necessary and why and how to implement them.
- The provision of ‘advice contact points’ to provide one to one tuition/advice when required.



### **Primary School Headmaster: Causing change in a difficult environment**

I spent time with a headmaster of a school in a difficult area of a large city. I have not identified the Headmaster or the school, but I found this to be one of the most instructive interviews I undertook during my Nuffield study tour. The school was in an area where education is not highly valued, where there is little parental support, and where school is primarily seen as day-care.

There are quite a number of children in the school who have low IQ and learning difficulties, but in common with many I spoke to in the agricultural sector, the headmaster saw the potential to greatly improve on the existing situation. Much like Mike Abrashoff, he realised the need to tackle the causes of the problems rather than the symptoms.

He highlighted the importance of giving encouragement at all available opportunities because many of those in the school receive none at home and as a result have very poor self image. Building a child's confidence in his own abilities is vital and to do this nurturing is important. Without nurturing and appropriate care, the children develop behaviour issues. If a child lacks boundaries and guidance, he or she will continually struggle. The school has to provide this because many of the parents either choose not to or simply don't have the skills. The giving of affection, reassurance, structure, communication and establishing a model for argument and resolution is necessary for children because they learn from experience.

Because the children don't necessarily receive this guidance and training at home, programmes have been drawn up to help the parents to learn good practice and to build attachment with their children. The school now runs structured games afternoons with the children and parents, allowing one-on-one time between the parents and the child (and shockingly many of the parents had never played a structured game with their child). This was supplemented with story evenings where the school helped parents to read stories to their children (virtually none of the parents had ever done this). Through events such as this, parents were brought into school life and gained some realisation of the importance of learning and the ultimate effect is that the children receive more encouragement at home to achieve and perform better in school.

He highlighted the importance of learning by role play, with children seeing how things are done rather than just being told. For instance, when a teacher is demonstrating how to write a story, he or she demonstrates it step by step demonstrating what the thought process is, breaking it down into chunks which can be more easily understood. An example role play of how to write the thoughts down in a structured way would then be given, followed by shared role play with involvement from all parties, continuing with guided role play with the children doing most of the work, then finishing with independent working.

The end result of all this (frankly exhausting!) work is that the children in the school are outperforming other similar schools and the school itself is rated excellent despite the challenging demographic.



## 6. Changing, and how we do it

### 6.1. Recognise that change is difficult

Change is difficult, but is more difficult for some than others. For this reason, I spent part of my study speaking to individuals who specialise in driving change. A number of key themes came out of these interviews, and again the issue is complex, with many different influencing factors.

***"People can react negatively to change  
– primarily based on how they perceive that change will affect them."  
– Peter Morrow, Owner, Morrow Communications***

***"Predictability is much more important to us than we realise  
and often predictable bad outcomes are subconsciously preferred to the unknown.  
Essentially we then behave in such a way as to confirm our predictions."  
- Gayle Manning, Senior Educational Psychologist***

***"Change is complex and this scares people"  
Lisa Bodel, Author of 'Kill the Company'***

***"Focus your energies on those who want to be helped"  
– Grant Cuff, CEO, Alliance.***

### 6.2. Recognise the need for change

All those to whom I spoke during the course of this report were in agreement that change and progress will not occur unless the individual is motivated to change and has the belief that he/she can actually achieve it. They were also clear that there are those who will change with a degree of enthusiasm, those who will never change, and a third class who are open to a certain amount of change following persuasion or coaching. Broadly speaking, the drivers of an alteration in practice which I observed were as follows (not all were actually verbalised, but were clearly indicated):

- Economic failure - *"I can't continue doing what I am doing, I need to make more money"*
- I want to run a really successful business with high profitability.
- I can't get enough labour/I'm getting older and can't do as much physical work
- I want to be the best at what I do/I want to do a good job
- I want to be respected by my peers
- I need to divide the business
- I need to spread risk

### 6.3. Recognise avoidance of change

Perhaps as an indication of the difficulties associated with change, I encountered a much larger range of reasons for not embracing new technology or practice. These are summarised below:



- I don't actually know that I need to change - it's all somebody else's fault.
- The problem is so big nothing I do will really make a difference.
- I don't know what to change to.
- This change looks too hard/I don't have the ability/skill to make that change.
- I don't know how to change/to make this change.
- I don't like the change which is proposed.
- I don't want to do the work necessary to make this change (record keeping etc)
- By the time I change, the goalposts will have moved so there is no point.
- I think what we are being asked to change to is wrong.
- I don't understand how to make the decision about what to invest in.
- I can't see the reason or the benefit.
- I can't see the vision of where the farm/business could be.
- I have little understanding of my end market and what customers are actually asking for
- I continue to believe that the customer can and will pay more for food and UK food in particular.
- I have a simplistic outlook and really only consider one or two data points before I make a decision or volunteer an opinion.

Some of these reasons are absolutely valid, while others seemed to me to be excuses, used by those who simply found the whole concept of change too much bother or effort. It became clear to me that not only are there are some who will not change (and time should not be wasted trying to alter this), there are some who are theoretically willing to change, but who generally will not due to either the level or type of effort required. There are also those whose business model is acceptable enough to enable them to reach retirement, and consequently have little motivation to change.

It is worth noting however, that no matter how open to change any of us purport to be, we all have a few of the above excuses lurking somewhere in the recesses of our minds! Lisa Bodel listed one of the inspirations for writing her book 'Kill the Company' as a change management meeting at a company where it became clear that the people who had invited her to speak were actually the ones who were most resistant and really only wanted her to endorse their own (incorrect) ideas.

## 6.4. Cycles of change

***"Change is a gradual process in farming"***  
***– Virginia Williams, Chair of Animal Welfare Committee,  
Ministry of Internal Industries, New Zealand.***

According to educators and behavioural psychologists, effective change tends to follow a sequence. Although these descriptions are normally used to describe individual behavioural change, they are broadly applicable to a business situation. They are listed below.

**Stage 1 Pre-Contemplation:** Unaware and Resistant. This is where the person is unaware of problems associated with behaviour (in this case associated with the business). They are certain that the positives of the behaviour or current practice out-weigh the negatives. At this point the manager is not interested in change, is unwilling to change or has no intention to change.



**Stage 2 Contemplation: Awareness, Openness, Decision, Commitment.** At this stage the manager becomes aware of problems associated with behaviour or business practice. He or she may be ambivalent about the positives and negatives of proposed behaviour. However, they explore the potential to change. They may desire to change behaviour or practice but may lack confidence and commitment to do so. Concludes that the negatives of the behaviour out-weigh the positives and chooses to change behaviour. Intends to change before 6 months.

**Stage 3 Preparation: Anticipation and Willingness.** At this point the person or manager accepts his/her responsibility to change behaviour, then evaluates and selects techniques for future behaviour, and at this point develops a plan. This builds confidence and commitment to change imminently.

**Stage 4 Action: Enthusiasm and Momentum.** At this point managers so committed engage in self-directed behaviour change and as they do this they gain new insights and develop new skills. They consciously choose new behaviour and learn to overcome their tendencies towards unwanted behaviour.

**Stage 5 Maintenance: Perseverance, Consolidation, Lapse or Relapse, Danger and Opportunity.** At this point the individuals master the ability to sustain new behaviour with minimum effort. They establish desired new behaviour patterns and display self-control. They remain alert to high-risk situations. The main focus is on lapse prevention.

**Stage 6: Termination:** At this point behaviour is consistent with desired behaviour and practice. The person displays confidence and enjoys his/her self-control. Appreciates the effect of the changed behaviour.

## 6.5. Helping change happen

*“Make simplicity a habit” Lisa Bodel, author “Kill the Company”*

As previously stated, the recognition that change is necessary will not necessarily result in effective change. There are many tools which an educator or advisor can use to translate education or awareness into practice. These must be employed to ensure that the manager understands the problem, works through potential solutions, understands the incentives offered by the solutions, chooses a solution, buys in to that solution, has the confidence to deliver the solution and then understands and implements the steps that are necessary to deliver it.

### 6.4.1. Create a pathway for change

In order for a result to be achieved, those responsible must be convinced that they can actually make the changes necessary to achieve it. I had the opportunity to interview Peter Morrow during my study. Peter has 25 years' experience in media, communications and change management and currently runs a successful media company, Morrow Communications. I interviewed him about his experiences in effecting and managing change, and he outlined a key set of rules which had proven useful. These were as follows:



1. To create positivity about change, **change itself should not be mentioned.**
2. **Vision casting** is important. If someone can visualise what success looks like and the advantages change could bring, he is more likely to implement it. Within this, consideration must be given to the individual(s) who will be managing the change and the changed business, as the best solution may differ for different people.
3. Once the vision is cast (and agreed with), an **end goal or target** must be set.
4. Developing a **pathway to the goal** is essential, breaking the activities down into manageable projects. Identifying the obstacles individually and outlining the solutions individually are essential.
5. In any business, a solution should not just be presented. The managers of that business must be allowed time to **consider the options** and to come to a conclusion themselves on the basis of the information available and the advice given.
6. It is important to allow problems and **solutions to be developed by the managers involved in implementing the change.**
7. **Set a realistic timeframe for delivery.** Change must be delivered correctly and trying to change too much too soon will usually result in chaos.
8. Decide if a **real solution** is available. If it is not more drastic action is needed!

### 6.5.2. Be clear about the change

Change without clarity is fruitless. I spoke to a wide range of employees in different companies, many of whom were charged with implementing change without necessarily having been involved in the process to decide what that change should be, or, more worryingly, really not being sure of what the long term aim of the change actually is. Some of this was due to poor (or inaccurate) communication, but another major cause was a lack of conviction on the part of senior management about what the change should be, resulting in constant (and demoralising) changes of direction. Often unrealistic expectations were evident and these were seen as confusing (or demotivating) and therefore damaging to effective change. If the expectations are too great, the timescales too short or the necessary resources not provided, people become demoralised and demotivated (or stressed) and solutions are not delivered.

### 6.5.3. Be clear about the goal

Change must be visualised. This can initially mean oversimplifying the problem, but without doing this, the difficulties can sometimes seem insurmountable. It was clear from the study that while education levels and personality do have a major impact on who can successfully change, they are not the sole determinant. All can change effectively if they are willing to do so. The key points in communicating the concept are:

- Take account of the audience and using appropriate language and methods.
- Show clearly what the business will look like when this is implemented.
- Communicate what individual jobs look like when this is implemented.
- How this change will make things better.
- What the simple pathway to implementing this change is.



#### 6.5.4. Make change relevant

Ultimately all change will fail unless the relevance of it is clear, as well as the method by which the change will happen. This is important for those who assist with change on-farm, and underlines the importance of creating understanding and buy-in as discussions progress. Advice should never really come in the form of an instruction, but instead should come out as agreements from a peer to peer discussion during which the manager is encouraged to recognise where change can be made and how it could be implemented. A particularly important technique in this is to draw managers into demonstrating how they have effectively made changes in the past, and in so doing to create confidence about the end result of proposed changes, while at the same time formulating a step by step development plan for the upcoming changes.

Having practical examples from other farms and farmers will carry considerable weight, particularly if communicated by the farmers who implemented them. Peer support (usually within discussion groups) or mentoring will also help to drive change more effectively.

#### **Raising performance. Mike Abrashoff, author “It’s Your Ship”**

Mike spoke at a conference I attended and was so good that I immediately bought his book. I found what he had to say to be incredibly useful and relevant to our industry. Mike was a Naval Officer who was promoted to command of his own ship. Unfortunately for him, this ship was one of the most poorly performing in the US Navy and could easily have become a millstone which sank his Naval career. Due to the application of good management principles, it took Mike (and his team) about 18 months to completely turn around the performance of the ship to the point where it was recognised as the highest performing ship in the Navy. The most useful principles he discovered are as follows:

- Don’t obsess over what you cannot change. Focus instead on what is in your control to change. In a similar way it is important for individual farmers to focus on business changes (within their control) and not price or legislation (outside of their control).
- Mike identified staff as his key resource, whereas I would view data and staff as the key resources of the farmer. Mike got to know his staff, spent time with them and identified their strengths and where they needed to improve. Farm business managers need to use data to prioritise work areas and then to enable the development of skills and understanding in themselves and their staff to enable the key targets to be achieved. For example the use of staff time on a sheep farm to supervise difficult lambings could be greatly reduced through detailed recording and selection of the ewes to prevent difficult lambings in the first place. Essentially any manager should be constantly seeking to find a better or easier way to do everything because time saved on the unnecessary allows more time to be spent on the core functions.
- On his ship, Mike realised that the top down ‘Command and Control’ approach did not work and that people needed to buy in from the bottom up. As a result he stopped telling people how to do things and gave people the responsibility to sort problems themselves, only intervening when really needed. He encouraged all staff to feed ideas in for improvement on the ship and gave credit where it was due. I would draw parallels here with both extension services and farm management, where solutions need to be jointly discussed and agreed rather than just implemented without consultation. Mike stated that when people’s ideas are listened to, they buy in – and this is crucial for our industry.
- Mike stated that in his role he needed to continually learn from role models. For me this emphasises the importance of having ‘flagship farmers’ communicating best practice in our industry.
- Perhaps the most inspiring part of Mike’s story was that the transformation from worst performing to best performing was achieved with almost entirely the same crew. As Mike put it ‘the talent was there in the crew’, it just had to be brought out. I would draw parallels with many farmers whom I have met, who sometimes lack the confidence to achieve what they are capable of. The talent is there. It just needs to be encouraged....



### **Make things simple. Lisa Bodel, author of “Kill the company”**

Lisa Bodel was another conference speaker who had much to say on the subject of change. She runs a ‘futurist’ company, helping other organisations to place for the future. She had the following to say about change:

- We all resist change because change is not easy.
- Change is getting harder because it seems so complex, but we should not use this as an excuse to do nothing.
- We often go about change in the wrong way – through policies, reports, governance rather than looking at our typical work practices and changing them. She stated that sometimes one needs to get rid of things to make the space for change.
- Fundamentally, she believes that we tend to value managing over leading, process over culture, doing over thinking and we are wrong – all are necessary and must be encouraged.
- She stated that we must **make simplicity a habit...** because this will free up the time to do the things we should be doing, but that ultimately **change is a choice** which we either accept or reject.

### **6.5.5. The importance of feedback**

***“If you can't measure it, you can't manage it” – Judith Bachelar, Sainsbury's***

Feedback is essential through a change management programme. The phrase ‘If you can't measure it, you can't manage it’ is overwhelmingly true in almost all circumstances. It was very noticeable throughout my study that the industries which have focused on data gathering have made the most progress.

Immediacy of feedback influences the management response. A change which is attempted in a dairy herd may bring a rapid response in milk yield, validating or invalidating the change made. A change made to a shed of broiler chickens will also display results quickly. This is not necessarily the case in beef or lamb, where changes to diet may not be seen for several months or changes to genetics may not be seen for several years, meaning it's harder to make the connection between a management change and the eventual outcome. This in itself has convinced many that performance measurement is less essential in these sectors, but this could not be further from the truth.

Craig Johnson of Massey University highlighted how much more data driven the typical New Zealand farmer is when compared to his UK counterpart *“Not only is data collected, it is acted on”*. In the UK we need to put more emphasis not only on obtaining feedback from external sources, but also on creating feedback on farm by collecting, measuring and analysing wherever we can.

### **6.5.6. The importance of management**

***“Whatever you choose to do, do it well!” – Craig Hickson, Progressive Meats***

Regardless of the change to be implemented, the effectiveness of the communication or the clarity of the steps for change, it will fail unless correctly managed. In almost all cases which I observed, the change required effort and constant oversight. It was perhaps best summed up by Craig Hickson, owner of Progressive Meats in New Zealand: *“A number of different models will work, but whatever one you choose, manage it well”*.

*Facilitating change within the red meat chain through knowledge transfer, feedback and technology uptake ... by Jonathan Birnie*  
A Nuffield Farming Scholarships Trust report ... generously sponsored by The Worshipful Company of Butchers



## 7. The role of technology and science in driving change

**“Increased production is essential, therefore increased use of science is vital”**

– Peter Kendall, NFU

**“86% of all content viewed online will soon be video.**

**All business should be using social media”**

– Michelle Carville & David Taylor, Social Media.

**“Data unlocks value” - Keith Woodhouse, Siemens**

Some aspects of agriculture have been quick to embrace technology, particularly the arable and intensive livestock sectors. Feed use, animal health, growth rates, fertility and labour costs have all been substantially improved by the use of technology to measure and implement change. Some examples of areas of necessary feedback which can or will be delivered by technology are as follows:

- **Carcass saleable value and eating quality feedback:** The current feedback systems on carcass value are an estimate. Carcasses are paid for on the basis of a subjective judgement which is not necessarily totally related to the actual sales value of the carcass. There are a number of reasons for this, including legislative requirements and tradition, but broadly the system remains in place because of the absence of a demonstrably better system. There are two main factors on which a carcass could be valued and these are yield of saleable meat and eating quality. Neither of these is as yet directly measurable to a high degree of accuracy and therefore the current system remains in place, simply because, as yet, there is nothing better.

The development of a system which could offer accurate feedback on both factors is still some years off, but this type of system will eventually be implemented and with it will come a degree of direction which livestock farmers have previously lacked.

Until the development of improved methods of measuring carcass value, sufficient data can be gathered from existing feedback to strongly influence farm profitability. Primarily animals should be supplied with low levels of fat, within a very clearly defined weight and conformation range. A simple analysis of the percentage of animals achieving ideal grade can be used as a management tool, and many farm record packages and some company websites already permit this. A large proportion of animals missing the ideal specification on the basis of weight or fat class would indicate the need for training on selection of finished cattle or sheep.

In an ideal world, the current price differentials between grades and fat classes would be altered to provide much stronger incentives and disincentives, but several representatives of different meat companies stated that because the variation in the genetic makeup of animals is so great, there is considerable push back from farmers when penalised for non-ideal animals. In reality this means that any change to the payment system cannot be unilateral, and would need to be done on an industry wide basis with a number of associated legal difficulties.

- **On farm data gathering through mobile phone technology:** many in the farming industry would cite the mobile phone as one of the most life changing inventions, and the uptake



across the industry was extremely rapid. However, it is obvious that the industry has failed to keep pace with the ever advancing capabilities of mobile technology. I believe that we are on the cusp of a revolution in how phones are used on-farm.

Phones can (or will soon be able to) recognise animals, carry out basic verification and analysis tasks, record all required information (potentially through voice recognition software) automatically synchronise data, automatically report to management advisors/vets, assess animal performance, provide immediate on-farm advice and much more. The combination of some or all of these abilities into a phone (which the farmer always carries) could permit regular assessments of animal growth (through imaging technology), production of detailed input reports, optimisation of feed level, early warning of disease and then automatic upload of the information to a central advisory service who would assess the information against known benchmarks and intervene when required.

The smartphone has become almost universal, and if we can harness its abilities in a simple to use format, data collection on farm will increase exponentially, and with it, farm performance.

- **Predicted breeding values through genomic technology:** Genetic progress in beef and sheep has been disappointingly slow. In part this is due to the previously mentioned lack of feedback, and the subsequent lack of value apparently offered to the original breeder of the animals. Advances in understanding the animal genome, in combination with massive increases in computer processing power will mean that we can much more accurately identify genes and gene combinations which impact performance, removing or reducing the need for large scale progeny testing to prove genetic value and thus accelerating the rate of progress.

Rapid genetic advances will be made in many areas, and will reduce the cost of production for those who implement the technology.

- **Realtime Grass/forage/feed monitoring:** Feed will eventually have to be matched to the genetics of the animal, but to do this, increased levels of feed analysis will be required. Technology is continuing to develop in this area, and it seems increasingly likely that on-farm analysis will become a reality, allowing much greater feed efficiency.
- **Realtime health monitoring:** Animal health monitoring will soon be able to be monitored constantly for relatively low prices. This will allow early treatment of disease and will result in improved growth and feed efficiency in animals.
- **Realtime performance monitoring:** This can be done now, but at relatively high cost. I anticipate technology becoming available which will permit relatively easy monitoring of animal growth, again giving early warning of possible problems and the potential to avoid them.



## 8. Providing direction through effective research and extension

*“Science can set the standards, but it can’t change behaviour”*  
– Mark Fisher, Manager at Ministry of Primary Industries, New Zealand.

Although I concluded that there is a vast amount of information already available to farmers, it is very clear that a) much more work is needed to assist implementation and b) continued research and knowledge increase is essential.

### 8.1. Where do producers get their information from?

The highest performing farmers also tend to be the best informed, and it has been demonstrated in Ireland that farmers who have undergone training or education display, on average, 17% greater productivity. This fact alone justifies the significant investment around the world in producer education.

I visited a number of different institutions and advisory bodies as I travelled, including EBLEX, Australian Dairy Board, Beef Checkoff USA, Beef and Lamb New Zealand etc. A strong degree of similarity was evident in what they did, but success varied from country to country.

*... it has been demonstrated in Ireland that farmers who have undergone training or education display, on average, 17% greater productivity.*

All were adamant that information was necessary, and nearly all expressed the view that many farmers still remained stubbornly out of reach. All had reached the conclusion that there was no one single method of influencing change and all used a range of methods to effect change. All employed permanent staff, all operated a meeting structure, research programmes and producer communications. All expressed a degree of frustration about the difficulty of reaching and impacting the bottom third of farms.

Globally, producers get their information from many different sources. These include inherited knowledge, experience, the farming press, information from other farmers, advice from consultants, information from government or paid advisors, information from discussion groups, information from the internet and many other less frequently used sources. Much information is available to those who look for it, but estimates suggest that less than 15% of scientific findings and potential advances actually end up being applied practically. The most widely used source of information appears to be the agricultural press and I came to the conclusion that any systematic approach to improving farm performance must include press articles.

### 8.2. Clear direction through relevant research

Clear direction is an essential component of effective change. Farmers in the UK are surrounded by a wide range of competing priorities, and a kind of paralysis can result (mainly due to the apparent complexity of the changes which are necessary). From my perspective, I see three main categories of change:



1. Structural change: mainly buildings or equipment, but also roadways, slurry handling etc.
2. Practice change: different ways of working, use of different systems, diets, genetics, collection and use of additional information
3. Market focused change - where feedback from the market alters farming practice. This will more usually result in changes in practice, but in some cases (particularly chicken and pork) it may require structural change.

Any new practices will almost inevitably be generated and tested through research, but right across four continents I found that a much larger volume of research was being carried out than was being published or made available to farmers and farm advisors. There was a further, severe drop in the amount of research which was eventually implemented on farm. I spoke with Neil Webster from the Australian Dairy Council and, through what was a very interesting interview, I learned that this had been an issue of such concern that the council now only carries out research which the board believes they can actually implement.

I am in full agreement with this approach. Something which is interesting (and even effective), but unable or unlikely to be implemented is almost always a waste of time, money and effort. Business principles must always be applied to production research.

*Business principles must always be applied to production research.*

Additionally I believe that the linking of research and extension is an absolute necessity. On the one hand, feedback on potential research needs can be practically guided by those on the ground who are advising on day to day issues, and researchers can develop solutions in conjunction with those who will initiate their implementation.

### **8.3. Clear direction through effective knowledge transfer**

*“Extension unlocks the value of R&D” – Neil Webster, Dairy Australia*

Research can only be driven into practice through effective knowledge transfer. Knowledge transfer must involve many different organisations and methods, but must be coordinated. Sector bodies or levy organisations have a large part to play in this and I believe that they are at their most effective when they become heavily involved with the whole chain, from production through processing and retail up to consumer level.

I spoke with John Wilson (Chairman) and Blair Stewart (Extension Manager) from Fonterra in New Zealand. Fonterra have driven change throughout their dairy farm suppliers. They have done this by setting clear targets (more milk, less footprint, improved quality) and then producing information to enable this to happen. This information is delivered to farm by a variety of methods, but all under the principle of ‘do not tell a farmer how to farm’. This information dissemination is under the control of 30 advisors who are responsible for approximately 10,500 farmers.

This team does not try to solve every problem, but focuses on those with direct customer or stakeholder impact. Team members work via a problem solving ‘partnership’ approach and try to resist direct instruction. The team’s work is based strongly on scientific principles, which are used to



underpin the work which is carried out. Much of this information is supplied by an in-house research team, but other information is taken from different sources (*Blair Stewart, Fonterra*).

John Wilson emphasised the need to have farmers involved in communicating the necessary changes. He stated that technology is critical to his supply chain, from farm through to sale, but he also emphasised that Fonterra was successful because they had addressed the weakness associated with their sector, namely the supply chain. With peak to trough volume ratios of 87:1, supply management becomes critical.

Craig Hickson from Progressive Meats in New Zealand backed up much of what others said. His particular view was that trust and confidence are absolutely crucial to a smooth ongoing relationship with livestock farmers. The nature of livestock farming is such that there is not all year round contact, so the contact which a meat processor has with farmers has to be meaningful and effective. Craig viewed communication as the main basis for this, and used a series of farmer groups, consultants and farmers meetings to relate to his suppliers. He emphasised that the communication should be a flow of all news, good and bad, and again underlined the need to work with farmers as equals.

Steve Morris, a livestock production scientist at Massey University, had some very interesting observations on knowledge transfer. In his view, traditional extension methods (as opposed to highly structured classroom based learning) have failed, and free extension methods are much more effective.

The FAO summarises the principles of good extension as follows: Extension works *with* people, not *for* them, is accountable to its clients, has a two way flow of information, cooperates with other rural development organisations and works with different target groups.

One of the most effective advisory/knowledge extension services I came across was in the Northern Ireland pig sector. Although relatively small, the industry benefits greatly from two very strong advisors who are heavily involved at many levels of the food chain. They have been able to help many producers take up best practice and are a key component in the competitiveness of the NI pork chain.

Overall I found that best practice varied from country to country and from sector to sector, but I came to the conclusion that there were several key factors which were common. In my view best practice is summed up below:

1. A single aggregation point for information
2. Available advice on all key topics through the chain
3. Technically strong advice which is easy to read
4. Clear implementation advice, shown step by step
5. One to one advice available on every farm by technically strong advisors
6. The use of a range of delivery and teaching methods including written information, video information, group advice, group meetings, individual advice, technical visits.
7. Market focused production advice.

Extension seems to work best in a kind of pyramid system. Instead of trying to reach every farmer at once, it is necessary to take a long term view and use a systematic approach to build compound



improvements through a trickle-down effect. Time and again through this study I was told that the most effect agent of knowledge transfer is another farmer. I believe this to be true in the context of accelerating change, but I am convinced that progress starts with scientists and advisors who inform the very top performing farmers who, in turn, accelerate change through others watching what they do.

*Time and again through this study I was told that the most effect agent of knowledge transfer is another farmer.*

#### 8.4. Maximising the use of the best advisors

**“Progressive farmers have a way of bringing others with them”**

**– Catherine Nakielny, Farm Advisor**

Traditional extension has involved meetings, farm visits, lectures, one to one training, handouts, text books and similar methods. These can be effective, but are labour intensive and resource heavy. New and developing technology would appear to offer the opportunity to improve our knowledge transfer and more effectively meet the needs of the farmer in the way that Steve Morris advocates.

There are myriad organisations offering farm advice. The quality of these organisations varies considerably (according to farmer opinion!), but perhaps more interestingly, the quality of advice provided within an organisation seems to vary considerably between the individuals who are responsible for delivery. Those advisors with strong knowledge, good people skills, common sense and a strong ability to simply communicate complicated information are invaluable.

In an ideal world, only the best advisors would be used, but in the real world this is not always possible. However, technology can actually go a long way towards duplicating these exceptional advisors. The use of YouTube and online meetings can multiply many times the number of farmers who can be effectively reached by one extension officer, possibly solving some of the communication issues which slow implementation.

*One weakness I picked up fairly repeatedly as I talked to many farm advisors was that, while they knew the technical details of farming well, they were often uninformed about consumer pressures and demands.*

One weakness I picked up fairly repeatedly as I talked to many farm advisors was that, while they knew the technical details of farming well, they were often uninformed about consumer pressures and demands. As a result they were unable to give reasons for specifications, to challenge some opinions or to contextualise the market requirements, perhaps removing a degree of the impetus some of their clients have for change.

I believe we can accelerate change by involving the highest performing farmers much more heavily in extension programmes. I repeatedly encountered the opinion (proven in practice in a number of areas) that farmers tend learn much more readily from those they view as ‘practical’. Hence, when



we are trying to inform about new farming practices, someone who has already 'done it' is invaluable.

In summary good extension must motivate people to change through explaining the need for it by filling in knowledge gaps. Good extension must provide examples and demonstrations about how to effect the necessary change and ultimately should help individuals to implement this change on their own farms.



## 9. Roles and responsibilities in the supply chain

### 9.1. Shared aims

All stakeholders should be united in the aim of achieving a high performing, sustainable food processing sector, from farm through to customer. This includes the shared aims of consistent supply, consistent quality, market focused production and high production standards (from a welfare, efficiency and environmental perspective). In reality, the steps towards these aims are not in debate, but the delivery mechanisms and associated risks are large, making progress slow and difficult.

### 9.2. Government/civil framework

The importance of the food industry to the United Kingdom and Ireland is now indisputable. With food production set to grow steadily in importance over the next few decades, government has a clear mandate for doing all it can to encourage greater production from the same amount of land. Government input is necessary due to the importance of the food industry and the fact that it is primarily composed of small businesses with very little coordination or joint working between them.

What should not happen, however, is for government involvement to take the form of ever increasing levels of legislation. During this study I came very strongly to the conclusion that government must set desired outcomes (through proper planning), but not attempt to control the details on-farm. Every farm is different and there are often a number of different ways to achieve the required results.

Government should support research, education and training. It should encourage this through provision of research funding and knowledge transfer. However, this is not enough. Government must also encourage change through fiscal changes and through tax breaks which encourage the implementation of improved practice and hence efficiency.

An example of this can be seen in Northern Ireland where essential land reform could be driven through legislation and changes to the tax system. It is generally agreed that the very short term nature of the conacre system (annual 11 month rents) in Northern Ireland is a very strong disincentive to any form of land improvement, and must be discouraged in favour of five and ten year tenancies. This type of change will undoubtedly help to improve efficiency and must be encouraged wherever possible.

*During this study I came very strongly to the conclusion that government must set desired outcomes (through proper planning), but not attempt to control the details on-farm.*



### 9.3. The responsibility of processors

The primary responsibility of processors in the red meat chain should be through the feedback of customer and market information to their suppliers. The level of this type of communication needs to improve, and this can only be done through building ever closer working relationships up and down the chain. The involvement of retailers in farmer groups in their own supply chain is useful in building farmer understanding of the end consumer, but many farmers are still outside this circle of influence (often by their own choice).

Processors have an additional role to play. They need to become more involved in communicating not just market information, but useful information from research organisations, extension organisations and industry advisors which can in any way contribute to improved farm efficiency and productivity. There is no moral or ethical compulsion to do this, it just makes good business sense.

### 9.4. The responsibility of farmers

The responsibility for change at farm level ultimately lies with the individual farmer. A farm business manager must:

1. Take responsibility for individual businesses and focus on what is in his/her power to influence or change.
2. Analyse business performance through collecting data and comparing it to other similar businesses.
3. Identify problem areas through the analysis of this data.
4. Gain a clear understanding of how to address these problems (through reading, training or the involvement of specialist advisors).
5. Implement the solutions, either alone or in partnership with specialists.
6. Take a long term view through the building of relationships and business models which bring long term gain sometimes at the cost of short term pain.

The best farmers recognise that a long term, informed and incremental approach is essential, and take the steps to address all the available issues.



## 10. Conclusions

A massive amount of information is available to the farming community, but the uptake of this information in the UK and Ireland is low. There are a number of reasons for this, but many of these can be addressed and many problems rectified fairly simply. Ultimately the responsibility for improvement of farm performance lies with the farmer, but all those in the supply chain bear some responsibility.

The people I met during the course of my study had all changed and implemented change. For some, the change was forced upon them by external circumstances, whereas others saw advantages and structured their businesses accordingly. However, they all had advice to give on the topic of managing change. I have summarised this advice as follows:

- Find the problems your business has.
- Set targets which are achievable for your business.
- Create a plan which includes small steps towards the target – get help if you need it.
- Know the role, responsibilities and effect of each person responsible for delivery of the steps in the target.
- Communicate the plan to all those who need to know, and keep communicating.
- Measure your progress and keep measuring.

### 10.1. Get knowledge and implement it.

I met with many industry professionals throughout this study and the similarity of the common challenge across several continents was evident. However, some sectors have made significantly greater gains than others. Supply chains which stood out for me were:

- **The NZ sheep sector**, where the overnight removal of subsidies forced a focus on farm performance improvements in order to remain in business.
- **The Northern Ireland pig sector**, where a bottleneck in the system led to the disappearance of about half the industry in a very short space of time, leaving those who were highly committed to the industry, forward looking and data focused. The government provision of one of the best advisory services I saw during my Nuffield Farming research has also had a part to play in this success.
- **Fonterra**, for the way they have managed to continually progress an entire, large supply chain.

Industry professionals were clear that progress is a combination of many factors, and that usually we should not expect overnight change. Any good knowledge transfer programme must be long term, inclusive, practical, delivered in several different ways. It should provide guidance for uptake, but most of all should be delivered in a way which shows a clear pathway to implementation. Imperfect systems which deliver practical change are ultimately more effective than perfect systems which the majority find too difficult to implement.



Solutions must be holistic and take all business factors into account, but must also be modular, allowing farmers to implement aspects of the solution which they believe they are capable of. Change breeds more change, and if a farm business successfully implements a change which improves performance, this will encourage the uptake of more change. My summary of different components which will help drive implementation of science on farm is set out below:

- **Learning is a two way process**
  - The best advisors and industry professionals make it clear that they are learning from the farmer as he or she is learning from them.
  - One of the advantages of professional advisors is that they see many different farms and can transfer the best of what they see from farm to farm.
- **A wide mix of different methods of extension are necessary**
  - Different people learn in different ways and any effective programme must take this into account, incorporating a range of different methods.
  - Successful extension must involve successful, progressive farmers as part of the delivery process.
- **Enabling maximum feedback from customer and processor is essential.**
  - There is a real need for farm advisors to become involved further up the food processing chain so that they understand the direction of travel and the problems and the possibilities and consequently put market requirements in context for the farmers they advise.
  - The processor has an important role in the delivering of customer information and animal specification targets to farm, along with the reasons for those specifications.
- **Discussion groups (either formal or informal) are very important**
  - Information is easily accessible and the traditional meeting is becoming less and less relevant, other than for the building of key relationships, but discussion groups will grow in importance.
  - Each discussion group needs a couple of key progressive farmers who are willing to try new technology and methods and to report back on the success or otherwise of these techniques.
  - A group will become effective more quickly (and probably last longer) if it is created within an already existing supply chain, or around a known central figure, such as a fieldsman or a local vet.
- **We must make more effective use of technology in training and supply of information.**
  - We are on the cusp of unprecedented levels of technological advance in farming and we should embrace this as soon as practically possible for both data collection, analysis and for the process of knowledge transfer.

## 10.2. Deal with the detail

There are very few poor stockmen in the farming industry, but there are many who fail to deal with the details which effectively drive profitability. The main reason for this failure seems to me to be



that there is a lack of understanding of how important this detail is and what its true economic value is. This is due to the almost total absence of data collection which allows managers to continue in a state of 'blissful ignorance'. Implementation is very difficult without any direction or any measures of success or failure.

I have come to the conclusion that easy measurement systems are essential. There are several key control points in the production of livestock and nearly all of them can really only be effectively managed through data collection and analysis. I believe that effective progress can be driven through the development of simple systems (probably involving phone technology) which capture farm information for central analysis and provide feedback of practical advice from specialists. Current technology is very good for those who are able to use it, but there is a large number of farmers who see IT technology as intimidating and complicated. We must focus on user-friendliness rather than total solutions.

It is common to state that 'there is no silver bullet' for problems associated with agriculture in the UK, and while this remains true, it does not disguise the fact that a vast impact could be made if all farms collected key management data and then acted on it. There are many common problems across different agricultural regions and sectors, but there is no 'silver bullet' which will solve all problems. However there is a multitude of clear solutions to many different problems. High farm performance is always associated with the business being treated as a business and the business focusing on small steps to bigger solutions.



## 11. Recommendations

- 1 **Production research must be practical, targeted at future** problems and must have an implementation plan before it is commissioned. I believe that a huge amount of money is wasted on research which is unable to be implemented and that a change in emphasis is needed. Ideally, research should be proven at farm level as part of the research process so that a route to implementation is developed hand in hand with the new process.
  - In practice, this would mean the presentation of a problem discovered at either farm or consumer level, the submission of this problem to a small panel of farmers, advisors, researchers and industry representatives who have a clear brief to plan an implementable solution, not just a research project. As an example, one challenge might be in developing beef with enhanced flavour through diet.
  - The previous response to a challenge like this might have been to immediately initiate a trial to demonstrate that beef flavour can be manipulated through the diet and to consider implementation at the end of the trial. The new approach would consider all of the following before initiating the trial: (1) What is the critical mass of animals which would be required to meet consumer demand? (2) Is there seasonality in supply or demand? (3) What is peak and trough demand? (4) What is the additional value which would be added by this process? (5) What is the additional amount the consumer is prepared to pay? (6) Is it possible to control the diets of the animals on all the farms required for this product? (7) Is there a viable verification process which can guarantee that what is supplied is what it claims to be? (8) Can the flavour of the animal be manipulated by the diet? (9) What is the additional cost of this process? (10) Does this process have any negative effects or additional benefits?
  - If there is no overall system to implement the process, then either the project is rejected or more fundamental research is proposed and considered.
- 2 **Knowledge transfer from research organisations, advisory bodies and commercial parties is important.** It must be focused on long term, incremental progress and must include the four basic learning styles.
  - It is easy to set over-ambitious aims and milestones in place for a knowledge transfer programme. The overwhelming majority of those whom I interviewed changed their businesses gradually and over a longer period of time, building improvement on improvement.
  - Knowledge transfer programmes must take this into account, and set targets which are achievable and build compound improvements. I believe it is better for the industry in the long run to work in a concentrated fashion with a smaller number of producers in an intensive fashion than to spread the available resource too thin and not achieve at all.
  - I would recommend working with a central core of farmers, and developing a wide network of others to whom information on new practice and findings is sent on a



monthly basis (including both newsletter and video formats). The provision of central contact points who can be contacted for advice in conjunction with this is important.

- I would also recommend policy change in CAP funding to encourage the uptake of external advice and practice change.
- 3 **The use of progressive farmers is essential in knowledge transfer.** Behavioural science (and experience) suggests that farmers value practicality very highly, and the involvement of people with direct on-farm experience of implementing change greatly increase the effectiveness of knowledge transfer events.
- In practice this would mean specialists presenting the basis for change, the benefits of that change, and then a farmer presenting (or ideally demonstrating) how they made the change, what the pitfalls were and how it benefited his or her business. This should be in an interactive and discussional format.
- 4 **We must give people confidence in their own ability to deliver change.** Giving individuals the confidence that they can deliver change will result in faster, more effective and more widespread practice change, and this in itself will encourage further uptake of best practice.
- This will probably mean the farmer receiving specialist help and coaching to implement the change – either on farm or via phone or video link. Although this is more labour intensive for the extension agency, it is effective because it is associated with high uptake of advanced practice. The coaching aspect is one of the main reasons why farms which regularly use an external advisor progress more quickly.
  - Simple, generic changes can be demonstrated step by step through videos, and easily delivered to farmers through weblinks. However, more complicated, or farm specific changes will need more direct advice and guidance.
  - A conversation with (or presentation by) another farmer who has already implemented the process or change on their farm is also extremely helpful in convincing other farmers that they are capable of the same change and the same or better results.
- 5 **Feedback is essential to permit effective progress on-farm.** This means that considerable effort is required by farmers to obtain evidence for the effectiveness of the changed processes. Data collection is essential.
- In practice we need to find ways of making data collection simple and part of normal practice.
  - When a farmer is prepared to collect data and to analyse it, the result is usually substantial change in the farming business. Many farmers have been shocked at how different their perception of an enterprise's performance is from the actual reality once the figures are actually available.
- 6 **The use of new technology is essential in both data collection and knowledge transfer** but it should be used to make things easier, not more complicated.



- Many farmers are not expert in the use of technology and, like many other people, are intimidated by unnecessary complexity.
- I believe that the development of integrated, simple systems will encourage much greater uptake of technological solutions. At a consumer level, Apple are a great example of this in that their technology is not always the highest performing on the market, but its user-friendliness means that uptake and consumer loyalty is very high.
- A holistic data collection, interpretation and advice system is necessary and would follow on from the development of a simple 'one stop shop' collection system. Data would be collected (from a range of sources, on-farm, at market, in-factory), then collated and then sent to a team of farm advisors who would use the information to issue advice and guidance at appropriate points. The secondary benefit of a central processing point for all data would be a much better understanding of industry issues from health through to feed use, growth data etc. which could then be used to steer research and development much more accurately.
- Farms are small businesses and cannot have the full range of expertise to accurately implement all business solutions. Easy external advice which is automatically delivered to the farm would deliver long term change.

## **7 CAP Reform and farming banks must encourage the use**

- The use of external advice in UK farming is essential, but many farmers don't understand the potential benefits.
- CAP reform offers the opportunity to encourage the development of long term plans with an external advisor.
- Many banks have traditionally lent on the strength of the balance sheet. This is changing (and needs to continue to change). Loans should be given on the basis of enterprise viability, which should be proven through enterprise business plans backed up by the use of an external advisor.



## 12. After my study tour

The process of the Nuffield Farming Scholarship has been exceptionally helpful to me throughout the past year, and it has equipped me with a much greater level of understanding of how to effect change within the livestock production base through focusing on different methods of education, knowledge transfer and incentivisation.

In particular I have realised the importance of simplicity and ongoing communication in the delivery of change. I have also recognised the debilitating effect of a manager's lack of confidence in their own ability to implement change, and how addressing this is the single factor which is most likely to enable a permanent alteration in practice. Confidence is built through a combination of enabling the end result to be visualised, the breaking down of the change into manageable components, the measurement of ongoing performance, the practical observation or understanding of how change has been implemented on other farms and an element of ongoing support and coaching.

Over the next few years I intend to focus on the development of holistic and implementable solutions which are simple to use and have maximum user-friendliness. Technology will have a key role to play in driving change in the livestock industry, but only if it is reliable, easy to use and requires relatively little time to use. Data collection and measurement will only become widespread if it can become a natural part of a daily routine.

The utilisation of findings from this study has already commenced, with substantial changes being made to the methods of farmer/processor interaction within the Dunbia supply base. A range of measures is being used, from the development of topic-led farmer discussion groups focusing on potential performance improvements, through projects to increase the ease of data collection on farm, to the development of enhanced measurement and feedback methods at abattoir level. Some of these measures will bring results relatively quickly, but others will take several years to develop and implement. All will, however, be targeted at enabling farmers within this supply base to identify and implement changes which will significantly benefit their businesses.

**Jonathan Birnie**



## 13. Executive summary

UK livestock farming is coming under increasing financial pressure. As external EU support decreases, it is essential that farms derive an increased proportion of their income from the marketplace, ensuring that each livestock enterprise is both profitable and sustainable. Much of the information on best practice is already available to deliver the required rise in performance, but the level of implementation is low.

The main purpose of this report was to study current methods of knowledge transfer to the farming supply base, and to study the factors which encourage or discourage understanding and implementation.

Throughout the Scholarship I visited and spoke to individuals from Australia, New Zealand, the USA, Canada, China, Ireland and the UK. These people represented a range of industries and organisations including farming, advisory services, food companies, press organisations, distribution services, teaching, psychology, public relations, the military and universities.

I used part of my study to understand the processes we undergo when learning, and the ways in which different people learn. It became clear to me that there were several ways to learn, and that different educational methods vary in their effectiveness for different individuals. I concluded that any knowledge transfer programme must include spoken, written, visual and interactive components.

I also discovered that the way in which people view their own abilities impacts the effectiveness of any training, with farmers (who primarily view themselves as practical) most likely to respond effectively to a practical demonstration of a new procedure. I also learned that helping people to develop confidence in themselves to deliver change is one of the key components for successful implementation. I believe that we must dramatically increase the use of farmers who have implemented best practice in the delivery of knowledge transfer. The use of external farm advisors who can bring advice on practical implantation procedures and offer accountability and follow up is also important.

I also concluded that there is an ongoing need for practical agricultural research, but that it must be developed in response to current or upcoming challenges and must only be commissioned on the basis of a feasible route to implementation. A new technique or practice which is theoretically 100% successful but can only be partially implemented has virtually no value.

Finally I concluded that the key component to unlocking farm improvement is through effective on-farm data gathering, local or remote interpretation and the provision of simple and direct ongoing advice from easily accessible experts. Technology has a major part to play in increasing data collection, interpretation and provision of advice. Maximising automation of this process will deliver fastest progress. The technology must be both simple to use and cost effective. Progress will be accelerated when farmers can measure the effect of changes they make and relate this to a financial return.



## 14. Acknowledgments and thanks

I am grateful to the Nuffield Farming Scholarships Trust for the opportunity to undertake this Scholarship. The Nuffield Farming process has been educational, challenging and, above all, useful.

During the course of this programme I have been able to visit New Zealand, Australia, USA, Canada and China, taking in views from many different parts of the food supply chain along the way.

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