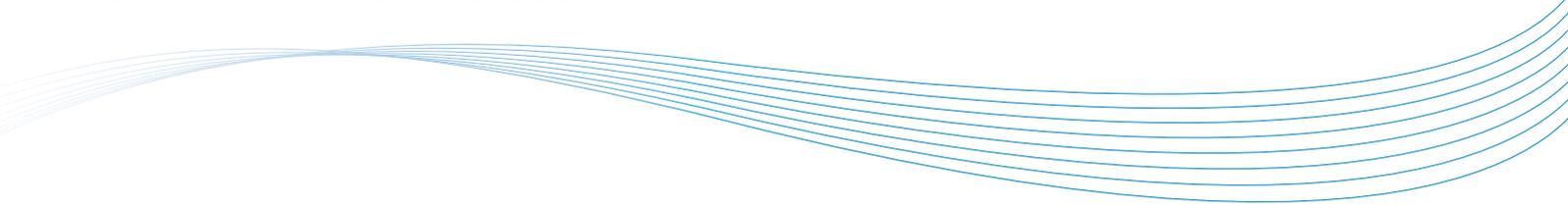


# Understand how to influence farmers' decision-making behaviour

a social science literature review



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In order to make a difference on the ground, policies, innovations, and best practices, must be implemented on-farm. Researchers, policy-makers, and other organisations have long investigated why some recommendations are never adopted by farmers, and much of this work has used behavioural approaches. The common rationale for such work tends to proceed along the lines of, ‘if only we can understand farmers better, then we can influence their behaviours and ultimately convince them to adopt our recommendations’. There is now a large body of agricultural literature on behavioural change, which tends to focus on individual farmers. Limited attention has, however, been placed on consolidating the lessons learned from the plethora of studies, which is particularly concerning given that recent studies continue to identify significant barriers to behavioural change amongst farmers.

This report set out to review the lessons learned from existing behavioural change work in agriculture, and supplemented the insights gained with knowledge from similar behavioural work conducted in other fields, such as health, medicine, and diet. We reviewed over 200 papers towards one clear objective – to understand how behavioural change approaches in the context of farmer decision-making could be improved, or even as we suggest, evolve.

**If the aim is to focus on individual farmer behaviour change, the following key recommendations were made in the literature:**

- 1. Target messages carefully** – the overwhelming message from the literature was the need to identify your audience before you communicate to them. Through making an effort to understand their workflows, you may get a better sense of which messages they respond to. In general, one of the key findings was that people generally respond better to positive or gain messaging as compared with negative or loss messaging. AHDB should, as far as possible, present optimistic messages to farmers, stressing the benefits of adopting particular behaviours.
- 2. Fund and encourage knowledge exchange activities** – good knowledge exchange and education initiatives, ideally delivered in a face-to-face manner or making the most of active demonstrations, were identified as key factors in influencing behaviour. Knowledge exchange activities must be sustained, not just using one-off events. Continued engagement should be seen as something more valuable than simply providing information through leaflets. AHDB already uses its ‘farm excellence platform’ to facilitate knowledge exchange with farmers, and it is considered that such active demonstrations combined with face-to-face advice (ideally through trusted individuals), are the best way of getting information to farmers, but also for receiving knowledge back from them.
- 3. Prove the value and ease of adoption** – if farmers do not perceive that there is value in adopting a new behaviour, then they are likely to stick with the status quo. AHDB could ensure that it finds ways to prove the value of adopting all of the tools, policies, and practices that are recommended. As above, active demonstrations could be a good way to do this, as well as collating evidence from long-term studies that prove benefits to a farmer’s bottom line, or other aspects of their farm business. It is much easier to encourage adoption if recommended actions are already matched with the workflow of the farmer, and if they address relevant tasks (behaviour change on the part of the farmer is not then needed).
- 4. Incentivise behaviour change, including nudging** – where behaviour change was incentivised, there were signs of positive change, although perhaps not in the long-term (more research needed here), and only if rewards were sustained. Thus, if AHDB is to incentivise behaviour change, it should ensure that the rewards can be sustained, and that it uses other forms of interventions to underpin financial rewards (e.g. education).

The overwhelming message from the study, however, suggests that it may be problematic to focus on influencing individual farmer behaviour in preference to stimulating wider social change, which necessitates actions from organisations, research institutions, policy-makers and funders alike to reach out across a farmer’s ‘ring of confidence’. Many of the reviewed papers argued that it is difficult to change individual behaviour without including trusted people, such as advisors, family, and peers, and without wider social and organisational change.

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We thus make the following key recommendations to guide approaches that move beyond the individual and towards wider social and organisational change.

- 1. Encourage a research culture both within and outside of AHDB that is participatory and practice-relevant** – instead of one that prioritises the production of academic material that is more suited to journal publication.
- 2. Involve multiple actors in knowledge exchange** – when conducting knowledge exchange, whether verbally or in writing, identify key advisors in a given region. There is a need to identify which groups exert the greatest social pressure on farmers, thereby helping to shift social norms and attitudes (could be friends, advisors, family). Trusted advisors could use the management guides produced by AHDB to ensure that the messages are right for the farmer.
- 3. Involve friends and families in knowledge exchange activities** – when conducting farming seminars or demonstration events, invite farmers' family and advisors along to the same session in order to stimulate peer-to-peer learning. Also ensure that other key decision-makers are there, which could include the landowner.
- 4. Find ways of communicating with farmers in existing formal or informal networks** – where possible, existing networks of farmer participation could be mapped in order to find opportunities for group knowledge exchange. This will be more appropriate if a project is working in a particular region, rather than across the whole country. Farmers may be given leadership roles in participatory meetings, instead of merely being spoken to, thereby increasing their level of confidence and control in performing a particular behaviour.
- 5. Invest in trained facilitators** – in order to increase the amount of face-to-face knowledge exchange with farmers and other practitioner groups.
- 6. Recruit 'peer champions' to shape AHDB advice and literature** – where face-to-face knowledge exchange is not possible, consider the value of including testimonies of peer groups (e.g. fellow farmers or advisors) in advice booklets. Results suggest that farmers listen more closely to advice (e.g. in the farming press) if they saw that it was being given by someone like them. These 'peer champions' could be encouraged by AHDB.
- 7. Keep track of ongoing research on peer-to-peer learning** – for example through the European PLAID project (Peer-to-Peer Learning: Accessing Innovation through Demonstration).
- 8. AHDB could lead a new phase of social change initiatives** – these would move beyond looking at the behaviour of individual farmers, which has long singled out problem non-adopters, towards a broader focus on the plethora of actors involved in farm decision-making. In order to prove the benefits of such an approach, the impact of holistic knowledge exchange activities on farm decision-making need to be investigated in a sustained, long-term fashion, and with an emphasis on actions taken, rather than merely intention to act (as in many of the literature studies).

# 1. Introduction

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This study has been undertaken by UEA Consulting on behalf of AHDB.

The aim of the research was to review current literature from both within the field of agriculture and also from other professional sectors, which could inform AHDB on how it can better understand and influence behavioural change on farm. A key output would be a series of recommendations that AHDB could adopt.

The question of how to influence farmer decision-making behaviour has been the subject of much research for several decades. In general, this research has focused on trying to encourage farmers to adopt tools, policy measures, or management practices, which researchers, extension workers, and agricultural organisations consider to be beneficial. Despite many recommendations being made on how to influence behavioural change, research continues to identify significant challenges. For example, Inman *et al.* (2018) report on a series of projects centred around Demonstration Test Catchments in the UK, focusing particularly on the adoption of recommended management practices. The authors found that it was difficult to change deeply embedded behaviours, but argued that some influence was possible with sustained, targeted engagement. Recent research has continued to identify key factors in influencing farmer behaviour (e.g. Hyland *et al.*, 2018), while studies focused on understanding farmer motivations to perform particular behaviours remain commonplace (e.g. Mills *et al.*, 2018). However, there have been few attempts to consolidate important lessons that have been learned about influencing farmer decision-making behaviour, nor any major efforts to harness insights learned from outside of agriculture. It is unsurprising, therefore, that lack of tool, policy, or practice uptake continues to be noted in the peer-reviewed literature; for example, low uptake of technology or decision support tools (McCown, 2002; Rose *et al.*, 2016; Rose *et al.*, 2018), limited implementation of catchment water management practices (Vrain and Lovett, 2016), and a restricted adoption of certain practices related to Sustainable Intensification (Morris *et al.*, 2017) and Integrated Farm Management (Rose *et al.*, 2017).

Alongside a great many behavioural change theories and models, Sutherland *et al.* (2012) developed a five-stage framework to predict the evolution of farmer decision-making:

1. Path dependency – the stage at which farmers follow the status quo. Farmers may be satisfied with performance and in their management practices. Sutherland *et al.* (2012) note that this stage may exist for indefinite periods of time.
2. Trigger event – the occurrence of a particular event (e.g. new market opportunities, injury/death, new management practices or technology becoming available) makes a farmer consider whether to do something new.
3. Active assessment – once a farmer starts to think about doing something new, they begin to assess a range of options using a variety of information sources.
4. Implementation – the farmer then decides to implement a new practice.
5. Consolidation – the farmer monitors implementation and learns from the process. If the new approach is considered successful, then the farmer returns to stage one; if it is unsuccessful, active assessment (stage 3) will begin again.

It is apparent that it may be easier to influence decision-making at particular points in time.

If we consider the significant changes facing UK agriculture post-Brexit, alongside calls for the sustainable intensification of the industry, partially through an agri-tech revolution, the industry is facing an unprecedented 'trigger event'. There is now a big opportunity to shape the future of UK agriculture (Gove, 2017<sup>1</sup>). If research institutions and other bodies are keen to ensure that post-Brexit agriculture is evidence-based and built on good practice, then recommendations need to be implemented on the ground by farmers.

The purpose of this research, therefore, is to learn lessons about how to influence farmer behaviour. Since there is such a large body of work both within, and outside of, agriculture on this subject, there is considerable value in identifying behavioural interventions that have worked in practice. In this report we present recommendations based on a review of the academic behavioural change literature, including studies conducted outside of agriculture. From an instrumental perspective, if we can better understand how farmers and growers make decisions and what influences their behavioural change, organisations such as AHDB can better target information and communication strategies to achieve maximum impact. Ultimately, this will help to create and sustain high performing agri-businesses.

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<sup>1</sup><https://www.britishecologicalsociety.org/windows-opportunity-influence-policy-four-tips-improve-uptake-scientific-knowledge>

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Throughout this report, we highlight the importance of considering critiques of behavioural approaches to ensure that the underlying assumptions of such approaches are made clear and explicit. In the final chapter, we pose the question of whether we should continue to fine tune existing behavioural approaches, most of which suffer from the same flaw of focusing on individuals, or rather whether strategies should evolve to consider how change can be achieved at different scales.

## 2. Methods

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We were keen to learn lessons about influencing farmer behaviour both from the agriculture literature and more widely. Often, researchers can feel constrained to disciplinary siloes, seeking to learn only from peers within the same field. Yet, some of the biggest advances can come from looking at what others are doing in different fields (e.g. the evidence-based conservation movement, which learned lessons from evidence-based medicine – Sutherland et al., 2004). Two structured literature searches were conducted, firstly on the theme of farmer behavioural change, and secondly a more general search covering fields such as psychology, medicine, public health and nutrition. A target number of search results was set to ensure that the review could be robustly conducted within the timescales of the project.

Both reviews were undertaken using ‘Scopus’. We acknowledge that there are flaws in using a singular literature search platform. Each platform – such as Web of Science, Pubmed, ASSIA – contains internal biases which means that the same search string will yield different results depending on where the researcher chooses to search. Some of these platforms are able to search the grey literature, whilst many are geared towards prioritising results from certain fields (e.g. Pubmed is good for the health and medical sciences). Based on the one month time period available for this review, we decided that it was not possible to use multiple literature search platforms. This is because a larger amount of search results would have been created, which we would not have been able to review properly. Since this report concerns itself with learning lessons from the peer-reviewed academic literature, we chose Scopus. This is the world’s largest database for searching peer-reviewed literature and it is useful for multi-disciplinary studies (we were keen to learn lessons from many fields). Scopus has been reviewed favourably in comparison to other search platforms (Chadegani et al., 2013), and it has been used as a standalone database to inform scholarly review papers (e.g. Young et al., 2018).

The review process used a tried and tested method, which has been used to inform peer reviewed research (see Young et al., 2018). We did not constrain either review geographically, but we acknowledge that agriculture is context-specific, and therefore an intervention that has worked in one place will not automatically work in another. Some work, for example from developing countries, may not be directly applicable in a more developed context, and vice versa. While the reader should keep this in mind throughout the report, we argue that the core principles of understanding and influencing human behaviour are, to a certain extent, generalisable.

### 2.1 Farmer-specific review

This report is primarily concerned with farmer behaviour. We thus limited the main review to articles that specifically used farmers as study subjects. The following search string was used:

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( TITLE-ABS-KEY ( "behaviour change" or "behavioural change" or "theory of reasoned action" or "theory of planned behaviour" or "diffusion of innovation" or "health belief model" or "social learning theory" or "social cognitive theory" or "transtheoretical" or "self-determination theory" or "nudge" or "nudging" or "choice architecture" ) AND TITLE-ABS-KEY ( farmer ) ) AND DOCTYPE ( ar ) AND PUBYEAR > 2009 AND PUBYEAR < 2018 AND ( LIMIT-TO ( LANGUAGE, "English" ) )
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We looked at articles published in English since 2010, excluding review-based articles, as we were interested in learning lessons from primary studies. These articles had to include the word ‘farmer’ (or ‘farmers’) in the title, abstract, or keyword, which meant that it was highly likely that farmers would be the study subjects (although not always). Articles were included if they contained the phrases ‘behaviour change’, ‘behavioural change’, ‘nudge’, ‘nudging’, or ‘choice architecture’, in the title, abstract, or keywords. These general search terms were chosen to ensure that results were relevant to the aim of learning lessons about how to change farmer behaviour, rather than merely understanding it.

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Since these search terms yielded just 103 results<sup>2</sup>, we decided to search for farmer-based articles which had used various behavioural models to inform their study. Since there are a plethora of behavioural change models, indeed Davis *et al.* (2015) found 82 different theoretical models in a review of the social and behavioural science literature, we initially selected ten. This decision was based on the review by Davis *et al.* (2015), which found that nine<sup>3</sup> (if the Theory of Planned Behaviour and the Theory of Reasoned Action are counted as two) behavioural models were used most often in literature from the social and behavioural sciences. We also included ‘diffusion of innovations’ theory since we knew that this had been widely used in the agriculture literature (see Rose *et al.*, 2018). Of these ten behavioural change models, the ‘health action process approach’ and the ‘information-motivation-behavioural skills model’ [also searched for “IMB” and “IMB skills”] yielded no extra results when added to the search string, and therefore were not included in the search string. All other models were deemed relevant to the study, including the ‘health belief model’, which had been used to explain environmental management decision-making elsewhere in the literature (e.g. Morris *et al.*, 2012).

The initial search resulted in 251 relevant articles (Appendix 1). These were then manually screened using the following criteria; if there was any doubt, then the default position was not to remove the article. Much of the screening was done by reading the abstract, but if there was doubt, then the whole paper was looked at. A paper was removed if:

1. It was not a research article; for example, any reviews that were not filtered out initially were removed.
2. It did not substantially address the subject of understanding behaviour or behaviour change of farmers; for example, there were some papers about the behaviour of consumers at farmers markets.
3. It appeared twice in the search results.
4. If it was inaccessible after searching using our institutional credentials, on Google, and on Researchgate where full-text requests were made (one week reply deadline).

After reviewing for relevance, 171 papers were included in the final review (Appendix 2). Each paper was reviewed according to the following protocol, which allowed the reviewer to pick out key pieces of data to inform our study:

- Country/region of study
- Purpose of study
- Farmer type
- Age of participants
- Gender of participants
- Number of participants
- Main methods used
- How did they try to understand behaviour? (i.e. Any theories or models used?)
- Major influences on decision-making behaviour
- Mechanism for stimulating behaviour change (if relevant)

<sup>2</sup>The search was conducted on 5th February 2018.

<sup>3</sup>“Of the 82 theories identified, just 4 theories accounted for 174 (63%) of articles: the Transtheoretical Model of Change (TTM; N = 91; 33%), the Theory of Planned Behaviour (TPB; N = 36; 13%), Social Cognitive Theory (SCT; N = 29; 11%) and the Information-Motivation-Behavioural-Skills Model (IMB; N = 18; 7%). A further four theories accounted for an additional 32 (12%) of the included articles: the HBM (N = 9; 3%), Self-determination Theory (SDT; N = 9; 3%), Health Action Process Approach (HAPA; N = 8; 3%) and Social Learning Theory (SLT; N = 6; 2%; SLT is a precursor of SCT).” (Davis *et al.*, 2015, 335).

- Change achieved?
- Nature of change
- Success factors for behaviour change
- Barriers to behaviour change
- Recommendations made in the study
- Research gaps identified in the study
- Notes

One person did the review, but 5% of papers were also reviewed by another member of the project team. There was little difference in data picked out by the different reviewers, so we had confidence in the methodology.

## 2.2 Search of the wider literature on behavioural change

We were interested in learning lessons from other fields about how to change behaviour. We focused this review on papers referring to a decision-making context, and thus specified that the words ‘decision-maker’ or ‘decision-making’ had to appear in the title, abstract, or keywords. The literature on behavioural change, however, is vast; for example, using the same general research terms of ‘behaviour change’, ‘behavioural change’, ‘nudge’, ‘nudging’ or ‘choice architecture’, in the context of decision-making, and searching in this decade, the number of results totalled 1954. Obviously, this was far too many papers to review in the allotted time. Thus, we restricted our research to review-articles only published between 2013 and 2017 inclusive (five years in total). There are certainly flaws in using review articles; this is because you rely on the soundness of other people’s methodologies, hoping that they have reviewed all of the useful literature within a particular field. Reviews rarely go into detail about specific studies, choosing to provide a general overview. Despite these flaws, however, we consider that using review articles served the purpose of this structured literature review; namely, to give us general insights about behavioural work from other fields, which can be used alongside findings from our detailed farmer-specific review. The following search string was therefore used:

```
(TITLE-ABS-KEY ("behaviour change" OR "behavioural change" OR "nudge" OR "nudging" OR "choice architecture") AND TITLE-ABS-KEY ("decision-making" OR "decision-maker" )) AND DOCTYPE (re) AND PUBYEAR > 2012 AND PUBYEAR < 2018 AND (LIMIT-TO ( LANGUAGE, "English "))
```

This initial search yielded 183 results (Appendix 3). Again, these were then manually screened using the following criteria; if there was any doubt, then the default position was not to remove the article. Much of the screening was done by reading the abstract, but if there was doubt, then the whole paper was looked at. A paper was removed if:

1. The paper was not a review, or it did not use a structured literature approach (e.g. search strings and literature search platform). This decision was made on the basis of time and excluded perceptive/essay-type pieces that had sought to give a general overview of the literature without clearly using a structured search approach (note that we did include papers by Mankad, 2016 and Wilson *et al.*, 2015, which did not clearly do a structured review, but the subject matter was farmer decision-making [but were reviews, hence not included in the first review]. Thus, we thought that they would provide useful insights for this report).
2. If it did not substantially address the subject of understanding behaviour or behaviour change.
3. It described behaviour medically, rather than from a social or behavioural science perspective. This was a common issue when screening articles from medicine or neuroscience.
4. It used an intervention that could not be repeated in agriculture – for example, some studies used medical treatments (e.g. a drug) which could not obviously be used elsewhere.
5. It was inaccessible after searching using our institutional access, on google, and on Researchgate where full-text requests were made (1 week reply deadline).
6. It appeared twice in the search results.

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After screening, 33 papers were included in the final review (Appendix 4). In total, 55 papers were excluded by using the strict rule of only reviewing papers that had clearly used a structured literature review methodology. While we accept that there would have been some value in looking at these, time constraints meant that we chose to focus our attention on the papers that did meet the set criteria. Each paper was reviewed according to a different protocol (see below), which allowed the reviewer to pick out key pieces of data to inform our study. Since these were review papers, we could not use the same protocol as the one used for the farmer-specific part of the study. The following components were included:

- Field of study
- Main countries/regions of study of the reviewed papers
- Purpose of review
- Number of papers reviewed
- Any focus on behaviour change interventions?
- Any theories used or highlighted?
- Key influences on behaviour (including behaviour change) identified
- Barriers to behaviour change highlighted (or critiques of behavioural approaches)
- Recommendations from the review
- Research gaps identified by the review
- Notes

In total, therefore, 204 individual papers were reviewed for this project, which is significant given the six week timescale for the review. This is a high number of papers for a short review, particularly when compared to many of the structured reviews assessed in the second search, many of which reviewed only 20–30 papers.

We also used our own knowledge of the literature to inform our understanding of work on behavioural change, including critiques. These papers were not subjected to the formal review process and were used as appropriate (see Chapter 5 for more information).

## 3. Review on farmer behaviour change

### 3.1 Information on the reviewed papers

In total, 171 papers met the criteria and were reviewed according to the protocol presented below (see Appendix 2 for full list of reviewed papers). The studies were global in nature, representing the views of farmers in 55 countries across all six habitable continents (Figure 1). The top five countries were USA (22), UK (17), Brazil (12), Iran (8), and The Netherlands/Australia (both 7).

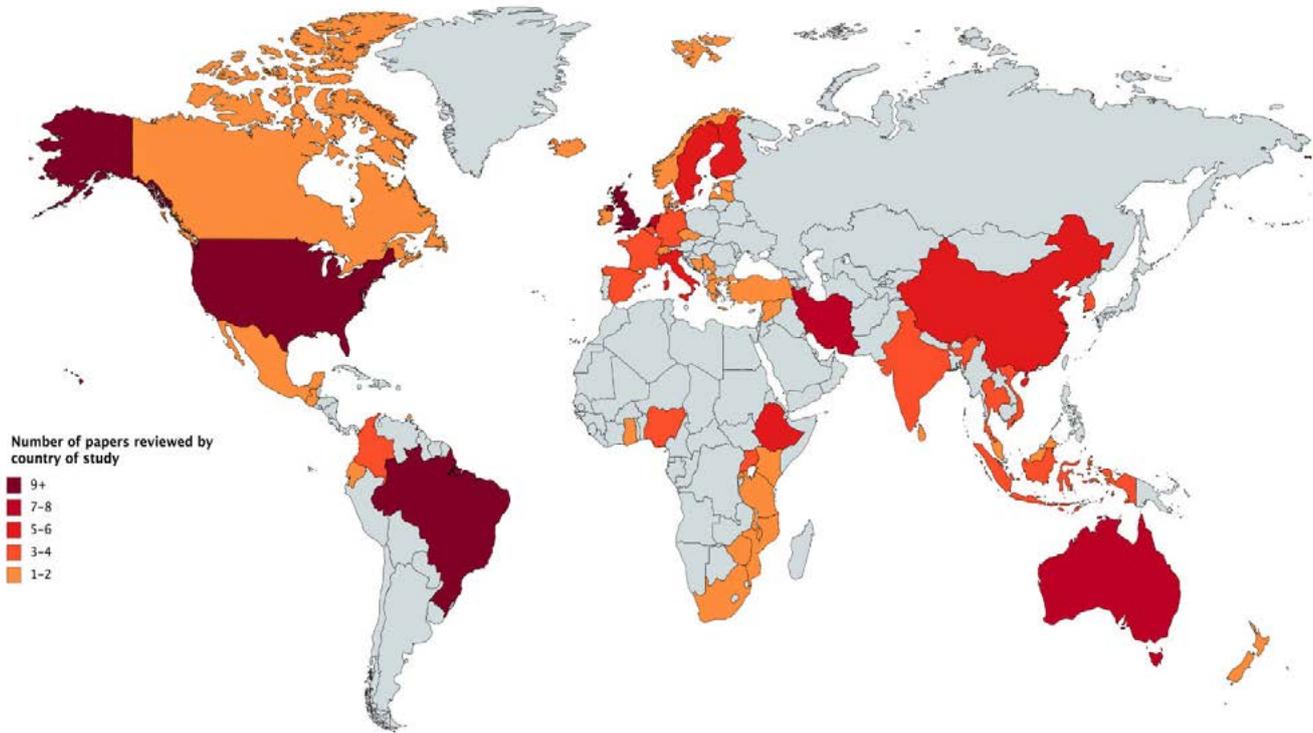


Figure 1. Map showing the location of the reviewed study, darker red meaning more studies were done in the country (note that if a study covered more than one country, all countries were included on the map)

The median number of participants from the studies was 183<sup>4</sup>. We chose the median because some of the studies had very high sample sizes, partially influenced by their method of choice. For example, Sorensen *et al.* (2017) were able to use data from over 35,000 farmers in New York State from an audit, while other studies also had large sample sizes (e.g. Roesch-McNally *et al.*, 2017, 4778, USA; Hammond *et al.*, 2017, 1015, China; Nöremark *et al.*, 2016, 2081, Sweden). Unsurprisingly, there were differences in the median sample sizes gained through different methods. For example, where interviews had been used as the sole methodology, the median sample size of farmers was 43 (interviews are more in-depth, but take longer to conduct and transcribe). If surveys had been used as part of the methodology, then the median sample size of farmers was 220 (surveys tend to be less in-depth, but are generally quicker to administer and analyse).

Across those studies that specified the average age of their farmers (including farmworkers and landowners), the mean age was 49, although a large range of ages was included across all the studies.

Methods used were dominated by surveys and interviews. Interviews were used as the sole methodology in 42 papers, but were also used alongside other methods in a further 14, giving a total use of 56/171 (33%). Surveys were used in 105 papers (61%). Focus groups were used as part of the methodology in approximately 11 papers (6%). Other common social science methods, including ethnographies/participant observation, were not commonly used – in fact, only two papers (1%) mention observation. The emphasis on using interviews and surveys, rather than direct observations, underlies the later critique that studies generally measure intention to change behaviour, rather than observing actual change.

<sup>4</sup> Some studies used the unit of a 'household' which meant that total number of participants were not included. These are not included in the analysis here. Some studies included different types of people in their sample, but we tried to only count numbers of farmers as far as possible (and farmworkers/landowners). We only included information from those studies which made their sample size explicitly clear.

With reference to gender, 93 papers did not clearly specify this information (54%). Five studies were all male (Solomon Islands, USA, India, Latvia, Nigeria), while only 15 studies included more than 40% females in their sample, and only 3 studies contained more women than men (in Uganda, India, Guatemala). The majority of other papers saw high proportions of males included in the study as compared to females.

The type of farmers included in the studies was not clearly mentioned in 37 of the papers (22%). Of the 171 studies, 20 clearly stated that they were focused on arable farmers (12%), 21 just on dairy (12%), 11 just on mixed (6%), 6 for both wine and pig farmers (4% each), 4 sheep (2%), and 3 just on poultry (2%). Many of the other papers, however, included a mixed sample of, for example, arable and livestock farmers, and many papers just specified cattle or livestock farmers.

### 3.2 Behavioural change or merely understanding behaviour?

Based on our interpretation of the 171 papers, we considered that only fifteen (9%) had actively sought to use an intervention to influence behaviour, before then monitoring its impact. Thus, the vast majority of the literature was interested in understanding factors influencing farmer behaviour and decision-making, as well as identifying barriers and solutions to the adoption of various behaviours. We return to this point in the ‘research gaps’ where we argue that more long-term intervention-based studies are needed in order to understand fully what works to change behaviour in the context of farmer decision-making.

### 3.3 Common behavioural theories used

Although we specified eight behavioural models plus terms related to nudging in our literature search string, we also searched more widely for all papers mentioning ‘behaviour change’ or ‘behavioural change’ in the context of farmer decision-making. Including modifications or extensions of standard behavioural models, the top models used were:

1. *Theory of Planned Behaviour/Theory of Reasoned Action* – we merge them here because Ajzen (1991) was responsible for construction of both models, and they are often used interchangeably in the literature. The theory of planned behaviour was the most common iteration and was clearly used as a theoretical frame in 83/171 (49%) papers. Based on its popularity, we explain this theory briefly below with the aid of a Figure 2. In short, behavioural intention is closely associated with actually carrying out the behaviour, although some papers note that intention does not always lead to action (e.g. Viira *et al.*, 2014). Behavioural intention is affected by three components – (1) attitudes, which relates to an individual’s beliefs, world views, and opinions towards a particular behaviour, (2) subjective norms, or in other words whether a particular behaviour is considered normal as compared to what peers are doing, and (3) perceived behavioural control, which can relate to either how easy it is for an individual to implement a particular behaviour, and/or the extent to which they feel in control of the decision-making process.

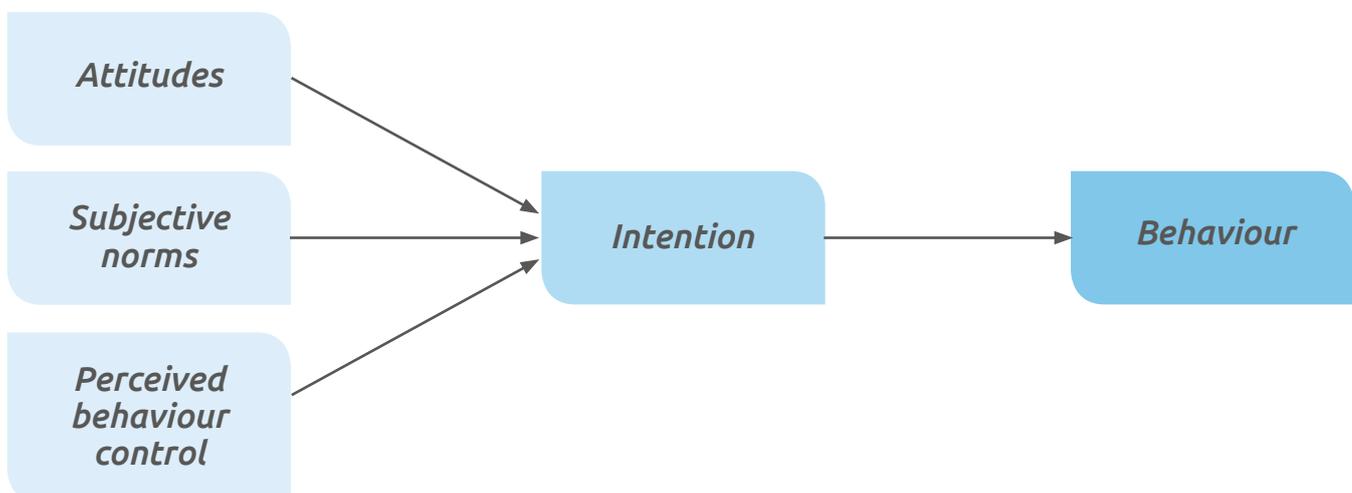


Figure 2. Theory of Planned Behaviour (adapted from Ajzen, 1991)

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2. *Diffusion of Innovations* – this theory was the second most common in the reviewed papers. It was used in 23/171 (13%) of the papers. In short, this temporal theory suggests that different individuals adopt innovations on various timescales – there are the ‘innovators’ or ‘early adopters’ who are the first individuals to decide to adopt an innovation or practice. As these early adopters put them into practice, peers see this and may then decide to adopt if success is achieved; these can be split into the ‘early’ or ‘late’ majority, or the ‘laggards’ depending on how long it takes for the innovation to be adopted (Rogers, 1962).
  3. *Health Belief Model* – this was used in eight of the papers reviewed (5%). Interpreting this broadly outside of health, the model suggests that an individual will take action if a negative outcome can be avoided, if they have a positive expectation about a behaviour, and further believe that they can implement the action successfully (Hochbaum *et al.*, see Rosenstock, 1974).
  4. *Econometrics* – this approach was taken in five of the papers reviewed (3%). This approach uses mathematical models to describe economic decision-making.

If a model is not mentioned in the list above, then less than five papers used it as a central part of their analysis. These results show that the theory of planned behaviour is by far the most commonly used model to inform empirical research in the context of farmer decision-making behaviour. Other theories are not widely used, although the diffusion of innovations model is commonly used for research aimed at understanding the adoption behaviour of farmers in relation to a particular innovation. It is worth noting that several papers used a modified form of the theory of planned behaviour, as it was not always found to be comprehensive. Approximately thirty papers used multiple theories to inform their analysis.

### 3.4 Key factors influencing farmer behaviour

Although there was some subjectivity involved in identifying key themes from the papers, the strict pro-forma contained in the protocol helped to minimise bias. We are not always able to make precise statements, such as ‘x’ number of papers identified factor ‘y’ as key to behaviour change, because some of the text in the papers is open to interpretation. However, the completed pro-forma in the form of an excel spreadsheet does allow us to make an overarching quantitative judgement about which themes appeared most often. These are now presented in turn below. It is worth noting that nearly all studies noted multiple influences on behaviour, for example personal factors alongside business factors and advice received from family. Thus, when we present an example of a factor being mentioned in one study, it is acknowledged that other factors were probably also highlighted in the same study. Factors are not mutually exclusive.

#### 3.4.1 Personal factors

Personal factors, such as age, gender, experience, attitudes, and beliefs were very common determinants of behaviour. The old adage of ‘everyone is different’ is certainly true, and personal characteristics influence farmers’ attitudes and beliefs towards adopting particular behaviours. Age was a commonly mentioned factor, particularly with reference to technology adoption. Aubert *et al.* (2012) found that Canadian farmers of different ages held different attitudes towards the adoption of precision agriculture (older more likely to be resistant), whilst pre-determined level of innovativeness was also a key factor. Gebrehiwot and van der Veen (2015) found a negative correlation between increasing farmer age and adoption of risk management practices in Ethiopia.

Education levels were also associated with the uptake of various behaviours across the set of reviewed papers (e.g. Gholamrezai and Sepahvand, 2017; Issa and Hamm., 2017; Mekonnen *et al.*, 2017). In Thailand, Arunrat *et al.* (2017) discovered that farmers’ uptake of climate change adaptation measures was affected by age, gender, personal beliefs, education, and experience. All of these factors were widely repeated across the reviewed papers.

The personal beliefs of a farmer, influenced by individual circumstances and characteristics, were found to be a key determinant of behaviour. In a UK case study, Mills *et al.* (2017) reported on a study to investigate farmers’ willingness and ability to undertake environmental management. They argued that farmers’ personal beliefs were the key factor in explaining levels of environmental

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management, as those with stronger environmental values performed more measures (see also Schroeder *et al.*, 2015, UK case study on environmental management). A further UK case study by May (2015) found that business competitiveness in agriculture was influenced by a farmer's willingness to try new things, as well as business factors such as number of staff (see following section). Alongside a number of other factors including level of knowledge, and feeling in control of decision-making, Toma *et al.* (2013) illustrated that UK cattle and dairy farmers' biosecurity behaviour was influenced by personal attitudes towards livestock biosecurity. In Finland, Kauppinen *et al.* (2010) argued that actions on animal welfare were most affected by farmers' personal views, and across Scandinavia, Espetvedt *et al.* (2013) noticed that farmers' intention to call vets to treat animals was most significantly affected by personal beliefs and attitudes. Past behaviour was also associated with current behaviour (e.g. De Lauwere *et al.*, 2012, Netherlands).

There was little discussion of the impact of farmer emotions on behaviour, although O' Kane *et al.* (2017) suggested that sheep farmers in England who displayed negative emotions (e.g. anger or misery) were more likely to be slower to act upon, and have a higher prevalence of, lameness on their farms (see also Wells *et al.*, 2011).

One final interesting point in this section is worth remembering in the light of subsequent discussions about a lack of long-term behavioural monitoring. We make the point several times in the report that most papers measure behavioural intention, rather than action. This may be problematic, as intention may not translate to action, a fact noted by Viira *et al.* (2014) in Estonia who noticed that older farmers were more likely to deviate away from their initial intentions.

### 3.4.2 Business factors

Business factors, such as farm size, cashflow, staff numbers, succession plans, and profitability (see section 3.4.5 for relative advantage) were commonly highlighted as major influences on behaviour. Some of these factors modified other determinants of behaviour; for example, having a higher number of farm staff could make it easier to implement management changes, while a bigger farm, and hence perhaps a greater level of income, can make it easier to adopt new innovations. Lemken *et al.* (2017) investigated factors affecting the adoption of mixed cropping amongst German arable farmers, finding that farm size was an important determinant. In addition, they found that behaviours could be strongly affected by the amount of land owned versus the amount rented (see also Arunrat *et al.*, 2017; Viira *et al.*, 2014). This is because farmers were not always in control of long-term decision-making on land that they did not own. Other papers that found a link between farm size and adoption of management practices, included Campbell *et al.* (2011, Ohio, USA) and Nöremark *et al.* (2016), the latter paper finding that the biosecurity behaviour of Swedish farmers was affected by herd size and number of employees (amongst many other factors). Uptake of technology was associated with high-income farmers, and with those who were able to make the most of employee expertise (Aubert *et al.*, 2012, Canada).

### 3.4.3 Family, peer, and advisor networks

The influence of other people on individual farmer behaviour was also very commonly noted in the reviewed papers. Studies found that the opinions of family, friends, peers, and trusted advisors were highly influential on farmer decision-making behaviour, also helping to delineate what 'normal' farm management looked like (social norms, derived from the theory of planned behaviour). The opinions of trusted people could affect farmer behaviour through the provision of formal or informal advice, or through the means of social pressure. Indeed, one study by Bell *et al.* (2016) on pest management decision-making in Cambodia found social pressure to be the most important determinant of behaviour, much more so than the attitude of an individual farmer. Similarly, in a Mexican study by Martínez-García *et al.* (2013) on factors influencing dairy farmers' decisions to adopt improved grassland management, social pressure applied by the fathers of farmers was found to be a significant factor (see also Kauppinen *et al.*, 2013 [social pressure on animal welfare behaviours in Finland]). Other papers illustrating the importance of social pressure include Mills *et al.* (2017) who found that the willingness of UK farmers to undertake pro-environmental management was strongly affected by social norms and societal pressure (see also Van Dijk *et al.*, 2015 [bird management in The Netherlands], and also Borges *et al.* (2016) who looked at improved grassland management

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amongst small cattle farmers in Brazil (see also Meijer *et al.*, 2016 [Malawi]; Prager and Curfs, 2016 [Spain]).

An interesting study of wine growers in France by Kuhfuss *et al.* (2016) found that farmers would be more willing to enrol into a management scheme if they believed that a significant number of their peers would do the same.

The influence of trusted advisors was also widely mentioned. In a study of dairy farmers in The Netherlands, Bruijn *et al.* (2013) found that decision-making behaviour regarding animal husbandry was heavily influenced by feed and health advisors. Elliot *et al.* (2011) illustrated that perceptions about lamb mortality were significantly influenced by advisors, and also the farming press and family, amongst their participants in Australia. Furthermore, Alarcon *et al.* (2014) used an English case study to explore the decision-making process used by pig farmers for disease control, finding that vets were most influential. A further UK case study by Enticott *et al.* (2012) found that positive biosecurity behaviour amongst cattle farmers was influenced by whether local vets had good knowledge about safe management practices (see also Jones *et al.*, 2015, UK for importance of vets' advice to dairy farmers). Advice from vets would only be influential if farmers could afford for them to visit regularly. Similar conclusions were reached in many other papers, thus suggesting that behaviour is not just affected by individual traits, but rather is also heavily influenced by family, peer, and advisor networks.

#### 3.4.4 Feeling in control of decision-making

Perceived behavioural control, derived from the Theory of Planned Behaviour (TPB), was commonly noted in the reviewed papers. Indeed, almost all of the 80+ papers which used the TPB found perceived behavioural control to be highly influential, far too many to discuss below. This refers either to the perceived level of autonomy over decision-making that a farmer feels he/she has, but also the perceived ease of implementing a particular behaviour (self-efficacy). If a farmer feels that they are being told what to do, rather than being in control, or feels that they do not have the skills, knowledge, or practical conditions to implement a management practice, it is unlikely that the action will be carried out.

Farmers must, therefore, be confident that they can perform a particular behaviour. The importance of self-efficacy was noted by a large number of papers, including in studies of disease prevention activities implemented by English and Welsh cattle farmers (Ellis-Iversen *et al.*, 2010), of silvopastoral adoption in Colombia (Hayes, 2012), of general farmer decision-making in India (Singh *et al.*, 2016), and of lamb mortality preventing practices in Australia (Elliot *et al.*, 2011). This factor is closely associated with levels of education, discussed in sections 3.4.7 and 3.5, as a higher level of formal education often meant that a farmer felt more confident about implementing new things. Further papers that found perceived behavioural control to be important, particularly the level of autonomy over decision-making, included studies by Yazdanparah *et al.* (2015 – water conservation in Iran), Roesch-McNally *et al.* (2017 – adaptation to climate change in the US corn belt), Andow *et al.* (2017 – adoption of organic agriculture by Brazilian strawberry farmers), and O'Kane *et al.* (2017 – livestock disease prevention in England). The overwhelming message from the literature is that farmers must be made to feel in control of the decision-making process, and feel confident that they will be supported in implementing new practices. Logically, this would be far more likely if any potential change was initiated and designed from the ground through deliberative processes.

#### 3.4.5 Relative advantage (incentives/rewards)

A number of papers discussed the influence of incentives or rewards on farmer behaviour, including a number of studies that had used a behavioural change intervention (see section 3.5 for these). Put simply, direct financial incentives to adopt particular behaviours are often needed because there is a cost associated with change. These can be in the form of direct payments or financial rewards (section 3.5) or in promoting relative advantage (below). The cost of adopting various practices was noted in a UK case study by Jones *et al.* (2015), who found that dairy farmers would only use antibiotics, even when required, if they were affordable.

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In addition, many of the papers argued that profitability and other benefits to the business had to follow from a change of behaviour (e.g. Leach *et al.*, 2010; Martinovska Stojcheska *et al.*, 2016; White and Selfa, 2013). If farmers could not be convinced that there was a relative advantage in shifting towards a particular behaviour, for example adopting renewable energy initiatives (see Silk *et al.*, 2014, Michigan, USA), then change was unlikely to occur. Relative advantage was commonly highlighted as a key factor, including by Haberli Jr. *et al.* (2017) amongst corn, soy, and cotton farmers in Brazil, by Reimer *et al.* (2012) in Indiana, USA (time-saving, reduced inputs, economic/environmental benefits), and by White and Selfa (2013) also in the USA (advantage also included reduced risk). Indeed, Cary and Roberts (2011) found financial benefits to be much more valuable than environmental benefits when investigating the adoption of environmental management systems in Victoria, Australia. Thus, it is clear that farmers must perceive that there is some sort of reward or incentive to change behaviour, otherwise they may stick with the status quo.

#### 3.4.6 Market or compliance-based rewards

One way of promoting the relative advantage of a particular behaviour is to associate it with market- or compliance-based rewards [gaining higher prices or doing an activity that helps them satisfy compliance). Several papers found that compliance was a key determinant of behaviour; these included Cary and Roberts (2011) who investigated uptake of environmental management in Australia, and in a study by Dang *et al.* (2014) about climate change adaptation in Vietnam, as well as by Prager and Curfs (2016) who looked at soil management practices in Spain (EU regulations were a key influence here). Home *et al.* (2014) use a case study of mixed farming in Switzerland to show that regulations are influential when farmers have good knowledge of them, in their case surrounding conservation compliance (thus, see information provision in section 3.4.7).

Market rewards for various behaviours were also seen as vital. Sutherland *et al.* (2011), for example, used an English case study to show that perceptions of organic farming were shaped by farmers' attitudes about whether there was a sufficient market to sell their produce into. Jones *et al.* (2016) found that dairy farmers in Spain, Sweden, France, and Germany were more likely to prioritise herd health very highly if there was a perceived market reward. Furthermore, studies by Herath and Wijekoon (2013) on organic coconut farming in Sri Lanka, and Velandia *et al.* (2010) on the growing of switchgrass in the USA, illustrated the value of perceived market rewards. Therefore, it is clear that farmer behaviour could be influenced if change is associated with clear market- or compliance-based rewards.

#### 3.4.7 Information provision education

Good information provision, alongside clear communication, were key factors influencing behaviour, and education-based behavioural interventions are discussed in section 3.5.1 [information provision through one-off events or leaflets cannot be confused with formal, sustained education). Here, we found many papers that highlighted education levels (see section 3.4.1) and information provision as key determinants of behaviour. Much of the vital information was provided by key advisors (see section 3.4.3).

Some of the many papers that cited the provision of useful information as key to enhancing perceived behaviour control (i.e. farmers feeling like they could do it) included: Zamasiya *et al.* (2017) who linked access to extension services to the implementation of climate change adaptation strategies in Zimbabwe, Micha *et al.* (2015) who found that decisions to continue vine growing were influenced by the availability of useful information, and Pino *et al.* (2017) who associated uptake of water saving measures in Italy with access to technical information. Other studies included Malaysian research by Tey *et al.* (2014) who linked uptake of sustainable farming practices with access to useful information, and Alarcon *et al.* (2014) who found that information sources were crucial to good disease control in pigs (England). Furthermore, Garbach and Long (2017) discovered that adopters of field edge planting in the USA used more information sources than non-adopters. Poor communication was associated with lack of behaviour change, including by Wynn *et al.* (2013) in Trinidad and Tobago, who blamed communication barriers for lack of IPM adoption. Some papers note that information provision and good communication must be sustained over time so that farmers are constantly supported (e.g. Oleas *et al.*, 2010, Guatemala).

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### 3.5 Insights from behavioural change intervention studies

Only a minority – fifteen – of the reviewed studies had clearly used some kind of intervention to influence the behaviour of farmers, before then monitoring its impact. Six of these studies were from the USA, with single studies also conducted in the UK, Colombia, Rwanda, Thailand, Tanzania, Indonesia, Cambodia, Kenya, and Vietnam. Since the active use of interventions was rare, we include information from all of the studies here (bar one<sup>5</sup>) grouped within four themes – (1) Education, (2) Theatrical education, (3) Community projects, (4) Incentives – although we note that many studies used a combination of approaches. It is worth noting that some of the claims made in the studies are based on either small sample sizes and on short-term monitoring, and some of the papers include rather scant details of the exact process used, including whether baseline behaviour was measured. Some of the claims should, therefore, be treated with caution, although there were a few robustly designed experiments. We suggest that there is a need for well-designed, robust scientific studies which measure baseline behaviour, use a clear intervention, have a control group, and then monitor behaviour change in the long-term amongst all populations.

#### 3.5.1 Education events

The use of educational interventions was most common across the fifteen studies, often representing the only intervention, and sometimes being used alongside other techniques such as providing incentives. The single UK example looked at a project designed to reduce the prevalence of dairy cattle lameness by influencing farmer behaviour (Leach *et al.*, 2013). Data was collected from 128 farms as part of the ‘Healthy Feet Project’. Farms were split into two groups; one received some information on which of their stock were likely to benefit from veterinary treatment, while the other group received the same information supplemented by additional advisory visits, more written information, and contact with fellow farmers in the project if requested. Results suggested that there was not a big difference in outcomes between the two sets of farms, although mean lameness prevalence decreased across all farms (35% down to 22%) in a three-year follow-up period.

In central Tanzania, Seetha *et al.* (2017) reported on the use of focus groups, field demonstrations, and farmer learning sessions to encourage arable farmers to take seriously the problem of aflatoxin infection. While 312 farmers were recruited for the study, 188 were then tracked over the next two years to monitor behaviour change. The authors claim that the number of farmers with understanding of the negative impacts of the disease increased from 19% to 82%, while contamination frequency decreased from 44% to 5.9%.

After noting that there was limited knowledge of the effectiveness of behaviour interventions, Helitzer *et al.* (2014) used an educational intervention to improve the safe use of integrated pest management techniques amongst arable farmers in New Mexico, USA. The project trained six ‘model farmers’ in the safe application and implementation of pesticides and then allowed them to train 120 farming families. This training covered aspects such as sprayer calibration, safe pesticide application, and further training in integrated pest management was offered through the New Mexico State University extension service. After the intervention, the project team found significant changes in positive behaviours concerning pesticide storage, use, and application. Interestingly, there was a clear acknowledgement that families shared the responsibility for farm management, illustrating again that change is always social in character, and not the domain of individuals acting alone. The study design was robust as significant amounts of data were collected before the intervention took place, including getting participants to do a full inventory of their farms and partake in a baseline survey of pesticide knowledge.

Genskow (2012) presents results from a study designed to influence nutrient management behaviour amongst mixed farmers in Wisconsin, USA. A total of 259 farmers participated in a multi-session educational workshop on developing nutrient management plans. The sessions presented the scientific, economic, and policy rationales for adopting nutrient management plans, plus information on the regulatory rules, and were led through University of Wisconsin extension educators and specialists. A visit to individual farms to develop personal management plans was also offered.

<sup>5</sup> One of the fifteen studies by Pounds *et al.* (2014) used a ‘stages of change’ and health behaviour model and a social marketing campaign via Youtube in a project designed to increase the uptake of health risk behaviours in the USA. However, it was particularly difficult to assess survey response and interrogate figures, so we do not discuss this study in detail here.

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Results from interviews conducted before the study, and then one to three years afterwards, suggested that significant changes in nutrient management occurred amongst the participants. For example, 47% decreased their Nitrogen applications, while 51% of farmers increased them. Similarly, for Phosphorus, 46% decreased applications, whereas 47% increased applications. Crucially, however, it was noted that those who increased rates were the farmers who were using too little initially, whereas decreases came from those who were using excessive amounts. Thus, there was a shift from the vast majority of farmers towards efficient application. Of the 248 farmers who had developed nutrient management plans after the training, 86% said that it covered more than  $\frac{3}{4}$  of their crops, while 41% said that it covered all of their farm. Most farmers felt that planning had made a positive difference to their farm. Post project data also suggested that farmers conducting soil testing every three years increased from 48% to 71%.

Using a 'Theory of Change' approach, Sayinzoga *et al.* (2016) reported on an initiative which provided a one week financial literacy course to smallholder farmers in Rwanda. Although there was a wider sample of farmers, 174 underwent the training exercise. The study noted that there was little significant impact on income in the short-term, but noticed that there was an increasing awareness of good financial practice, which involved some farmers saving more while others took up investment loans. New income generating activities were also started by some farmers, so there was some influence on behaviour.

Conan *et al.* (2013) reported on a project to increase biosecurity on poultry farms in Cambodia. Working with 351 households, they split a group of villages into 'control villages', where no intervention was conducted, and 'intervention villages', where a community education scheme was led. This education scheme was led by trained local people and involved various activities, such as role plays and group sessions. Participants in the intervention villages who attended these sessions were given equipment such as quarantine cages. Over a 14-month period, the researchers followed up behavioural change amongst both populations using interviews and surveys. It was noticed that farmers in the intervention villages reported making more positive changes to biosecurity, including using quarantine cages more often for sick birds. The authors noted, however, that further monitoring was needed to check whether behaviour persisted.

Fattah *et al.* (2016) conducted a field school for 25 shrimp farmers in Indonesia to encourage productive decision-making behaviour, suggesting that yields and profits increased amongst the participants (details are rather sparse).

Cowan *et al.* (2015) present results from a study in Washington State, USA, which attempted to stimulate interest in biodegradable plastic mulch amongst various groups, including farmers (11 in study). The study claimed that after a one day field event, interest increased, but noted a low response rate.

### 3.5.2 Theatrical education

Reed and Claunch (2017) conducted an interesting intervention with 33 farmers in central Kentucky, USA (16 were couples, which shows that the project team considered it inadequate to identify just one decision-maker). The aim of the project was to convince farmers to adopt better farm safety practices. They invited the farmers to an event called a 'dinner theatre' where local farmers performed three humorous plays lasting between two and fifteen minutes, which contained messages about farm safety. After these plays, the principal investigator gave a short presentation on farm safety. After one week, a phone survey discovered that 42% of participants had made safety changes, while 67% were thinking about doing so. Reed and Claunch (2017) used the theory of planned behaviour to inform their project, and claimed that shifting social norms was a key part of the process. They argued that hearing funny and engaging testimonies from local farmers convinced them that farm safety behaviours were normal and that they were easy to implement (perceived behavioural control). The authors note that the sample size was small, and that the phone survey only monitored behaviour or behavioural intention one week afterwards, but plan to scale-up to a larger study.

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### 3.5.3 Community projects with education initiatives

There is some overlap in this section with the educational theme, as many community projects used some form of education initiative. Both of the projects outlined below were conducted in the developing world, in Thailand and Kenya respectively.

Raksanam *et al.* (2012) conducted a study of 101 rice farmers in Thailand (46 females, 55 males). The project aimed to influence farmers to make more informed decisions about agrochemical safety, and it was informed by the Health Belief Model. There was a control group and a further group who received a three-stage intervention. An initial home safety visit was offered to each farmer during which a pesticide risk assessment was completed. This was followed by community events consisting of six monthly meetings in which discussions were interactive (including a drawing competition!). A final home visit was carried out. After six months, the farmers who received the intervention showed significant improvements in health risk behaviours, while the control group showed no significant improvement.

Hockin-Grant and Yasué (2017) reported on a project by a Canadian NGO in Kenya who worked with 110 small-scale farmers. The aim of the project was to increase the adoption of permaculture to improve food security and income. Both farmers and their children were involved in the study. Two types of interventions were offered; firstly, community projects in which primary school students received permaculture clubs in schools, and they were then encouraged to convince their families to implement techniques at home. Children were given various seedlings to take home to diversify crop production. Secondly, permaculture design certifications (PDC) were undertaken – these were two week training programmes where adults lived, studied, and interacted with professionals at the Practical Permaculture Institute of Kenya. Based on the post project survey, 90% of the community project participants and 100% of the PDC participants said that they would use permaculture on their farm. The PDC scheme seemed to promote greater feelings of confidence amongst farmers than the community project. We note again, however, that the survey measured intention rather than actually monitoring practice.

### 3.5.4 Incentives

Some of the studies offered incentives for farmers to adopt particular behaviours, although most were accompanied by another form of intervention, such as training. Donham *et al.* (2013) used financial incentives as part of a larger package of interventions to influence the behaviour of lowan pig farmers (USA) with regards to personal protective equipment. The study was informed by a hybrid model based on the Health Belief Model and the Theory of Planned Behaviour. In total, 438 farmers were recruited for the study, although 36 were lost along the way. Farmers were split into two groups – one received the intervention, one did not. The intervention consisted of four components – (1) a clinical health screening for each farmer was performed and individual health goals set, (2) an on-farm health and safety audit was conducted, (3) an educational process which consisted of group and individual learning, and individual farm visits, which included demonstrations of how to use protective equipment as a barrier against hazardous occupational exposure, and (4) financial incentives, such as \$150 if farmers completed 85% of the risk audit. Thus, financial incentives reinforced another aspect of the intervention. After the intervention, 89% of intervention farmers used protective equipment regularly as opposed to 78% in the control. Furthermore, the percentage of farmers who never wore respirators in the intervention group was half that of the control group. Thus, the intervention was associated with positive behavioural change around health risk management.

In a study designed to increase the adoption of small scale beekeeping in Vietnam, Yap and Devlin (2015) illustrated how interventions used a combination of incentives and education. Working with 195 farmers (71 women, 124 men), all participants were given beehives for free, then beekeeping clubs were formed, and training DVDs were made and given to each farmer. Two workshops on basic and advanced beekeeping practices were provided one year apart. The strategy was informed by the diffusion of innovation model (Rogers, 1962), which suggests that stimulating initial adoption is key (hence beehives were provided for free). Six months after basic training, a post-intervention survey suggested that 65% of farmers had adopted and expanded their number of hives, with 100%

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doing so six months after the advanced training. 97% of farmers claimed to have trained others, such as friends and family. However, there was no long-term monitoring, and the study also noted that many more farmers had initially been engaged, but did not participate in the project (therefore the sample was self-selecting – treat the numbers with caution!).

Lastly, Hayes (2012) looked at a Colombian project to encourage small-scale potato and dairy farmers to switch to a silvopastoral system. Farmers signed a contract in which they agreed to adopt the practices and to protect their forest; in return, they received materials and extension support for three years to cover the start-up costs and to pay them for pledging to change systems and conserve their forests. In total, 23 farmers went through the pilot project, and a survey asked them about their experiences. In addition, 60 new participants joined around the same time as the survey was administered, and 54 of these were surveyed in order to ask them about their perceptions of joining. Pilot participants were found to be significantly more positive about their ability to sustain a silvopastoral system compared to new participants who hadn't yet received the incentives to switch. Interestingly, less than half of the pilot participants (48%) thought that they could sustain the changes with additional external help, which suggests that continued financial or extension support would be needed. This supports the point made in section 3.4 concerning the fact that behavioural change brought about through financial incentives could be short lived if support stops.

### 3.6 Research gaps

A number of research gaps were identified by the reviewed papers. Some of these research gaps form part of our actionable recommendations to AHDB presented in Chapter 6. Here, we briefly present a number of research gaps highlighted by the review, noting that gaps identified by earlier papers may, to a certain extent, have been filled by later studies:

#### 1. Few robust, long-term studies of farmer behavioural change

This was widely mentioned as a research gap in the reviewed papers, and forms a key part of the critique and recommendations offered in Chapters 5 and 6 respectively. As stated in previous sections, there were a lack of studies in the analysis that had attempted to perform a behavioural change intervention. Of those that did, some of the experiments were not particularly robust. For example, sometimes an adequate measurement of baseline behaviour was not carried out. This is problematic as a study by Jones *et al.* (2015), which looked to encourage livestock farmers to reduce antibiotic usage in the UK, suggested that those who did ultimately reduce use may have been those who wanted to do so anyway before the intervention. In a study of dairy farmers in Denmark, Lind *et al.* (2012) argue a similar point, finding that baseline behaviour concerning disease prevention was not fully understood in the target population. This, therefore, brings into question the claims of some intervention studies that claimed to have had success, but may have had self-selecting samples.

Furthermore, we also found that some studies did not include a control population, nor did they measure actual behaviour (they used a survey measuring intention), and nor did they monitor change over time. Thus, many of the results from the behavioural change studies in section 3.5 should be treated with caution – for example, Yap and Devlin (2015) claimed that 100% of farmers said that they had expanded their number of beehives and 97% claimed to have trained other farmers. Both were intentions based on a survey, thus how can we be sure? In addition, some of the reviewed papers noted that management practices may only be effective in the first few years (Hillis *et al.*, 2017), and that farmers could deviate away from their intentions over time (Viira *et al.*, 2014). While it is certainly challenging for researchers to maintain engagement once funding ends, real care should be taken to design and fund projects which seek to monitor actual change over time.

#### 2. Few studies mapping the 'ring of confidence'

Some of the reviewed papers called for much greater research attention on mapping out a farmer's 'ring of confidence' (AIC, 2013), in other words where key information came from. For example, in a study of field edge planting amongst arable farmers in California, Garbach and Long (2017) argue for more research into the chain of communication between farmers, landowners, extension agents, and others, to understand better how to influence behaviour. Borges *et al.* (2016) state that there is a need to determine which groups exert the greatest social pressure on farmers in the context of small scale cattle farming in Brazil.

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Many other papers suggested that more studies are needed into the role of social referents (Espetvedt *et al.*, 2013) on farmer behaviour, including the role of key advisors (Martinovska Stojcheska *et al.*, 2016) and other information sources (Leach *et al.*, 2010). Furthermore, Reed and Claunch (2017) argued that more information was needed about the impacts of working with farmers who know each other, particularly as Bell *et al.* (2016) suggest that enhanced behavioural influence was exerted within known groups.

### **3. Limited work on understanding personal traits and characteristics plus impacts on behaviour**

Although many of the papers highlighted the impact of personal traits and characteristics on behaviour, the need to understand it better was commonly recommended. This included the effect of demographic variables (e.g. age, gender) on behavioural intention (Ellis-Iversen *et al.*, 2010; Zeweld *et al.*, 2017), the impact of attitudes on soil erosion decisions (Wauters *et al.*, 2010), and the effect of general social (and indeed business) factors (Martinovska Stojcheska *et al.*, 2016). An interesting research gap, raised in very few papers, related to the impacts of personality traits on behaviour (Charatsari *et al.*, 2017). At least two papers had noted that negative emotions could be associated with lack of interest in adoption (O' Kane *et al.*, 2017; Wells *et al.*, 2011), and thus more work is perhaps needed to explore cognitive, emotional factors further. As we suggest in Chapter 6, however, it is suggested that further work in this area might not be fruitful if necessary developments in behavioural approaches are made, namely moving away from a focus on the individual (see Chapter 5 too).

### **4. Lack of knowledge about how past behaviour affects current behaviour**

This theme was raised explicitly by only a couple of papers, but it is interesting to consider. Wells *et al.* (2011) and Borges *et al.* (2016) suggested that current and future behaviour could be predicted by assessing past behaviour. Farmers have been known to be risk-averse and to follow the status quo for large periods of time, always doing what they have done in the past (Sutherland *et al.*, 2012). Borges *et al.* (2016) certainly claimed that past behaviour had been influential in other studies of behavioural change.

### **5. Lack of investigation of how targeted policy tools may work for behaviour change**

This gap was not widely raised, but it is worthy of brief consideration. Based on a study of best practice uptake amongst arable and livestock farmers in Ohio, USA, Campbell *et al.* (2011) argued that there was little knowledge of which policy tools are more likely to get results in specific contexts. This is an interesting point. The results thus far have suggested that personal attitudes and characteristics can significantly influence behaviour, as can other factors related to the business. Since each farmer is different, and each farm is different, one might expect different messages to be salient to different farmers. For example, a technical pro-innovation message might be more appealing to younger farmers, while an incentive-based message might be more exciting for those with limited cashflows who need much greater support to perform a behaviour. It is certainly true that a one-size-fits-all behavioural approach is unlikely to work across different groups of farmers (see Chapter 5), and thus we do need to understand better how to shape policies and messages for different groups of individuals.

## 4. Behaviour change insights from outside of agriculture

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### 4.1 Information on the papers reviewed

In total, 33 studies met the criteria for inclusion in the analysis. The most common field from which papers were derived was health, including studies related to dental health, sexual health, and food safety (19/33). Seven of the studies related to diet (including children and the elderly), two were clearly related to medicine (e.g. prescribing behaviour), although there was some overlap here between papers in the health field, while two further papers were related to agriculture. Two more papers related to drugs/substance use related to adolescents, while a single paper was concerned with community-based conservation behaviours.

Usefully for our review given that the agriculture papers focused less on behavioural change interventions, 27/33 of the papers from the wider review clearly discussed impacts of intervention studies. Due to the subject matters of the papers, which included reviews specifically about low and middle income countries, a number of countries were covered in the studies. In the health and diet fields, papers contained in the review papers predominately came from the USA and the UK, and other richer Western nations. For example, in a review on the effectiveness of interventions on food safety, Sivaramalingam *et al.* (2015) noted that 70% of the studies came from North America, including 64% from the USA. Other papers though covered a range of other countries, but we do not include a map here because some papers did not clearly specify where studies originated from.

Across those papers that gave clear methodological information, the mean number of papers reviewed in the studies was 55, although there were just a few papers with large samples (e.g. Onrust *et al.*, 2016 – 283, and Sivaramalingam *et al.*, 2015 – 246). The median number of papers reviewed was 22.

### 4.2 Common behavioural theories used

All papers did not specify the behavioural theories underpinning the reviewed papers, although we note that the original studies may have used them to inform their research designs. For those papers that highlighted behavioural change theories, a plethora of different ones were identified. The list included some of the commonly cited theories – health belief model, social cognitive theory, theory of planned behaviour, nudging/choice architecture, transtheoretical model (stages of change), and one mentioned the diffusion of innovations. Other theories highlighted included self-determination, self-regulation, precede-proceed, and many more. Indeed, Phiri *et al.* (2015) identified 26 behavioural change theories. In a review on food safety interventions, however, Sivramalingam *et al.* (2015) found that only 26.6% of the reviewed studies had used a behavioural change theory to underpin their interventions.

From our analysis, it is clear that there are many behavioural change theories and models in existence, as found by Davis *et al.* (2015), and furthermore many new iterations are being designed over time. This may suggest that it is difficult, if not impossible, to model and predict human behaviour. On an individual level, we question whether further attempts to model unpredictable individual behaviour is a good idea, particularly if behavioural approaches evolve to focus on scales beyond the individual (see Chapter 6).

### 4.3 Key factors influencing behaviour, including intervention-based studies

#### 4.3.1 Attitudes/personal factors

In a similar vein to the agriculture review, many studies found that personal factors, including age, gender, financial circumstances, attitudes, and beliefs, played an important role in influencing behaviour. In one of the agricultural reviews assessed here, Mankad (2016), for example, found that the biosecurity behaviour of farmers was influenced significantly by pre-existing habits and past behaviours, as well as level of personal resilience, emotions and risk attitudes. Likewise in other scenarios, including cervical cancer screening (Chan and So., 2017), substance use in adolescents (Onrust *et al.*, 2016), and sexual health behaviour (Alexander *et al.*, 2015), pre-determined attitudes and belief systems influenced the extent to which behavioural interventions were effective. Many of the reviewed papers addressed subjects where stigma, or fear of carrying out a behaviour, was a strong barrier to change (Witzel *et al.*, 2017).

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### 4.3.2 Influence of family, friends, and peers

While this was a strongly mentioned factor in the agricultural literature, we found especially good evidence of the value of family, friends, peers, and other advisors, to behavioural change in this review. For example, in a study of factors influencing the decision of individuals to attend Accident and Emergency, instead of selecting other medical services (e.g. GP, pharmacist), Coster *et al.* (2017) found evidence that advice offered by family and friends was most important. In one of the reviewed studies, Coster *et al.* (2017) discovered that 48% would attend Accident and Emergency if advised to do so by friends or family, compared to just 35% when advised by a healthcare professional. Other studies analysed by Coster *et al.* (2017) backed up this point, showing the influence of trusted friends and family to decision-making behaviour, and to creating social norms. Several other papers found evidence from intervention studies, which highlighted the value of such advice. In the context of female sexual health behaviour, Phiri *et al.* (2015) generally found that involving male partners was a key way of influencing decisions, as indeed was face-to-face advice delivered through home visits. Two reviews on children's dental health by de Castilho *et al.* (2013) and Albino and Tiwari (2016) established that parents' actions were the key determinant of child behaviour. For example, the parents' toothbrushing habits alongside their attitudes towards supervised brushing was a key component of positive child behaviour (de Castilho *et al.*, 2013). Albino and Tiwari (2016) presented results from two studies in Austria and Australia respectively, which showed that mothers' involvement in dietary and oral hygiene behaviours was a strong influence on behaviour of children. Again, in a similar vein to the agricultural review, the peer support of like-minded individuals sharing similar issues, was seen to be important. For example, self-care for older people in Thailand was much better if peer groups were established who could support each other in health management (Anuruang *et al.*, 2014).

Hughes *et al.* (2017) also found that creating groups of like-minded individuals could provide vital support for encouraging good management of long-term health conditions. If this process was to be led by outsider researchers or health professionals, then approaches needed to be truly participatory. A barrier to behaviour change through such group processes was created by poor facilitation of meetings, for example when the aims of the facilitators were mismatched with the objectives of participants, or if there was a lack of authority and trust. Hughes *et al.* (2017) also cautioned that negative attitudes of some members of the group could hold back collective progress.

### 4.3.3 Relative advantage, including incentives

Several papers found plenty of evidence to suggest that individuals had to perceive a relative advantage in performing a new behaviour. Often, this involved presenting messages in a positive light (see section 4.3.5) or providing incentives for behavioural change. Kullgren *et al.* (2017) found that financial incentives were generally important in stimulating good health management, for example weight loss or dietary changes, but questioned whether behaviour was influenced in the long-term. A further study looking at the uptake of conservation behaviours of local communities across the developing world found that offering financial or livelihood-based incentives empowered them to make pro-environmental decisions (Nilsson *et al.*, 2016)

Other papers that found financial incentives being used questioned why behavioural change studies did not take a more long-term monitoring approach (e.g. DeCosta *et al.*, 2017; Hendrie *et al.*, 2017). Kullgren *et al.* (2017) were clear that many studies had highlighted that financial incentives could not be given without being sustained in the long-term, or without being accompanied by other interventions such as education.

Some papers noted that barriers related to relative advantage were constructed by private companies. For example, in trying to convince restaurants owners (Kraak *et al.*, 2017) and vending machine companies (Grech and Allman-Farinelli, 2015) to promote healthy offerings, pushback occurred on the basis of potential revenue loss. This point resonates with a further paper by McGuckin and Govednik (2013) which found that prompting by patients of good hand hygiene practice of medical professionals often received a negative response from staff. This put patients off from prompting staff. Thus, interventions do not just have to operate at the user-end, but rather should be aimed elsewhere in the network.

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#### 4.3.4 Education enhances perceived behavioural control (preferably face-to-face)

Educational interventions were found to be important by many of the review papers. For example, Hazavehei and Afshari (2016) argued that education about the benefits of increasing fruit and vegetable consumption raised the self-efficacy (confidence to do the behaviour) of elderly people, who then changed their behaviours. In fact, enhancing perceived behavioural control was an important outcome of education. For example, in a review of diet-based interventions, Hendrie *et al.* (2017) concluded that knowledge alone was not enough, but rather active demonstrations of the behaviour helped to raise the confidence of children that they could perform the behaviour.

Education and counselling helped to reduce the fear and stigma about sexual health and HIV testing (Alexander *et al.*, 2015; Witzel *et al.*, 2017), particularly if it was tailored to the individual through face-to-face personal visits (ideally to the home). Education, regular auditing and feedback, as well as shared decision-making were found to be important components of altering engrained prescribing behaviours of medical professionals (Moe-Byrne *et al.*, 2014). Many of these studies again note that long-term sustained engagement is needed to maintain change, as old behaviours often returned after interactions stopped (Alexander *et al.*, 2015; Moe-Byrne *et al.*, 2014). In short, education through sustained interactions is not the same as information provision, for example through leaflets or one-off events.

#### 4.3.5 Nudging e.g. through positive messaging, pricing, or other incentives

Nudging was discussed in the reviewed papers through techniques such as pricing, message framing, and positioning of resources. For example, Bucher *et al.* (2016) found that 16/18 studies found a positive impact caused by positioning fatty foods further away from people during lunch breaks, and Grech and Allman-Farinelli (2015) discovered that pricing was an important part of encouraging healthier food choices from vending machines. Scott *et al.* (2017) discovered that clinicians were generally more distressed by loss, rather than gain scenarios (i.e. would prescribe if they feared a catastrophic worst-case scenario, regardless of level of risk), and therefore were too overcautious to prevent doom-laden scenarios. A recommendation was to liaise in a positive way with clinicians highlighting the benefits of changing behaviour. This point resonates with a study of health management by Kullgren *et al.* (2017). Their review found many examples of how positive messaging (or 'gain messaging') influenced people's behaviour more significantly than negative scenarios ('loss messaging'). One study in their review argued that gain messages on NHS letters (e.g. if you adopt this behaviour your life will benefit in these ways), rather than loss messages (e.g. if you don't do this, you will suffer from x), were more effective in stimulating uptake of advice on diabetes. In addition, DeCosta *et al.* (2017) presented the results of one study that had looked to increase healthy eating in schools. Children were more likely to choose healthier options if they were framed positively (e.g. Carrots were called 'X-Ray Carrots'). The nudging literature, therefore, suggests that there is some benefit in adopting an approach that uses positive language/scenarios, and does not make behavioural manipulation obvious (reduced inertia caused by a reaction against an attempt to change behaviour). We could perhaps learn from this literature more in agriculture.

#### 4.3.6 Holistic approach needed

It is important to make the point that the vast majority of the reviews found that a holistic, multi-faceted interventional approach was often required to change behaviour. Winpenny *et al.* (2017) argued that behavioural change approaches targeted at medical professionals' referral behaviour were only likely to work if multiple strategies were used; for example, feedback/auditing, education, incentives, and guidelines. Most of the other papers supported this view, especially when referring to long-term behavioural change. For example, financial incentives would be most effective when reinforced by educational interventions. Despite positioning fatty food away from diners, Bucher *et al.* (2016) said that prompting from staff (e.g. do you want a large or small portion? Do you want this option?) was still needed to encourage healthy eating.

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#### 4.4 Implications for agriculture

When presenting recommendations in Chapter 6, we bring together both of the reviews conducted in this project. It is worth stating briefly here, however, that lessons learned from other fields can be incredibly valuable for changing approaches in agriculture. Although we note, for example, that some of the lessons learned above may not be directly applicable to an agricultural context (e.g. overcoming stigma regarding sexual health, or changing people's diets), all of the interventions relate in some way to changing human behaviour. One of the key conclusions from the sexual health literature, for example, was that the stigma or fear of carrying out a new behaviour prevented action. This may be overcome by involving friends or family to shift social norms, targeting incentives, or by providing education (or probably all three!). These high-level messages would seem to be important for agriculture. The agricultural review found that farmers may be apprehensive, even fearful, of trying out new behaviours, and further suggested that changing social norms, creating societal pressure, amongst other techniques were good ways of overcoming such fears. Although the contexts are vastly different, therefore, direct parallels can be drawn in situations where you must overcome the barrier of fear.

As discussed in Chapter 6, many of the same major influences on behaviour were also identified in this study – personal factors, influence of family and friends, incentives, participation, perceived behavioural control, nudging, face-to-face advice, education. The wider review certainly gave more insights on nudging, for example through positive messaging, and this is where the agriculture literature could develop further. However, since similar messages about how to influence human behaviour seem to be present across many different fields, it would suggest that we already know an awful lot about what behavioural change approaches should look like. We return to these points in the final chapter.

## 5. The limitations of a behavioural change approach

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Although the subject of a vast amount of research, as this literature review testifies, and consistently of interest to policy makers and policy influencers, a behavioural change approach has also attracted considerable criticism. It is important to highlight some of the key dimensions of this critique, not least to make visible some of the typical assumptions on which behavioural change research is based while also drawing attention to its limitations.

A structured review of the published work that criticises a behavioural change approach would be justified, but has not been possible within this project. As such, we draw on a small number of sources here that are familiar to the authors, some of which are critical of a behavioural approach as this has developed within the authors' home academic discipline of Geography. In this context, behavioural research has attracted a "bewildering variety of criticisms, implicit and explicit" (Gold and Goodey, 1984, p.544). It is possible to differentiate between critical perspectives within behavioural change research and those which originate from outside i.e. are 'external' to behavioural change studies developed by researchers who reject this approach to social research.

The first type of critique usually accepts the fundamental premises of a behavioural approach, but identifies particular challenges in executing this and/or argues for the use of one type of model or perspective over another, such as the theory of planned behaviour rather than the theory of reasoned action (e.g. Burton 2004). An ongoing matter of debate within behavioural research is the problematic relationship between cognition and behaviour (Gold and Goodey 1984), sometimes discussed in terms of the 'attitude-action' or 'value-action' gap where expressed attitudes and values do not map onto their behavioural correlates; for example, a farmer may articulate an interest in and commitment to environmental protection, but their practices do not reflect this. This point was noted in both Chapters 3 and 4, for example by Viira *et al.* (2014) who found that farmer intention did not always lead to farmer action, and by many other papers which argued that long-term monitoring of practice needed to be prioritised. Many of the papers we reviewed relied on post-intervention surveys asking participants whether they intended to change behaviour, but did not always interrogate whether any changes were actually made.

Two examples provide further illustration. In a widely cited paper published in 2004, Rob Burton argued that behavioural research in agricultural studies needed to be 'reconceptualised' through more extensive use of socio-psychological models, notably the theory of planned behaviour. All too often in agricultural studies, there was an undue focus on farmer attitudes and other cognitive precursors to decision-making. A more recent example is a study by Yazdanpanah *et al.* (2015) which seeks to understand Iranian farmers' intention and behaviour regarding water conservation. While accepting that a focus on behaviour is entirely legitimate, these authors question whether one-size-fits-all behavioural models are adequate for practical studies where sub-groups differ in their actions.

'External' criticisms of behavioural change studies typically object at a more fundamental (i.e. philosophical) level to how these studies understand the social world. In other words, the assumptions of behavioural studies are seen as unhelpful at best, and misguided at worst, and unlikely to lead to desirable forms of social change.

Some of the key lines of criticism are as follows:

1. Behavioural change studies are often philosophically positivist. Positivist approaches have long been the target of wide ranging criticism by social scientists who argue that the social world cannot be understood through the same analytical lens as that adopted within the natural sciences and used to study the natural / material world. A particular aspect of behavioural change studies is that they seek to measure both antecedent psychological conditions (attitudes, perceptions etc.) and actual behaviour in empirically replicable and verifiable ways, leading to a methodological preference for questionnaire surveys and large scale data sets. The analysis in Chapter 3, for example, showed the reliance on surveys as a methodology in studies of farmer behaviour. This is the case in spite of the fact that cognition – a key facet of behaviouralism – has long presented a challenge to positivism which proceeds on the basis of empirically observable phenomena. In other words, psychological processes are not directly observable and so attempts to measure these are unlikely to be reliable (Ley 1979). Even when research attempts to measure

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actual behaviours, typically it is ‘reported’ actions rather than the actions themselves that are assessed through research, so again the behaviours are not ‘observed’ as such. Methodologies like ethnography are rarely used, but this could be one possible way of observing actual behaviours over time.

2. Behavioural approaches put too much emphasis on egocentric interpretations of the world, in other words the cognitive processes and actions of individuals. This can run the risk of psychologism, the notion that social phenomena can be explained in terms of the mental characteristics of individuals without due recognition of the social, economic and political situation in which individuals have to live within (Argent and Walmsley 2009).
3. Behavioural studies have been accused of employing ‘status quo thinking’ because they see the behaviour of individuals as the problem to be addressed rather than the prevailing power structures in society that may produce those behaviours in the first place (or at least significantly contribute to them). As such, behavioural research is seen as being un-political, or de-politicised and de-politicising. What is needed instead is a critical examination of social, economic and political conditions that shape outcomes (i.e. including the regulatory ‘rules of the game’) and which are understood as operating largely or wholly independently of the individual (Rieser 1973).
4. By extension, behavioural studies encourage a form of thinking, including thinking about how to address social and environmental problems that is atomistic and individualised. In being unduly concerned with individuals and how individuals might change this necessarily diverts attention away from the possibilities of social action, which involves groups of people deliberating together over the nature of the problems to be addressed and how to work together to bring about change. Inman *et al.* (2018) provide a nice discussion of how farmers might be supported in doing just this, and the encouragement of peer and advisor networks (including family and friends) forms a key part of the actionable recommendations in Chapter 6.
5. The interest in, and excitement around, behaviour change approaches reflects and reinforces prevailing ‘neoliberal’ thinking which asserts and endorses individuals’ right to choose, while simultaneously encouraging the state to withdraw from intervening in matters of concern. Sometimes, this line of criticism points a finger at the ‘responsibilising’ of individuals to make particular behavioural changes at the expense of changing the regulatory rules of the game, which might be politically more difficult or less acceptable.

To help elaborate these rather abstract points we provide examples of two studies that are critical of a behavioural (change) approach. The first study is by Elizabeth Shove, a sociologist whose research is concerned with societal level transitions towards sustainability. She has been particularly influential in developing ‘practice’ based understandings of everyday, household level, resource intensive consumption activities such as showering and laundering. Although on the face of it such activities – and their investigation – may appear to be behavioural, the approach is actually very different. Analysis focuses on the ‘practice’ itself, its evolution over time and space, and not on the decision-making processes of the many different individuals who contribute to the practice.

Shove’s critique of behavioural change approaches is in a journal article from 2010 entitled ‘*Beyond the ABC: climate change policy and theories of social change*’. In this, she summarises the contribution to climate change of many familiar consumption patterns. According to Shove, contemporary climate change policy is based on a very limited understanding of the social world and its dynamics and is therefore unlikely to be successful in bringing about the extensive social changes required to address this pressing environmental problem.

In particular, Shove argues, climate change policy as currently configured is incapable of moving beyond the ‘ABC’ i.e. an approach to encouraging social change to benefit the climate in which A=attitude, B=behaviour, C=choice. The popularity of ABC, which derives from social psychology, and specifically the Theory of Planned Behaviour, is seen to reflect the belief amongst decision-makers (i.e. policy makers and influencers) that the responsibility for dealing with climate change lies with individuals whose behavioural choices will make the difference<sup>6</sup>. However, the ABC obscures the extent to which governments help to sustain unsustainable economic institutions and ways of life, and the extent to which they have a hand in structuring options and possibilities.

<sup>6</sup> One example is DEFRA’s 2008 framework for pro-environmental behaviours.

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As such, although the ABC of climate change policy has become very influential Shove questions whether it is capable of comprehending, *let alone* intervening in, social change on the scale required. She goes further, making the case that the language of ABC does not contain within it the terms and concepts required to discuss or debate significant societal transformation. For example, it offers no scope for wondering about how needs and aspirations come to be as they are. She quotes Uzzell, who says that “trying to persuade people to consume and waste less through behaviour change programmes will not address the larger and more significant problems concerning the ways under which people need or think they need to live and consume” (Uzzell, 2008, 4). The ABC makes it impossible to see how the environmental costs of daily life emerge, evolve and are sustained by ways of organising politics, economy and society that go far beyond the scope of behavioural change but are left unexamined.

While Shove’s study highlights limitations of the behavioural change approach it also encourages social scientists, who want to undertake research into social change relating to environmental problems, to consider the potential of alternative perspectives that seek to overcome the limits of the ABC. These alternatives are transitions management and practice theory.

A second case study of technology-adoption is interesting not least because it is agricultural. Taking the specific case of decision support tools, many studies have tried to convince farmers to adopt them on-farm, thereby changing existing decision-making behaviour. However, research has illustrated that decision support tools, designed at great expense, are rarely used in practice by farmers (see Rose *et al.*, 2016). Lots of research has explored how to change farmer behaviour in order to encourage adoption of decision support tools, and also how to change the design of tools to make them more farmer-friendly (Rose *et al.*, 2016; Rose and Bruce, 2017). Despite such research, adoption of tools remain low and considerable barriers remain to their use on-farm. One could argue, therefore, that we have not been particularly effective in changing the behaviour of farmers to help them embrace such tools.

Rose *et al.* (2018) suggested that there were a number of deficiencies in the ways in which tools were designed and delivered to farmers or other groups. Broadly speaking, these deficiencies related closely to the key themes originating from the review. Rose *et al.* (2018) found that tools were often irrelevant to farmer needs and difficult to use as a result of limited user co-design, or sometimes they did not do anything useful or valuable. Furthermore, it was discovered that delivery strategies did not make the most of peer-to-peer or advisor-to-peer knowledge exchange, and did not always provide any technical help to assist farmers in adopting/using them. The inability to prove the value of adopting tools may mean that messages were not targeted carefully in a positive way, although this was not considered in the analysis (Rose *et al.*, 2016).

As such, tools were often irrelevant to farmer needs, or were difficult to adopt or use, or were simply delivered in a format that was never going to work for a specific farmer. Building on some of the critiques of a behavioural change approach, Rose *et al.* (2018) argued that it is often better to alter designer behaviour, rather than trying to force farmers to change to suit the new innovation. Evidence illustrated that tools would be more likely to be adopted if they fit existing workflows, rather than expecting farmers to change their behaviour.

This is a point that has been furthered by authors such as Klerkx *et al.* (2012) and Wilson *et al.* (2015), the latter article being reviewed as part of this study. Wilson *et al.* (2015) build on the notion of ‘agricultural innovation systems’ (developed by Klerkx *et al.*) to show that an individual approach to technical behavioural change is misguided. They argue that innovation does not just originate from one group, for example scientists, but rather a multitude of different actors within the system, including advisors and farmers. As such, technology adoption work should not just seek to focus on the individual farmer, characterising that they are problem non-adopters, but rather seek to understand the chain of communication between several actors in the network. Wilson *et al.* (2015) argues that all parties involved in behavioural change need to learn, including those scientists who may be designing new tools.

In order to design influential tools, the following process (Figure 3) of user-centred participatory design was proposed by Rose *et al.* (2018):

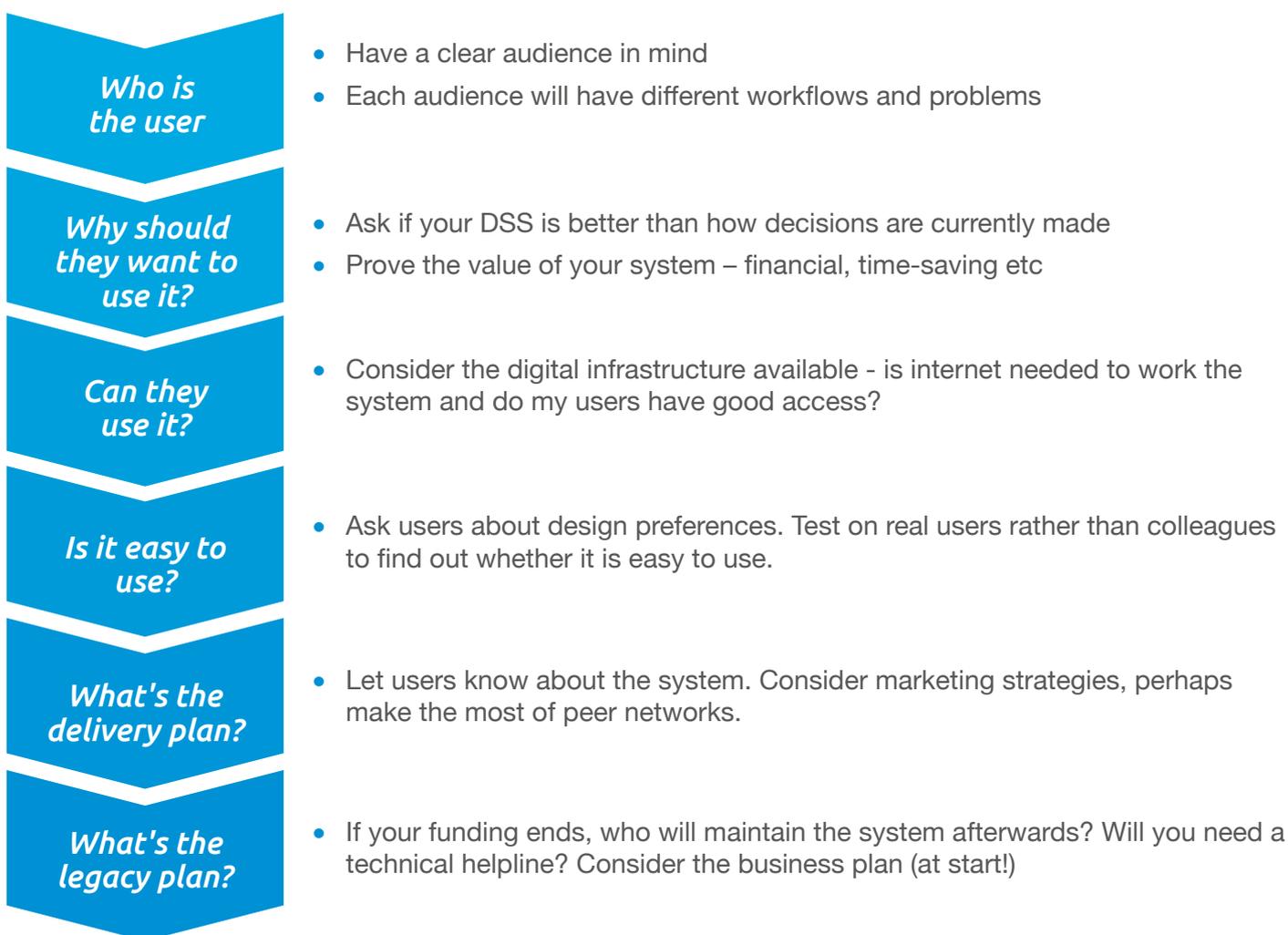


Figure 3. Six-stage framework for good user-centred design of decision support tools

Source: Adapted from Rose *et al.* 2018, <http://bit.ly/2GFIFan>

### Six stages are required in order to smoothen the transition from design to implementation:

1. Who is the user? – designers must consider who their tool is aimed at, for example arable farmers. After making this decision, the designer must understand what workflows of arable farmers looks like, and have some knowledge of the management decisions that they require help with. To succeed at this stage, designers must make an effort to leave the ivory tower, and to understand fully what it is to be an arable farmer. This will always involve inviting farmers to contribute at an upstream stage.
2. Why should they want to use it? – instead of merely designing a fancy system and expecting the sophisticated science to sell itself, designers should seek to carve out a unique selling point of the product. To do this effectively requires an understanding of how farmers currently make decisions to identify how the tool can be better. If the system provides relevant decision support that fits within existing workflows, then it is more likely to be used.
3. Can they use it? – the infrastructure must be available in order for the tool to work on-farm (e.g. internet). The designer must consider what the situation is on-farm and think about whether their system will work in practice.
4. Is it easy to use? – Woolgar (1990) writes about how designers of tools attempt to configure, or change the user, in order to make them fit their systems. This is the wrong way around – instead of trying to change user behaviour so that they can use new interfaces, why not invite the users to participate in the design and prototyping stage, so that the interface is suited to their preferences?

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5. What's the delivery plan? – this is less related to the design process, but design strategies should seek to make the most of trusted peer and advisor networks, allowing farmers to spread knowledge about the tool through use.
  6. What's the legacy plan? – once the tool is released, designers should be open to tweaking the design based on user feedback, again making the tool more suited to the user, rather than expecting the user to learn.

Common sense suggests that the user (e.g. farmer or adviser) will need to be involved at every stage of this process so that tools are designed to fit into their workflows, rather than expecting workflow change. Funders and organisations like AHDB could force successful applicants to follow a user-centred tool design process to improve the chances of developing relevant, user-friendly tools that make an impact in practice (see Rose *et al.*, 2018). A relevant, user-friendly tool should not require behavioural change since no change to workflows will be needed if it already fits with life on the farm (i.e. already fits to task/workflow, see Parker and Sinclair, 2001; Rose *et al.*, 2018). The same logic could be applied to the development of policies and management practices; if they are co-produced with farmers and other practitioners, they will be more likely to fit within existing workflows, rather than demanding a change of behaviour (see Wilson *et al.*, 2015). We pick up on this point in the following chapter.

## 6. Learning lessons: recommendations from this study

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This section is divided into two sections. Firstly, we present overarching recommendations made in all of the reviewed papers about how behavioural change approaches can be made better. In light of some of the recommendations made both within the reviewed literature, and in assessing some of the critical literature, we secondly propose a series of recommendations about how behavioural approaches may evolve to consider more than individuals. In relation to identified research gaps, we argue that there is a need for more long-term, sustained research, which monitors actual change, rather than simply aiming to understand motivations and intentions.

### 6.1 Recommendations for changing the behaviour of individuals

If the aim is to focus on individual behaviour change, an approach which we critique in the following section, a list of common recommendations made in the papers is presented below.

- 1. Target messages carefully** – papers noted that different farmers respond in different ways to interventions (e.g. older versus younger farmers), in a similar vein to the varied responses noted by individuals in relation to health, diet, and lifestyle interventions acknowledged in the wider review. The overwhelming message from the literature is the need to identify your audience before you communicate to them. Through making an effort to understand their workflows, you may get a better sense of which messages they respond to. In general, one of the key findings is that people generally respond better to positive or gain messaging as compared with negative or loss messaging. AHDB could, as far as possible, present optimistic messages to farmers, stressing the benefits of adopting particular behaviours, rather than highlighting the problems caused by not doing something.
- 2. Fund and encourage knowledge exchange activities** – many of the papers in both reviews identified information provision as crucial, as well as level of formal education. Indeed, good knowledge exchange, ideally delivered in a face-to-face manner or making the most of active demonstrations, underpinned the success of many other forms of intervention, such as financial incentives. Knowledge exchange activities must be sustained, not just one-off events, and such continued engagement should be seen as something more valuable than simply providing information through leaflets. AHDB already uses its ‘farm excellence platform’ to facilitate knowledge exchange with farmers, and it is considered that such active demonstrations combined with face-to-face advice (ideally through trusted individuals), are the best way of getting information to farmers, but also for receiving knowledge back from them.
- 3. Prove the value and ease of adoption** – several papers in both reviews noted that proponents of new behaviours did not always make the relative advantage obvious. If farmers do not perceive that there is value in adopting a new behaviour, then they are likely to stick with the status quo (Sutherland *et al.*, 2012). AHDB could ensure that it finds ways to prove the value of adopting all of the tools, policies, and practices that are recommended. As above, active demonstrations could be a good way to do this, as well as collating evidence from long-term studies that prove benefits to a farmer’s bottom line, or other aspects of their farm business (e.g. environmental, social).
- 4. Incentivise behaviour change** – where behaviour change was incentivised, there were signs of positive change, although perhaps not in the long-term. Recommendations from the papers included finding ways of rewarding good behaviour in a sustained way. Thus, if AHDB is to incentivise behaviour change, it should ensure that the rewards can be sustained, and that it uses other forms of interventions to underpin financial rewards (e.g. education).

### 6.2 Beyond a behavioural change to a social change approach: practical recommendations for action

Given the limitations of an individual behavioural change approach, would there be some value in considering alternative strategies? Are we limiting our impact by trying to make existing behavioural change processes a bit better, ignoring the pervasive difficulties in changing the decision-making of diverse individuals, instead of developing better approaches? We consider that there might be value in rethinking current approaches, and present two themed recommendations below accompanied

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by a series of smaller recommendations – these relate to how AHDB can lead the way in developing participatory approaches that look at change across the network of people involved in agriculture, not just the individual farmer. AHDB could facilitate more bottom-up, participatory approaches that recognise that change is a social process, and hence reach out to family, friends, peers, and others in a farmer's 'ring of confidence' (AIC, 2013) when designing projects. In short, AHDB could seek to develop and promote a 'social change' in agriculture agenda rather than a 'behavioural change' agenda.

**Thus, if we are to embrace approaches that move beyond individual behaviour change, the following recommendations are made:**

### **1. Make upstream (early stage) participatory engagement a standard approach**

One clear recommendation from both reviews relates to participatory engagement as a means of influencing decision-making behaviour, and this ties in with the critique which argues that an individual-focused approach is misguided. Engagement tended to be most effective when meetings were held face-to-face as this built trust. In agriculture, the act of bringing together practitioner communities has several benefits – building trust between practitioners and 'outsider' groups like researchers, helping to create social pressure which shapes social norms, providing a peer support network to adopt new behaviours, and most of all allowing practitioners' attitudes, beliefs, and priorities to be heard. If farmers are included, then they are more likely to feel like they are in control of decision-making and may indeed co-design practices and policies, and hence are then more likely to adopt a particular behaviour. Ideally, stakeholder engagement should be conducted at an upstream stage (Wilsdon and Willis, 2004), or in other words at the very start of a project, ideally before questions have been finalised. This is important because scientists, policy-makers, and other organisations may be more inclined to design relevant strategies if farmer input has been provided from the beginning. A process which sees farmers being consulted only after a policy or research project has been formed is misguided because they may be designed in a way that does not fit in with existing workflows, and then behaviour change will be required in order to make farmers fit around it. Farmers should be included at all stages of a project, including conception, design, implementation, analysis, and delivery (Rose *et al.*, 2018).

Literature on effective participation shows that behaviours are most likely to be influenced if the engagement process is truly inclusive and iterative (Reed *et al.*, 2017). There are several key components of effective engagement - including having a trusted facilitator who is able to control group dynamics and to understand relationships between participants (and gaining the respect of stakeholders) while crucially also ensuring that the right stakeholders are in the room. Indeed, the study by Reed and Claunch (2017) found that using local farmers in a humorous theatrical production about farm safety increased the receptiveness of the message amongst peers. Thus, farmers themselves could be asked to take a leadership role in projects. Participatory events should also seek to minimise disruption for stakeholders, ideally compensating them in some way for leaving their daily routines or ensuring that events are held at convenient times and locations (see Reed *et al.*, 2017). Some of the studies went to visit farmers on their own farms, which delivered a more personal tailored approach (e.g. Donham *et al.*, 2013; Genskow, 2012).

Mapping existing spaces of engagement should be a key part of the process. There are several informal spaces where farmers and other groups already congregate to share ideas, such as the market or at the pub, while there are a plethora of formal participatory events running across the UK by bodies such as Farming Connect, NIAB-TAG, and others. There are often already trained and trusted facilitators associated with these networks, such as Catchment Sensitive Farming Officers in the case of the demonstration test catchments (Vrain *et al.*, 2017). Furthermore, formal networks such as farmer clusters and demonstration test catchments offer the opportunity to offer advice to communities of farmers, rather than individuals.

### Actionable recommendations for AHDB:

1. Encourage a research culture both within and outside of AHDB that is participatory and practice-relevant, instead of one that prioritises the production of academic material that is more suited to journal publication. This will involve putting pressure on funders to prioritise the funding of impactful research, and on organisations to ensure that they are consulting farmers, advisors, landowners, and other groups regularly.
2. Find ways of communicating with farmers in existing formal or informal networks. This will build trust, help to co-produce relevant knowledge, and help knowledge exchange facilitators to understand attitudes and beliefs towards particular behaviours. Ultimately, this may help to target messages to different groups of individuals. Where possible, existing networks of farmer participation could be mapped in order to find opportunities for group knowledge exchange – this will be more appropriate if a project is working in a particular region, rather than across the whole country. Farmers may be given leadership roles in participatory meetings, instead of merely being spoken to.
3. Invest in trained facilitators in order to increase the amount of face-to-face knowledge exchange with farmers and other practitioner groups. We acknowledge that face-to-face knowledge exchange requires more resources and cannot be undertaken all of the time, but advice delivered via humans is often preferred to guidance booklets. Some of the studies in the USA were aided by using university agricultural extension services, which utilised trained educators and specialists in a number of issues. This is now rare in the UK.
4. Recruit ‘peer champions’ to shape AHDB advice and literature. Where face-to-face knowledge exchange is not possible, consider the value of including testimonies of peer groups (e.g. fellow farmers or advisors) in advice booklets. Results suggest that farmers listen more closely to advice (e.g. in the farming press) if they saw that it was being given by someone like them. These ‘peer champions’ could be encouraged by AHDB.

### 2. Don't just focus on the individual

Both reviews showed that understanding the attitudes, beliefs, and personal circumstances of individuals is important for behavioural change interventions. Personal factors such as age, gender, wealth, experience, and beliefs, are key determinants of behaviour; thus the old adage of ‘everyone is different’ is certainly true and this presents a significant challenge to one-size-fits-all interventions.

However, the overwhelming message from both reviews is that a focus on changing the behaviour of individuals often missed the important influence of family, friends, peers, and advisers. Indeed, the unwise focus on the individual was a major part of the critique of behavioural change approaches discussed in Chapter 5. In the medical literature, for example, the opinion of family and friends seemed to be valued much more than advice offered by a health professional. In the health literature, establishing a support network of like-minded individuals and trusted facilitators was seen as a good way of changing behaviour collectively. In agriculture, research has illustrated the importance of advisors to farmer decision-making, including vets, agronomists, land agents, business advisers, seed/stock merchants, amongst many others (AIC, 2013; Ingram, 2008; Rose *et al.*, 2018). In a report on trusted advisors, the Association of Independent Consultants (2013) used the term ‘ring of confidence’, while Vrain *et al.* (2017) illustrated the varying levels of trust associated with different types of advisors (e.g. land agent v water company v catchment sensitive farming officer). Indeed, landowners are often a missed group when trying to change the behaviour of tenant farmers, who often cannot make long-term decisions without their support.

Given that family, friends, advisors, landowners and peers can play such a key role in influencing farming behaviour, it is essential for interventions and knowledge exchange activities to take a holistic approach. The studies by Reed and Claunch (2017) in central Kentucky or by Helitzer *et al.* (2014) in New Mexico show the value of inviting families to events, rather than individual farmers. Indeed, much of the literature on behaviour change interventions in developing world agriculture suggests that a household approach is more common (e.g. Hockin-Grant and Yasué, 2017).

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Perhaps this is because the whole family is more obviously involved in agriculture in developing parts of the world, but it is equally apparent that the entire family plays a key role in decision-making in the developed world too, even if this is not always fully appreciated.

When visiting farms or arranging farmer seminars, a wide range of individuals could be consulted and invited, including family members and advisors. When working in a particular region, an effort could be made to identify key advisors; if you can get these individuals on board, then they could be a useful ally in changing the behaviour of their clients. When working within a particular farming enterprise (e.g. dairy versus arable), it should be fairly easy to identify the roles which provide crucial advice to farmers (e.g. vet versus agronomist).

#### Actionable recommendations for AHDB:

1. When conducting knowledge exchange, whether verbally or in writing, identify key advisors in a given region. Building their support is crucial for influencing the behaviour of their clients and these trusted individuals are often better able to tailor advice to individual farmers. AHDB could ensure that advisors such as vets, agronomists, land agents, and others, receive advice meant for farmers, particularly since farmers may rarely read it themselves. There is a need to identify which groups in a given place exert the greatest social pressure on your subjects, thereby helping to shift social norms and attitudes (could be friends, advisors, family).
2. When conducting farming seminars or demonstration events, invite farmers' family and advisors along to the same session in order to stimulate peer-to-peer learning. Also ensure that other key decision-makers are there, which could include the landowner.
3. Make better use of existing expertise within a farmer's ring of confidence, considering whether your management guides add anything to it. Advisors of all kinds could be recruited to edit some of the guides in order to deliver relevant farmer-friendly messages.
4. Keep track of ongoing research on peer-to-peer learning, for example through the European PLAID project (Peer-to-Peer Learning: Accessing Innovation through Demonstration). One of the deliverables involves the development of success factors for good peer-to-peer knowledge exchange, a key component of social change.

#### Concluding remarks

This review has shown that there are a number of different behavioural techniques that could be used in the context of farmer decision-making. The overriding message from the review, however, is that focusing on changing the behaviour of individual farmers diverts attention away from influencing wider social change, which may actually be a much better way to influence decisions on-farm. AHDB could lead a new phase of social change initiatives that move beyond looking at the behaviour of individual farmers, which has long singled out problem non-adopters, towards a broader focus on the plethora of actors involved in farm decision-making. In order to prove the benefits of such an approach, the impact of holistic knowledge exchange activities on farm decision-making need to be investigated in a sustained, long-term fashion, and with an emphasis on actions taken, rather than merely intention to act (as in many of the literature studies).

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## 8. Further Information

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**Figure 1.** Map showing the location of the reviewed studies, darker red meaning more studies were done in the country.

**Figure 2.** Theory of Planned Behaviour (adapted from Ajzen, 1991)

**Figure 3.** Six-stage framework for good user-centred design of decision support tools

### Appendices

**Appendix 1:** Original list of papers for the farmer-specific review

**Appendix 2:** Final list of papers reviewed in the farmer-specific

**Appendix 3:** Original list of papers for the wider review

**Appendix 4:** Final list of papers for the wider review

### Citing this report

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