Chapter 3

Insights from behavioural economics into farmer livestock disease management

This chapter adds the insights from behavioural economics into farmer disease management. This research area combines psychology, sociology, and economics to examine the behaviour of economic actors. The theoretical framework of behavioural studies and the mapping of behavioural drivers into different policy areas is presented first, followed by an overview of the key findings of behavioural research applied to livestock farming. The final section presents a summary of the policy implications.

3.1. Theoretical framework for behavioural economics

The intention of behavioural economics is to infuse psychological realism into theories of economic behaviour as opposed to the standard economic model where actors are fully "rational", with perfect control, and consistently act in their own self-interests (Roberto and Kwachi, 2016). Applied to agriculture, the behavioural economics literature emphasises the importance of social and psychological influences in farmer decision-making and suggests that farmers seek to balance economic, social and lifestyle goals (see overview by Howley, 2015). The behavioural approach has been instrumental in examining the issues related to a voluntary change of farmer behaviour, such as sustainable farming, and mitigation and adaptation to climate change (reviewed in OECD, 2012). The rise of animal disease and animal welfare concerns in the 2000s and the recognition that the individual producer plays a key role in addressing these concerns led to a growing behavioural research in livestock farming.

Behavioural economics attempts to find patterns on how people act in ways that classic economic theories may characterise as "irrational". It seeks to build models that can account for behaviour in a psychological and social context (Amir and Lobel, 2008). If behaviour deviates in predictable ways, policy makers can design policies that take into account a range of drivers of human behaviour, including non-economic ones. While there is no unified underlying theory for behavioural economics, there are models that may be used to understand farmer livestock disease decision-making.

A theoretical framework applied in many behavioural studies in agriculture originates in the Theory of Planned Behaviour (TPB) (Ajzen, 1991).[1] It states that behaviour is the product of an intention to perform the behaviour and distinguishes the following determinants of intention (Figure 3.1): the attitude towards behaviour, the subjective norm to engage or not in behaviour, and the perceived behavioural control. These constructs have further determinants. The attitude towards behaviour results from the beliefs about possible effects of performing the behaviour (outcome belief) and the value that is attributed to this effect (outcome evaluation). The subjective norm is determined by how one sees if the "important others" expect him or not to perform a particular behaviour (social normative belief) and one's motivation to comply with these perceived expectations. The perceived behavioural control is determined by one's belief that he (she) has necessary resources to perform the behaviour (control belief strength) and the importance of these resources (control belief power). That is, of two individuals with equally strong intentions, the one who has the confidence to master this activity is more likely to act.

Ajzen (1991: 199) acknowledged that the TPB was open to additional predictors[2] and more developed versions of TPB consider additional factors that explain why intentions do not always translate into behaviours, such as skills, knowledge, and environmental constraints (e.g. Fishbein and Yzer, 2003). Other studies also introduced additional independent variables that could contribute to the intention-behaviour relationship (Figure 3.1). These, for example, include inertia or habit, moral obligation, self-identity, personal normative beliefs, past behaviour, and cognitive skills (Burton, 2004; De Lauwere et al., 2012). Behavioural research related to livestock disease management employs also other theoretical models and methods which use relatively similar behavioural constructs.[3] The TPB is presented here to facilitate further review as the behavioural studies on livestock disease refer extensively to this model.

The TPB presents (farmer) behaviour as a complex interaction of influences where the explanatory power of these influences regarding behaviour depends on specific contexts. In the context of agriculture, this implies that the impacts of individual factors on intention and the transformation of this intention into specific behaviour depends on a farming issue in question, farming type, individual characteristics of a farmer and other contextual parameters. Using the TPB constructs, Garforth (2015: 34) well describes this multifactorial and context-specific nature of farmer behaviour: "… farmers' behaviour in respect of animal disease risk management would be influenced by their knowledge of specific practices; their attitudes to specific practices and to disease risk management in general; their view on the efficacy of specific practices in reducing disease risk (…'outcome beliefs' and hence attitudes) and of disease risk management in general; their previous experience of specific practices and the experience they have heard from others; their perception of their ability to put specific practices into effect and of factors that constrain them (...'Perceived Behavioural Control'….) which may include current habitual behaviour; their perception of what other farmers in similar

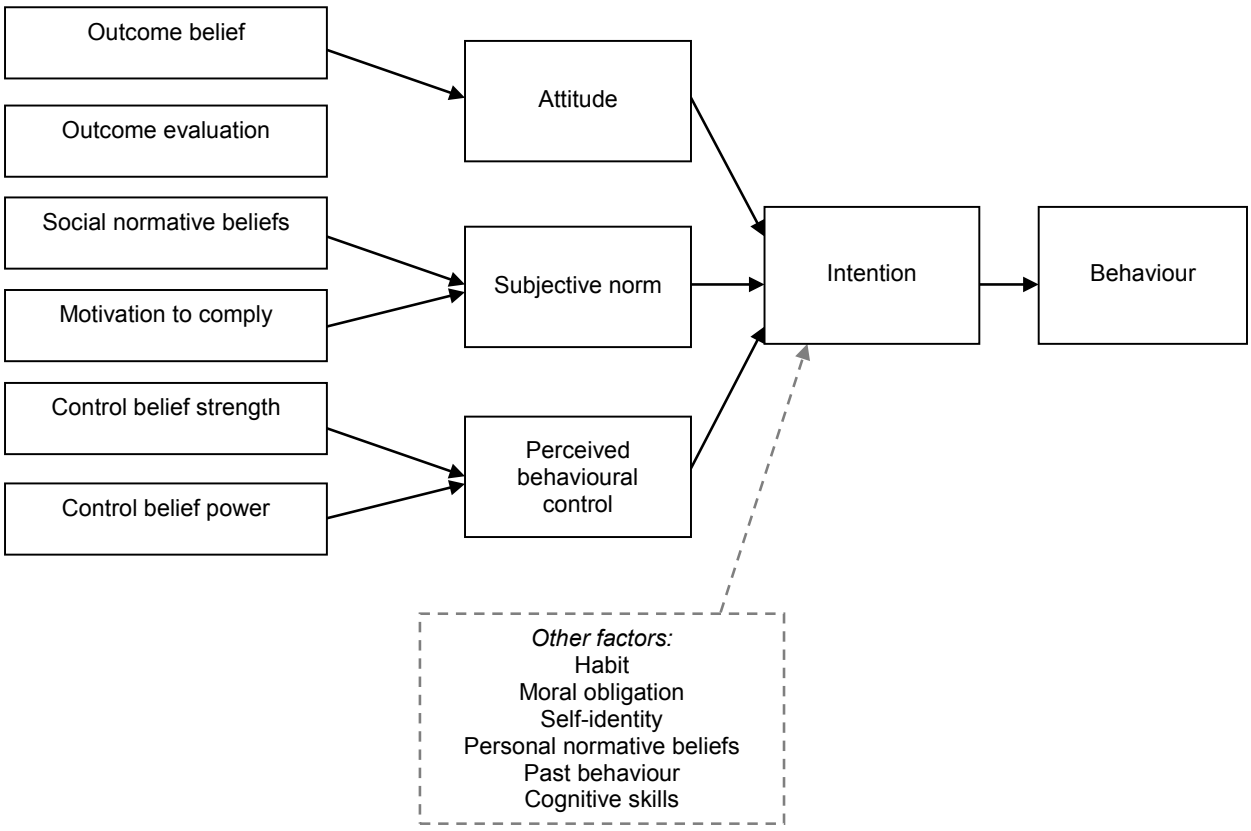
situations are doing with respect to disease risk management; and their perception of what other people important to them would think about their implementing or not implementing specific measures (…'subjective norms'…)."

Because of the contextual specificity, any generalisations about the relative importance of behavioural drivers, i.e. the degree to which each of them – farmer attitudes, subjective norms, perceived behavioural control, or any additional predictors – lead to certain behaviour, can be only suggestive. Also, the results coming from various studies depend on specific methods of analysis and how the surveys are structured. However, the value of behavioural research, such as TPB and other models, is that it helps to typify the drivers of behaviour. A further step is to establish connections of these behavioural drivers with specific policy actions. The framework developed by Prendergrast et al. (2008) from the Social Market Foundation in London is an example of such a mapping exercise.

This framework groups the drivers of individual's behaviour into external, internal, and social ones and links them with specific policy domains and policy instruments (Figure 3.2). External factors include monetary and effort costs and are influenced by traditional market-based policy interventions, such as taxes, subsidies and regulations. Internal factors concern individual characteristics of decision-makers related to how they cognise reality and the role of habit in their behaviour. Social factors encompass norms and other aspects of social capital.

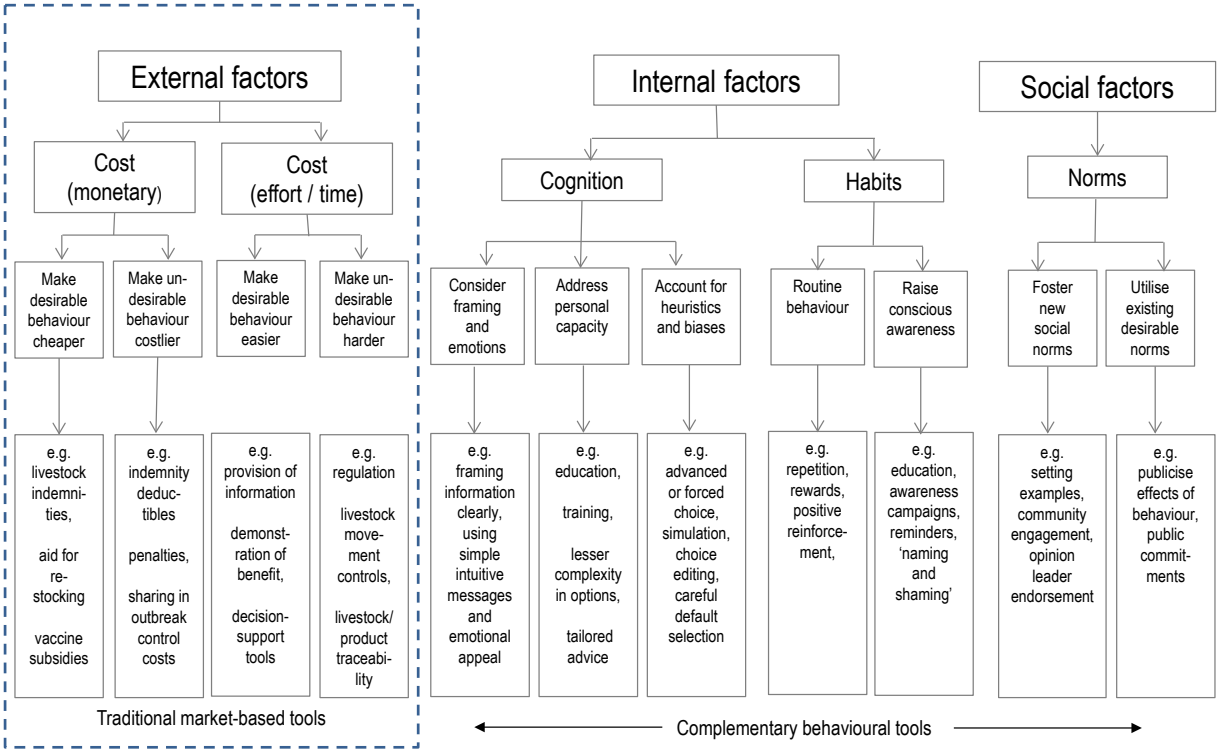
This framework illustrates that traditional market-based interventions work through only a part of behavioural drivers. They may be necessary but most likely are insufficient and that policy interventions influencing individual and social drivers need to be also engaged to induce preferred behaviour amongst farmers (Prendergrast et al., 2008; OECD, 2012).

Figure 3.1. Theory of Planned Behaviour framework



Source: Adapted from Burton (2004); Garforth (2010); and De Lauwere et al. (2012).

Figure 3.2. A framework for policy makers: Behavioural drivers and policy options and tools



Source: Adapted from Prendergrast et al. (2008).

The following sections are structured along the three axes of the policy framework above: external (economic), internal and social factors of farmer behaviour. The findings from the behavioural economics literature with implications for livestock disease management and policy are discussed. The discussion also draws on general behavioural literature and the studies related to other agricultural issues which are considered of relevance to the disease management. Although the body of behavioural studies in agriculture is increasing, more research is required. In particular, the work focussed on livestock disease and other issues of livestock farming has been less extensive than in the application to environmental and climate change issues. Yet, the available research allows drawing insights that can help livestock disease policies to become more effective.

3.2. Economic considerations: Impact on key determinants of farmer decision making

- Cost-benefit considerations affect all elements of farmer decision-making process.
- Policy can influence farmer beliefs about economic outcomes of their actions and thus facilitate socially desirable private decisions.

Behavioural analysis of livestock farmers demonstrates that economic considerations affect all key determinants of their disease management decisions. Alarcon et al. (2014) studied the decision-making process of pig farmers using the TPB model which includes farmer attitudes, subjective norms, and behavioural control. They found that financial reasons were the most frequent drivers for disease control. In a related qualitative analysis the farmers reported that the observation of ill pigs, reduced production performance, and (or) mortality levels were the most frequent drivers for disease control, the majority of respondents linking these factors with the risk of entering an economically unsustainable situation. Looking further into the subjective norms that affect disease control decisions, the study found that farmers' motivation to comply with external advice depended on their belief that they obtain positive returns. Farmers valued the

advice of a veterinarian high because they believed he was able to consider the economics of disease and of possible interventions. The same study also points out that perceived behavioural control as a driver of farmer decisions also had strong economics aspects. Thus, a measurable outcome of a disease measure was shown to be a factor of farmers' control belief, while farmers' perceived inability to employ additional labour or investment to implement a disease measure as a factor of their power to control.

These findings imply that the cost-benefit perspective permeates all elements of farmers' complex decision-making process. There is a role for policy which is to influence farmer perceptions and beliefs about the economic outcomes of their actions. This involves enhancing farmer knowledge and information necessary to assess the cost and benefits of disease management decisions. This also requires providing sufficient evidence on the cost-effectiveness of desired farm practices which can facilitate farmers' decisions to adopt them. The policy objective is to encourage farmers for socially desirable decisions that reduce the overall risks and impacts of diseases. Behavioural approach reveals that economic choices can be influenced by psychological and cognitive factors which policy makers should possibly take into account in formulating and communicating policy.

3.3. Internal factors in farmer decision making: Cognition and bias

- The cognitive process is at the core of farmer decision-making.
- Farmers' overconfidence with respect to biosecurity practices may lead to a lack of action.
- Cognitive biases and habits are defaults that can mislead farm decisions.
- Overcoming these is a role of livestock policy from the behavioural perspective.

Behavioural models regard decision-making mechanism as a cognition process: the process of acquiring knowledge and building understanding by individuals. Thus, farmer decisions depend on whether they are willing to use information, the extent to which they are capable to process it and learn, whether they generally have adequate knowledge, and how they are able to transform it into a decision. Referring to the TPB model, Garforth et al. (2006) state that a significant positive correlation between the attitude, subjective norm, perceived behavioural control, and intention indicates a cognitive driver, while a significant negative correlation indicates a cognitive barrier. In order to induce a desired change in farmer behaviour, policy should reinforce cognitive drivers and address cognitive barriers (Garforth, 2015).

Behavioural research provides insights into perceptions of livestock farmers about their own expertise in disease management and the adequacy of their effort to control disease risks. Based on several collective studies of UK livestock farmers, Garforth (2010) concludes that farmers generally seem to trust their own judgement. Kaler and Green (2013) provide similar observation from their survey of UK sheep farmers who generally consider themselves the experts to manage their complex business. Another study of UK farmers' attitudes to recommended livestock disease practices showed that "farmers felt they were currently doing all they reasonably could do, within the constraints of their farm, to minimise risks and their decisions were appropriate to the level of risk they saw at a time". Farmers typically judged they were making rational decisions and had high level of confidence in their own knowledge and expertise (Garforth, 2015).

The analysis also suggests that although farmers seem to generally feel confident about their expertise and the adequacy of their biosecurity effort, they are susceptible to cognitive biases and failure. Bruijnis et al. (2013), for example, analysed farmer ideas about the cost-effectiveness of various practices related to animal welfare and found that farmer evaluations diverged from the results obtained from models, and in some cases, quite significantly. The authors note that this might be particularly the case of new practices whose cost-effectiveness may be more difficult for farmers to evaluate compared to the well-known techniques. Meuwissen et al. (2001) concluded that farmers were conceptually interested buying insurance for consequential losses of epidemics, but because these epidemics are low-probability/high-consequence events farmers have trouble assessing the probability and potential magnitude of such risks. Due to this cognitive

failure, farmer willingness to pay for epidemic insurance is generally less than the actual premium required (Skees and Barnett, 1999).

Biases are defined as systematic error in (farmers') judgments that affects their decisions and behaviour. Some of the relevant biases include the planning fallacy wherein people overestimate the ability to perform future tasks. In application to disease management, such bias could consist of farmers being over-confident in their ability to manage a disease incident without recourse to external expertise, such as testing and consultation by a veterinarian. Optimistic biases may be where people assume they are at below the median risk. For example, although producers may acknowledge disease outbreaks as a high threat at the national level, they may perceive their personal risks as low (Palmer et al., 2016). Present-biased preferences and intertemporal choice where one disproportionately weighs present over future concerns, i.e. farmers may prioritise investments in areas other than increased farm biosecurity because they perceive other business concerns as more obvious concerns (Wright et al., 2016). Finally, the status quo bias results in people sticking to current default options because this involves less effort than switching. Status quo bias routinize behaviour or leads to habits. Even where a new behaviour brings substantial benefits to the individual concerned, breaking habits requires a distinct cognitive effort on the part of the individual (Prendergrast et al., 2008 with reference to Jackson, 2005). Education, training, and awareness campaigns can help establish new behaviour, which should then be reinforced through repetition, awards and continued awareness. Understanding default livestock disease practices and pushing or resetting them is one role for policy. For example, the status quo bias can be overcome by making a programme opt-out rather than an opt-in, which can have a large impact on participation. Habits may have specific aspects in application to livestock disease. Lupo at al. (2014) studied oyster farmers reporting behaviour and observed that "habituation" impeded disease reporting despite the incentive to do so provided by compensation. They described habituation as a consequence of lacking continued alertness and awareness, and the continued involvement by authorities that led to an exotic disease becoming endemic. Barnes et al. (2015) develop this idea by noting more broadly that producers may become accustomed to a situation that was previously stressed as being significant. They highlight the need for persuasion and regular baseline communication between government and producers.

A role of livestock policy from the behavioural perspective is to overcome farmers' cognitive bias and failures. The way in which the policy and disease consequences are presented can factor into overcoming bias (Box 3.1).

Box 3.1. Psychological and cognitive bias affecting economic choices

Problem framing concerns the ways of communicating about the reality. The way a problem is defined determines one's understanding of and approach to that problem. Redefining or reframing a problem can help broaden the range of alternatives and solutions examined. Kahneman and Tversky (1979) developed these ideas in application to economic choices. They pioneered the concept of "loss aversion" which says people care more about losses than gains. Thus, if a problem is framed in terms of potential expenses and costs it will often elicit a different response than the same situation framed in terms of potential gains. Considering loss aversion would suggest that referring to potential losses is likely to be more effective than to gains in encouraging behaviour such as reporting diseases or implementing biosecurity. Bocqueho et al. (2013) confirmed that farmers responded more to penalties than bonuses because of "loss aversion".

The endowment effect occurs when ownership tends to make people overvalue resources because of attachment. The result of the endowment effect is that people's willingness to pay (WTP) is not equal to their willingness to accept (WTA). WTP value is the maximum amount a person would be willing to offer for a good, while WTA value is the minimum amount required for an individual to forgo a good, or to bear some harm. The empirical studies show that the values obtained by WTA are consistently higher than those expressed by WTP, when valuing the same good. The implication of the endowment effect is that policy makers should use willingness to accept values if possible (Shogren et al., 1994). This effect shows up in the willingness of farmers to part with diseased livestock and could affect their intention to report disease in response to the amount of indemnities offered.

The next effect is the reference effect where people tend to judge potential outcomes and actions relative to a previous experience or what they have witnessed even when the current situation has little or no reference. If the farmer has no experience with epidemic diseases, he may fail to understand the potential consequences for their operation.

Another effect can originate with sunk costs which, despite the assertions of economists that these should not influence decisions, often do so. People become psychologically invested when they already have expended money and effort into a project, regardless of the current costs and benefits. Thus, if recommended disease prevention requires a new investment or a move away from current practices, farmers may resist. In this case, demonstration of benefits of alternative practices and setting examples becomes particularly important.

3.4. Social influences in farmer decision making

- Psychological and social factors influence farmer behaviour.
- Opinions of "important others" are factored into farmers' decisions, particularly through subjective norms.
- Veterinarians are the largest outside influence on farm behaviour.
- Social capital is essential to activate norms and collective action.
- Individuals see different values in farming, necessitating a more nuanced rationalising of policy.

The agricultural behavioural literature abundantly demonstrates the importance of the psychological, moral and social aspects of farmer decisions (e.g. Howley, 2015; McGregor et al., 1996; O'Donoghue and Howley, 2012). In a more specific context of livestock disease management, Alarcon et al. (2014: 227-228) report that animal welfare, the image and reputation of the farm, and the pride of being a good manager also acted as motivators of disease control, although these were stated less frequently than the financial ones. Delgado et al. (2012) and Delgado et al. (2014) using the TPB framework examined factors related to Texas cattle producer's intent to participate in FMD detection and control and disease reporting. Moral norms, trust in other producers and social pressure, were among the factors that influenced producer behaviour.

Social influences have been shown to have great effect on decisions. People have a tendency to base actions and beliefs on what others are doing or believing. The probability of an individual adopting certain behaviour increases with the increase in proportion of those who have already done so (Colen et al., 2015). This section discusses social factors of livestock farmer decision-making: social norms, farmers' referents and social capital are in the focus.

Veterinarian, other farmers and government influence on decisions

While farmers generally appear to prioritise their own expertise, the views and opinions of others have been shown to have an effect on farmer decisions. Using the constructs of the TPB model, external opinions influence farmers' outcome beliefs and outcome evaluations and thus, their attitudes towards performing specific behaviour. Opinions of others also affect farmers' behavioural control beliefs. "Important others", or social referents, are at the core of subjective norms as another key construct of farmer behaviour. As a socio-psychological concept, norms represent individuals' basic knowledge of what others do and think they should do. Individuals do not like to feel their actions are out of sync with norms and are motivated to do "the right thing".

A great deal of behavioural research has found that, not surprisingly, veterinarians are the most important source of information and the primary opinion sought by farmers. Garforth (2015: 36), with reference to research in the United Kingdom, notes that veterinarians in private practice are widely seen as credible sources of advice and information by livestock farmers. One reason is that farmers consider veterinarians capable of interpreting and adapting the information according to their farm circumstances. Alarcon et al. (2014) find that the majority of surveyed pig farmers considered their veterinarian's opinion and advice the most valued, while trust in the veterinarian and (or) the acknowledgement of his professional competence was in many cases an important factor to comply with external advice. Garforth et al. (2006: 162) studied the decisions of dairy farmers in South West England to adopt techniques for heat detection in cows. Their respondents indicated the veterinarians as the most important external referents. Elliot et al. (2011), Taylor et al. (2016), Delgado et al. (2014), and Sok et al. (2015) report a similar finding. However, research also contains caveats on the role of veterinarians as farmers' referents. Alarcon et al. (2014: 239) report respondents' negative views that veterinarians "have fashions" and farmers have to be sometimes cautious to take up their advice, importantly also, two respondents in this study saw a conflict of interest of veterinarians as they also sell drugs. Derks et al. (2013) examined veterinarian awareness of farmer goals and attitudes to herd management in the Netherlands and diagnosed veterinarian misperceptions in that area. Hall and

Wapenaar (2012) found that the value that farmers place on discussion with their veterinarians was not matched by a readiness of the veterinarians to initiate discussion.

Research also identifies "other farmers" as key referents of farmer disease management, although the evidence is mixed due to specific contexts. Garforth et al. (2006) found other farmers to be the second important referent after the veterinarians in motivating farmers to act in a specific way. They also measured a considerable gap between the impact of these two referents on farmers' motivation to comply with their views and the impacts of other referents (artificial insemination service, farming press, private consultancy, agricultural universities and internet). Alarcon et al. (2014: 231) similarly report that other farmers' experiences guided some of the respondents' decisions on how to control a disease problem, particularly when the cost issue was of concern to the respondents. In contrast, Bruijnis et al. (2013: 109) studying farmer decisions related to the adoption of dairy foot health techniques found that fellow farmers were not seen as important referents compared to feed advisors, foot trimmers and veterinarians. These authors also found a low "motivational power" on farmers of the animal health service and press.[4]

Farmers' perceptions of government can be drawn from Garforth et al. (2013), who report that the majority of UK pig and dairy farmers in their study judged one or more of Defra's recommended practices for livestock disease management to be either ineffective or inappropriate. In another study of farmers' attitudes towards buying consequential loss insurance, the respondents showed a strong disinclination to comply with the views of Defra on this matter (Garforth, 2015: 34). More generally, Garforth (2015: 36) concluded that a "recurring theme from recent research in the United Kingdom is the view that government departments and agencies are ill-informed about the realities farmers face and are principally interested in regulating and restricting what they can do rather than supporting their farming enterprises". Palmer et al. (2009) also report for Australia a lack of trust in government sources, e.g. scientific institutions linked to the government. This evidence may be partial and reflect a specific country situation at a particular juncture (e.g. an aftermath of a serious disease outbreak), but it suggests that farmers' (dis)beliefs about government may act as barriers to voluntary uptake of policy recommendations.

Overall, these findings underscore the importance for policy makers to understand who the farmers' referents are in order to exploit the most effective "entry points" to communicate and deliver policy. Sok et al. (2016: 118) suggest that social pressure might act as a "catalyst" for policy instruments and leverage the (cost) effectiveness and efficiency of interventions. Veterinarians appear to be the main influence group; in other circumstances, fellow farmers may be also important. Thus, "farmer-to-farmer" or "veterinarian-to-farmer" communication may be more effective in influencing farmer decisions than that of "government-to-farmer". Local and personal contacts have more influence on livestock farmers' intentions than more distant and impersonal sources (Garforth, 2010). Farmer forums should be exploited or promoted where farmers could learn directly from others' views and experiences (Garforth, 2015 with reference to Kilelu et al., 2014).

Social capital and collectivity

Farmers can be viewed not just as individuals making separate choices, but as members of communities which have a tangible interest in common (Defra, 2008). Livestock farmers have an obvious interest in common in discouraging behaviour which causes negative externalities of animal disease. This common interest also serves to address broader societal concerns, such as food safety, various aspects of human health and also food security in less developed countries in particular. Society members identify and pursue common interest through trust, reciprocity, obligations, networks, norms, relationships, values, and informal sanctions. All of these form social capital and determine the quantity and co-operative quality of a society's social interactions. Ahn and Ostrom (2008) distinguish three categories of social capital: trustworthiness, networks, and institutional arrangements. Mutual trust is essential for establishing social relationships. Networks can be described as a set of relationships characterised by familiarity with the others involved through past dealings and repeated interactions with them. Institutions represent more explicit relationships with formalised rules and procedures which often have statutory form, and also tacit rules, but which are sometimes forged over a long history (OECD, 2013). Social capital is important for livestock disease management from several perspectives.

First, social capital helps to promote values and norms that discourage behaviours which cause negative externalities. Because actions outside of social norms are often viewed with disapproval, peer pressure and the need for approval provide incentive to conform. Thus, if social norms include responsible farmer disease prevention and control, the effects are more likely to be lasting than when influenced by authority and less monitoring and enforcement of these practices may be required. If it is normally considered shameful, it might be counter-productive to introduce fines, while if it is normally considered the right thing to do, it might be counter-productive to introduce financial benefits (Dawnay and Shah, 2005).

Second, social capital fosters virtue by encouraging community orientation and co-operation (Defra, 2008). Although farmers are generally in competition with one another, they may in certain situations see collective action as a rational approach to limit or halt disease and to deal with the consequences. Behavioural economics has been applied to examine when and under which conditions collective action occurs. These conditions are largely rooted in social capital, such as responsibility, trust, reciprocity, and information flows through social networks. According to Ostrom (2009), co-operation is more likely to occur in settings where: 1) many of those affected agree on the need for behavioural change and feel joint responsibility for future outcomes; 2) the reliability and frequency of information about the phenomena of concern are relatively high; 3) participants know who else has agreed to change behaviour and that their conformance is being monitored; and, 4) communication occurs among at least a subset of participants. Heffernan et al. (2008: 369), observing UK cattle and sheep farmers, concluded that a lack of trust, or more broadly, a lack of "social connectivity" within the farming community explained a lack of collective action for biosecurity. The primary message is that farmers are much more likely to choose cooperative behaviour if they have social bonds and are aware that others are choosing cooperation as well. Thus, information about costs and consequences from reliable and relevant sources and facilitating communication among farmers may encourage cooperative solutions. Educational and information programmes could utilise well-known examples of preferred behaviour relative to livestock disease prevention and control. These programmes could also utilise veterinarians and industry sources to convey costs and consequences of disease and potential benefits from co-operation across and among farm operations.

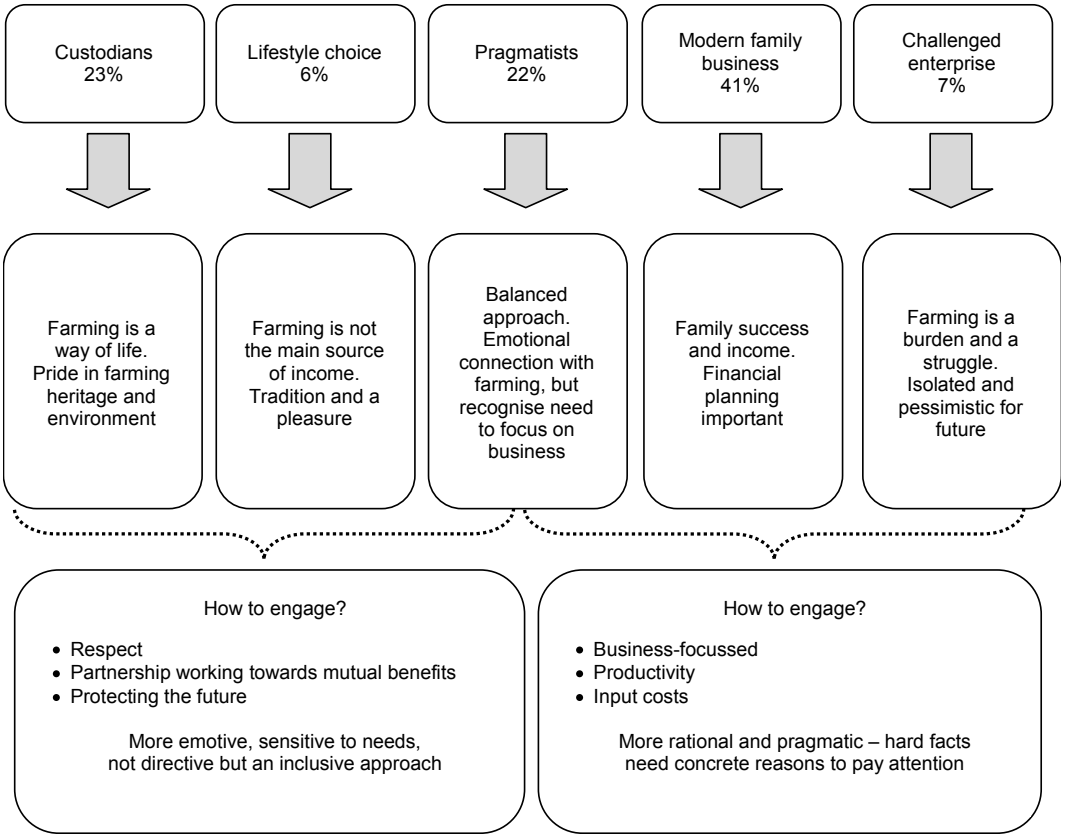
Third, social capital is likely to activate interactions between farmers and government. Participation through the existing social networks in discussing issues helps farmers learn about the policy context and act in ways beneficial to the community. Farmers with high linking social capital seem to be inclined to increase interaction with government on specific issues as opposed to farmers with low linking capital (Defra, 2008).

3.5. Farmer values and motivations attached to farming

Rural sociologists have studied farmers' values and their motivations to be engaged in farming. These studies brought into light a concept of farming styles, strongly synergetic with other behavioural analysis. Gasson (1973: 527) distinguished four broad value orientations of those undertaking farming: instrumental: farming is a means of obtaining income and security (e.g. making maximum or satisfactory income and security, safeguarding future income, expanding business); social: farming is for gaining prestige as a farmer (e.g. belonging to farming community, maintaining family tradition); expressive: farming is a self-expression or personal fulfilment (e.g. exercising special abilities, exercising self-respect for doing a worthwhile job, chance to be creative), and intrinsic: farming is an activity in its own right (e.g. enjoyment of work tasks, healthy outdoor life, value in hard work, independence).

These insights led to further research into patterns of farmers' behavioural motivation and the related farm typologies. For example, Rehman et al. (2008) identified several farming styles in England and this work fed into Defra's further development of its Farmer Segmentation Model. Based on a multivariate analysis of responses to a set of 51 statements about farming values and objectives, five farming types were identified: "custodians", 'lifestyle choice", "pragmatists", "modern family business" and "challenged enterprise" (Figure 3.3).

Figure 3.3. Defra's Farmer Segmentation Model



Note: A recent pilot study by Wilson et al. (2011) embedded Defra's segmentation framework within Farm Business Survey for England. 750 Farm Business Survey respondents were interviewed for this study, which established the following distribution of farmers according to segments: custodians (14%), lifestyle choice (7%), pragmatists (53%), modern family business (21%), and challenged enterprise (4%).
Source: Defra (2008).

Notably, this analysis revealed that segments were similar when profiled by "external" descriptors, such as farm size, region and farm specialisation, and it was only when attitudes were included that major differences emerged. Thus, farms can be characterised differently if "internal" characteristics of farm operators are taken into account. A key policy inference is that different farm groups may be less or more reactive to the reasoning based on purely economic rationality (and to economic policy tools). A broader rationale should be employed in incentivising a desired behaviour amongst farmers and different communication and language need to be exercised to influence different farm groups (Defra, 2008). As Defra's Farm Segmentation Model suggests, for some farm groups, a less directive and emotive outreach may be more effective, and which also suggests collective solutions and appeals to public good aspects of farming – these could be benefits of good livestock practices for the local community, animal welfare, human health, or societal welfare more broadly. For other groups, a more pragmatic messaging is required, with reference to cost management, financial consequences of bad or good livestock diseases management, and its impacts on farm productivity.

Certainly, because culture and values differ across societies, the farm segments can have different psychological and social profiles and weights across countries compared to those drawn in the model above. However, a general implication is that differentiating farms also by these features as opposed to conventional criteria of farm size, specialisation, or region, may make policy more effective. Policy communication should engage different notions – psychological, social, as well as economic – to have broader response in farming community. Synergies can be found here with the concept of "nudging" which suggests that policy makers

can design policies that improve well-being through gentle nudges rather than through coercive measures by appealing to individuals' more profound values (Box 3.2).

Box 3.2. Nudging approach in policy

Thaler and Sunstein (2008) developed the concept of "nudging" as "any aspect of choice architecture that alters people's behaviour in a predictable way without forbidding any options or changing economic incentives". Nudge is the idea that formal regulations are not required because a small push can get people to change behaviour. In contrast, regulation is "budging" by reducing choice sets (Barnes et al., 2013). Thaler and Sunstein argue that if behavioural economics teaches us that we do not always act in our best interest, then policymakers must rethink the tools of regulatory command to change behaviour and better align our immediate choices and our deeper, truer preferences.

Applied to livestock disease policy, nudging means steering farmers towards better decisions by presenting choices in different ways. For example, it may be the case that presenting biosecurity practices as a form of "production insurance" may encourage adoption more than simply presenting them as livestock health protection. Another example from the research is that that telling someone of their electricity consumption compared to their neighbours prompted them to use less. Perhaps the same applies to livestock disease prevention and control. These types of questions about what language is most appropriate for nudging behaviour could form the core of a rigorous research programme. Economic experiments could be instrumental in this regard (Colen et al., 2015). They allow the identification of relevant behavioural parameters and testing the policy performance against farmer preferences.

3.6. Implications for animal disease policy

Behavioural theory suggests that identification of farmer behaviour is a starting point for policy that aims to influence that behaviour. This theory regards farmers' decisions as an outcome of complex influences which go beyond purely economic and financial factors. Farmers' broad values and motivations, their ability to process information and build knowledge, and their social connectedness also drive farmer decisions.

One implication is that if policy makers desire to see a positive change in farmer behaviour they need to build evidence about it and invest in behavioural research. Beyond monetary cost, this requires joint work between the government and researchers. An important task for the government would be to formulate the policy problem and the objectives sought to be achieved because contexts are essential in any behavioural work. Another implication is that for policy to become more effective, it should act along the whole spectrum of behavioural drivers to constrain those that prevent the desired behavioural change and build upon those that work towards it. Behavioural analysis shows that such interventions lie primarily in the domains of information, education, advice, and policy communication. There is a substantial body of expertise that combines behavioural and communication science which could be applied to livestock disease management (Fishbein and Yzer, 2003).

Livestock farmers generally feel confident about their expertise, but this may reflect overconfidence, cognitive biases and cognitive failure. The role of livestock policy is to understand and offset these through improved risk communication, credible early warning information, and targeted information and advice (Garforth, 2015).

Behavioural economics suggests that information about the disease including its likelihood and consequences, should be framed so as to alleviate or overcome cognitive biases. Establishing a culture of habits and preferred behaviour may strongly influence farmers. The government may wish to use surveys, focus groups and other means of communicating with stakeholders to assess the relevant biases, habits and norms. These actions may have both short- and long-term implications for farmer behaviour.

Perceptions of farmers about trustworthiness of information and advice are highly important. Information from government may be mistrusted and ignored, whereas veterinarians and fellow-farmers may be perceived as reliable referents. Policymakers need to understand who the farmers' referents are to exploit the most effective pathways to communicate and deliver policy. Some evidence suggests that livestock farmers are not particularly proactive in seeking new information (Garforth, 2015). Their willingness to operationalise the information also depends on whether it can be easily adapted to their particular circumstances. Thus, any modes and tools that help farmers to customise general information and evaluate the proposed measures in application to their own business will increase the absorption of information.

Economic considerations permeate farmers' decision mechanism for livestock disease management. Enhancing farmers' knowledge, information, and ability to assess the economic costs and benefits of these decisions should be a permanent policy focus. Providing sufficient evidence on the cost-effectiveness of desired farm practices is integral to that task. To encourage desired behaviour it may be more effective to highlight potential losses than gains, as people tend to focus on losses much more.

While economic motivation is important, farmers differ in how they balance it against other values which are not necessarily connected with farming as business. Farmers may be less or more responsive to the reasoning based on purely economic rationality and, thus, to economic policy tools. Policy should engage different notions – psychological, social, as well as economic – to have broader response in farming community. By appealing to preferred values, policy makers can use gentle nudges, rather than applying coercive measures. Through the use of displaying and communication choices and context, policy-makers can nudge behaviours such as biosecurity practices and reporting of suspect animals.

Social capital – social norms, local networks, professional groups – assists in appropriate decisions by individuals and enables collective action where they see common interest. If policy can change social norms to align with preferred behaviour, the effect is likely to be long-lasting and require less enforcement. Engaging communication and social connectivity amongst farmers should be factored into livestock policy. Building trust between livestock farming and broader society is also important. Raising the general public's awareness on existing biosecurity standards and systems for disease prevention, industry quality assurance, voluntary certification which makes safe products easily recognisable, are ways to reinforce social norms for high biosecurity in livestock farming.

In sum, to integrate a behavioural approach into policy for improved animal disease management decisions the first step is to understand which behaviour is occurring (and by whom). This may result in determining that the behaviour is in line with goals or out of bounds, and identify segments or subpopulations that can be targeted. The second step is to understand why undesirable behaviours are occurring. This information can be utilised in the third step which is to design and implement potential actions to nudge, anchor, or otherwise positively reinforce preferred actions. The policy actions may include information and education programmes, framing desired actions in terms of avoided losses, providing professional or expert information on risks and frequencies of occurrence, or resetting default actions.

Notes

1. Theory of Planned Behaviour is the extension of the Theory of Reasoned Action (TORA) by Ajzen and Fishbein (1980). See Burton (2004) for a discussion of the evolution of TORA model into TPB.
2. De Lauwere et al. (2012: 152), for example, present the views of several authors on the weaknesses and strengths of the TPB model.
3. For example, Valeeva et al. (2011) applied a Health Belief Model to study risk management behaviour of Dutch pig farmers. Palmer et al. (2009) draw on the Social Cognitive Model to research the effect of trust on responses of Australian farmers to infectious diseases. Both of these frameworks originate from behavioural health research. Other authors (e.g. Toma et al., 2013; Sok et al., 2016) employ statistical methods, such as Structural Equation Modelling (SEM) to test and estimate the causality between the *a priori* determinants of farmer biosecurity behaviour. This method is also used in combination with behavioural modelling to test model parameters. Other works (e.g. Elbers et al., 2010 a, b) use a "grounded theory approach" which begins with the collection of qualitative data. These data are then reviewed and codified, and grouped into concepts and categories to constitute a framework of analysis
4. Interestingly, spouses can also be very influential in farmers' decision making. Kuhfuss et al. (2015), for example, report this finding with respect to the adoption by farmers of agri-environmental schemes.

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