Understanding and influencing positive behaviour change in farmers and land managers

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Introduction A study was undertaken to investigate how the advice provided by Defra and its agencies can best be delivered to encourage and enable long-term, positive behaviour change in farmers and land managers. Its focus was specifically on environmental behaviour with respect to soils, water and waste. The study was undertaken jointly by the Countryside and Community Research Institute and the Macaulay Institute between July 2006 and September 2007.

Materials and methods The study was organised in two stages. Stage one comprised a full literature review to examine the current state of understanding of knowledge transfer, effective communications and advice-behaviour change linkages, and also to analyse the 'Knowledge and Information Systems' of farmers in England. Stage two involved identifying and examining five contrasting advisory initiatives in England: Birds Eye Pea Growers, National Trust Farming Forward project, Farm Waste Management Plans, Soil Management Initiative, and Westcountry Rivers Trust. Within these initiatives a range of farmers and farm families, including those identified 'loosely' as early, late and non-adopters in each case, were interviewed (75 in total). Scheme promoters and key stakeholders were also interviewed and discussion groups were convened with farmers and stakeholders.

Results Three overarching themes emerged in the research: farmers' engagement, farmers' capacity to change and farmers' willingness to change. Farmers' engagement with the initiative is important, specifically in terms of how advice is given, who gives advice and how the message and messenger are evaluated. For advice to resonate with the audience, it has to be seen as relevant and demonstrate financial dividends. Advice that is problem-solving, helping farmers address current concerns in respect of new legislation, grant schemes, time-saving techniques or business innovations, is most appreciated. Of the mechanisms for delivery, one-to-one advice and group events are popular although some publications can be effective if the format is appropriate. The value of tapping into farmers' own social networks should not be overlooked. Interviewees also expressed interest in initiatives or practices which enable them to raise their environmental profile with the public, with the local community and consumers.

Secondly farmers' capacity to change behaviour is also important with reference to farm characteristics, finance, markets, human capital, labour, social capital and time. Farm characteristics (climate, soil etc) clearly dictate what is practically, technically and economically feasible, whilst the farming system is also a factor influencing change, as some practices might not be possible with existing enterprise mixes. Finance is also important. Farmers with appropriate existing infrastructure are more easily able to respond to advice than those who will have to invest in new infrastructure. Many farmers interviewed were under significant financial constraints, particularly mixed and livestock farmers who had been affected by disease outbreaks (BSE, TB, FMD). In such circumstances adoption of new practices can be seen as risky. However for some farmers some environmental practices were favoured as it was claimed they reduced costs or offered access to high yielding markets. Time and labour are major constraints upon capacity to change. The reduction in labour is often a trigger for changes in farm management practices towards those that are less labour intensive, however less labour on the farm means that many farmers do not have time to carry out the environmental improvements they would like to. Farmers are increasingly relying on contractors, agronomists, crop consultants or vets to support their decision-making and these agents need to be targeted with advice as well.

Thirdly farmers' willingness to change, encompassing individual values, self-identity and social influence, is shown to be an important factor in influencing decisions and achieving long–term behavioural change. The influence of advice on farmer behaviour is largely context-dependent. Advice can be very influential at moments of transition and in the periods leading up to such moments, but may be dismissed if a farmer or farming family are 'locked in' (ideologically, financially, and physically) to their existing system. At times decisions are taken (stimulated by market, policy or personal triggers), and then advice is used to select *how* to change the practice; but at other times, advice can stimulate the need for a decision in the first place. Furthermore, once a decision is taken, the process of implementing change can give rise to further learning, from which new decisions flow. The complex interconnections between these three themes were explored in the research.

Conclusions Environmental considerations apply to the vast majority of farm businesses, it is no longer an optional extra. However farmers are heterogeneous and the task of advising them needs to be differentiated and sophisticated. A hierarchy of approaches is also needed to pick up the various phases in the cycle of farm decision making. .Successful initiatives will take time to establish, to develop into maturity and then to deliver real change and because of this initiatives need to be able to adapt to changing external circumstances.

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Transferring technology or facilitating innovation? reflections from research with English farmers

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Introduction The language of "extension" and "knowledge transfer" has been evolving towards "communication to support innovation", recognising that the integration of something new into one's way of life and work is an innovation process. More broadly, "innovation systems" thinking has helped us recognise that new ideas come from a wide range of sources. Research with English farmers highlights the varied influences on their decisions whether or not to take on board new ways of doing things.

Materials and methods Several studies have been done within the conceptual framework of the Theory of Reasoned Action. Typical methodology involves two stages: focus group discussions and telephone interviews to identify (a) beliefs about the outcome of performing a behaviour, and (b) people, organisations and sources of information that are seen as knowledgeable or influential in decision making on the behaviour. A questionnaire survey (by post, face to face interview, or telephone) then measures intentions, the extent to which each outcome belief is held and the importance of the outcome, and the extent to which the respondent feels each social referent will support a decision to perform the behaviour and the importance of conforming to that referent's preference. Correlation analysis identifies associations between attitudes, social norms and behavioural intentions.

Results Social referents influential in farmers' decisions vary depending on the area of decision, and between categories of farmer. Table 1 below, for example, shows the main social referents for beef farmers in seven areas of decision, based on data from 319 postal survey respondents in 2006.

Table 1 Social referents with influence on beef farmers' innovation decisions

	decision area	*referents with positive influence on decision to change*
1	referral to EBVs when selecting a sire	family / stockman, other experienced farmers, EBLEX
2	herd health and fertility monitoring	vet
3	adjust feed level to its nutritional value	independent nutritionist
4	adjust feed level to stage of growth	feed supplier, independent nutritionist, EBLEX
5	target production for specific markets	buyers, marketing group, EBLEX
6	assess market readiness by regular handling / weighing	local market
7	use EUROP classification to assess market readiness	buyers, abattoir, EBLEX, marketing groups

Similar variability is seen in studies of consequential loss insurance (University of Reading 2004), techniques for detecting oestrus in dairy herds (Garforth et al., 2006) and referral to EBVs when selecting rams (Garforth and McKemey 2005). A consistent finding is that farmers have confidence in their own ability to make assessments of the condition and quality of their animals, with many feeling that technological aids and research based information cannot outperform them. Drivers and barriers to change are those outcome attitudes (strength of outcome belief x importance of the outcome) which correlate significantly with the intention to perform the behaviour in question. Barriers are often perceived technical or managerial constraints, or simply a view that the new idea "will not work on my farm". Beyond the expectation of productivity or financial gains, drivers range from lifestyle factors to farmers' view of themselves as entrepreneurs or stewards of the resources they manage. With consequential loss insurance, those who think that it would enable them to get back on their feet quickly after an outbreak are more likely to feel positive about buying it, while barriers include the suspicion that it will strengthen government intentions to move more of the cost of disease control from the public purse to the industry.

Conclusions A view from the farm suggests farmers have been successful in transferring the technology they feel they need and can afford. Those outside the farm who feel a need to develop a technology transfer strategy need to be aware of the different ways in which farmers access information about, and the various factors that influence their evaluation of, new ideas. The problems and opportunities that science identifies are not necessarily those that farmers prioritise.

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Adapting livestock management, feeding and breeding systems to climate change

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The exact nature of any change in climate remains uncertain but the likeliest scenario may see increased variability, particularly at the extremes, with overall increases in mean temperature and decreases in mean rainfall. What do these changes mean for our livestock and how may our livestock management, feeding and breeding adapt?

Climate change may have direct or indirect effects on livestock. The quantity and quality of the feed supplied to the animal is a major factor but as well as the direct relationship between the nutrition of the animal and its thermal environment, modifications to the seasonal availability of forage may have implications on animal production systems. For example, altered lambing times may be possible if patterns of spring forage growth change which would have implications for the marketing of finished lamb.

Direct effects of climate result from the normal rules of environmental temperature, along with relative humidity, wind speed etc, on the animal's climatic physiology. The responses of animals to changes in environmental temperature and emphasises the key difference between our ruminant and non-ruminant species in their comfort zones. Ruminants have wide comfort zones and a high degree of thermal tolerance so it is likely that climate change resulting in an increase of a few degrees is not going to have any major effect on animal performance. The exceptions would be at the extremes. Areas currently characterised by low temperatures and high rainfall may become more favourable and be associated with a reduction in the mortality of calves and lams. At the other extreme high summer temperatures may be expected to present the dairy cow with thermal stress and result in reduced intakes and performance. Adaptations to management systems such as increased provision of shade and water should be adequate to counter this. By contrast the non-ruminant species have very narrow comfort zones. This is one of the reasons our pig and poultry enterprises have often been based on intensive, housed systems. Dealing with housed livestock we might expect the direct effects of climate to be small – which is true with two important riders. Higher environmental temperatures in winter may lead to a saving in heating costs for pig and poultry buildings. However in the summer months our existing housing systems may not be able to cope with the increased thermal load. This may lead to an increased requirement for costly air conditioning systems.
With regards to the supply of feed, central to this consideration is an appreciation of what is currently fed to our farm livestock. Non-ruminant livestock will continue to receive diets consisting largely of cereals and oilseed residues and with least cost ration formulation fairly major changes in ingredient inclusion can be made without altering the nutrient specification. Many diets already include a lot of high quality by-products and imported ingredients and it is unlikely that climate change would alter the range of ingredients available for ration formulation. A much greater threat is likely to be posed by the food:feed:fuel conflict providing reduced feed supplies.

Ruminant diets differ in that there is a major forage component. In the case of extensive systems this may make up the entire diet whereas in more intensive dairy cattle systems the forage will be balanced by a more concentrated supplement. It is the source, quality and quantity of the forage component of ruminants' diet which is likely to be affected by climate change. The result may be either effects (advantageous or deleterious) on the existing forage species or a change to forage species not currently grown. With respect to our existing forage species, low environmental temperature, particularly in spring, is one of the major limitations to higher Dry Matter production. Thus any increase in temperature might be expected to have benefits on early season growth. It is important to note the effect which this might have on the component species of a mixed sward. If mean rainfall were to decline this would lead to soil moisture deficits which would require expenditure on irrigation unless reductions in DM yield were to be accepted. For existing species the stage of maturity at which the crop is cut is a major determinant of quality and in any altered climatic scenario the interplay between increasing quantity and declining quality would continue to be of major importance although the alterations in climate may be favourable to conservation and reduce losses during either ensilage or hay-making. In many hill and upland areas, which are currently characterised by low temperatures and water logged soils, climate changes may be expected to lead to more favourable conditions and result in a shift towards more productive species with accompanying implications to both animal production and the appearance of the countryside. The other major possibility is that climate change will lead to a shift in the forage species grown. For example, elevated temperatures may lead to an increase in the hectarage of maize grown for silage and of alfalfa for hay. This might be expected to result in improvements in both the quantity and quality of forage for ruminant livestock and could lead us towards the forage component of rations fed to dairy cattle elsewhere. Nutritional studies have also focused on trying to reduce GHG emissions but whilst some success has been achieved it has often been accompanied by greater use of imported materials with the associated burden of GHG production associated with transport.

Many non genetic farm technologies that could help to mitigate emissions require ongoing investment of some sort to maintain the commercial benefit (e.g., dietary manipulation). Genetic improvement on the other hand is effectively a permanent change and does not require additional or continuing resources. Many breeding goals for livestock species include production traits and production efficiency and this helps to reduce emissions. In many cases this can be achieved simply through selection on production traits. Reducing the number of animals required to produce a fixed level of output can also have a favourable effect on methane emissions. For example it has been demonstrated that efficiency of the beef production system was paramount in reducing the GHG emissions/unit output showing that intensive concentrate based systems produce the lowest emissions. Further analyses of the data showed that there was also a significant breed difference suggesting that bigger continental breeds of cattle produced less emissions/unit output than the smaller British type breeds. Selection for fitness traits (lifespan, health, fertility) will help to reduce emissions by reducing wastage of animals. Improving lifespan in dairy cows and maternal line animals (i.e. ewes and beef cows) will reduce wastage by reducing the number of followers. For example, by improving lifespan in dairy cows from 3.02 to 3.5 lactations will reduce methane emissions by 3%. Also it has been estimated, using modelling, that if cow fertility was restored from the level in 2003 to the level in 1995 that methane emissions from the diary industry would reduce by 10-15%.

Broader breeding goals have become the norm in many livestock species, usually incorporating production and "fitness" (health, fertility, longevity) traits. Breeding goals can be built in a number of ways including the popular method of weighting traits by their relative economic value (REV). These REV's tend to be calculated by estimating the economic dis/benefit to the system of a unit change in the traits being examined. A lot of the example traits given earlier have been incorporated into indices for particular livestock sectors. However, livestock industries have more recently needed to consider societal views of aspects of farming systems, including issues such as welfare, biodiversity, food safety, health properties and environment. Traits and tools will need to be developed and applied to help livestock industries mitigate emissions using genetic tools.

A new range of pests and diseases will affect our crop and forage species with effects on the quantity and quality of livestock feeds. Similarly, we will face new challenges in the field of livestock diseases. Diseases currently thought of as “exotic” may become of importance (eg Bluetongue) whilst existing diseases eg parasitic gastroenteritis may become more widespread with increased costs of control and risks of immunity developing.

Altered climate may result in altered soil conditions which may result in altered soil conditions which may encourage outdoor systems of poultry and pigs and encourage out wintering of livestock which have previously been housed – not because of the climate having direct effects on the livestock but due to indirect effects via treading. This has possible implications on the type and sophistication of housing systems required.