(Un)willingness to contribute financially towards advice surrounding diffuse water pollution: the perspectives of farmers and advisors

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Abstract

Purpose: This study explores whether farmers across England believe that advice on diffuse water pollution from agriculture (DWPA) which is currently provided for free at the point of delivery is credible, relevant, and legitimate ('CRELE') enough to justify paying towards.
Methodology: A mixed-methods study consisting of an online questionnaire survey (n = 225) and telephone interviews of farmers (n = 60) and farm advisors (n = 50) was conducted.
Findings: Across all methods (n = 330), 63.3% of participants (n = 208) responded negatively to the prospect of paying towards DWPA advice, with just 10% expressing a clear willingness to contribute. The main negative themes related to categorical unwillingness, financial constraints, the presence of alternative sources of advice, the accountability of farmers, and exclusion risk. Factors which may increase willingness included the delivery of high quality, farm-salient advice, or where compliance requires engagement.
Practical implications: This paper concludes that governments should continue to provide free advice on DWPA if water quality goals are to be met. Originality/value: This is the first known European study which explores farmer willingness to pay towards advice for DWPA. Theoretical implications:

The use of the 'CRELE' framework is novel as it is typically used to explore science-policy interfaces.

Introduction

Poor water quality is a global issue, with countries across the European Union (EU) failing to achieve their targets for healthy watercourses according to the EU Water Framework Directive's criteria (WFD, 2000/60/EC). In the UK, just 16% of waterbodies achieved an overall 'good' status in 2018 (Defra 2020). There are ongoing debates surrounding who is responsible for addressing water quality problems due to its external nature. This makes it a 'wicked problem' (see Smith and Porter 2010; Patterson, Smith, and Bellamy 2013). There are, as a result, contested discourses surrounding whether farmers should contribute financially towards improving water quality. Moreover, many farmers across Europe have historically been incentivised to adopt farming practices that have contributed to water quality problems (for example, by the EU's Common Agricultural Policy) (Martin 2000; Walford 2013). In addition, diffuse water pollution is often invisible on-farm, making it challenging for farmers to know whether they are contributing.

Agriculture therefore contributes to WFD failures; an estimated 81%, 31%, and 72% of total nitrogen, total phosphorus, and sediment loadings delivered to watercourses in England and Wales derive from agriculture (Zhang et al. 2014). Numerous emerging contaminants also originate from agriculture; for example, slug pellets (Metaldehyde) (Pesticides Forum 2014), microplastics and pharmaceuticals (Zuccato et al. 2000; Hurley, Woodward, and Rothwell 2018). Several approaches are being used to tackle water pollution from farming, including regulation, incentivisation, and advice, the focus of this study.

In England, Catchment Sensitive Farming (CSF) is a major government-led advisory initiative which aims to improve water and air quality. It achieves its goals through providing free confidential advice on DWPA within designated priority catchments (through Countryside Stewardship – a current agri-environment scheme). Approaches used by CSF include 1:1 advisory visits, reports, farm walks, and meetings (Defra 2018a). In addition, farmers are assisted with applying to water quality capital grants under Countryside Stewardship and other environmental funding schemes (Defra 2018a). CSF is currently state-funded and provides advice for free at the point of delivery. This is somewhat reminiscent of a previously national publicly funded farm advisory service, ADAS (the Agricultural Development and Advisory Service), which had a larger remit than CSF but moved towards a privatised model during the 1990s (Winter 1995; Curry et al. 2012; Labarthe and Laurent 2013).

Discussions surrounding whether to charge farmers for environmental advice in England have re-emerged since the onset of Brexit, whereby new agricultural policies and schemes are being developed. The arguments for and against public extension organisations have been well-rehearsed in

the context of production-oriented advice. For example, there are concerns that small-scale or 'hard to reach' farmers might be neglected (Coleman et al. 2010; Labarthe and Laurent 2013; Leeuwis 2004). Expecting farmers to pay for environmental advice, such as on DWPA, does not mean that the state is necessarily withdrawing from being involved in extension. For example, CSF could charge for advice and continue as a Natural England activity. In addition, charging for advice does not necessarily mean that the Government loses its policy agency. For example, the government could stipulate the content of advice that farmers should buy as a condition of being enrolled on an environmental land management scheme. In other words, charging for advice becomes a transactional cost to farmers entering a scheme. However, if advice is not 'required' in this way and is merely recommended, then farmer uptake of best management measures might be reduced.

Existing literature reveals potential disadvantages of moving towards a fee-for-service model. Firstly, moving towards privatised advice can result in farmers feeling disconnected due to the removal of a previously well-respected service. Sutherland et al. (2013) found that farmers did not trust commercial advisory entities due to the 'hidden agenda' held by many of these. Secondly, farmers may expect advice to become more tailored to them if they are paying towards its delivery. The resulting shift towards client-oriented delivery may dilute the ability of the advisory entity to achieve its own objectives as the advice sought by farmers may not be as environmentally-oriented (Ingram 2008). There is, therefore, a clear risk that a 'fee for service' approach could encourage advisors to build funding applications based on farmers' needs, which may not be conducive with what works best for the environment (see Sutherland et al, 2013). Dunne et al., (2019) found that many Irish farmers perceive private advice as of higher quality. Again, this may be due to private advisors being more farmer-centric than those delivering advice for environmental protection. Linked to this issue is the likelihood that farmers may expect funding applications to be successful where they have paid towards advice. Where these applications are unsuccessful, the advisory entity may lose credibility (Sutherland et al, 2013). If CSF began charging for advice, it is hypothesised therefore that this assumption that paying for advice will result in funding may undermine their ability to focus on their remit of improving water and air quality.

The delivery of public goods from agriculture features strongly in England's new agricultural policy framework, including the Environmental Land Management (ELM) programme. There are also plans for a wider roll-out of CSF across England. Due to policy discussions relating to whether farmers should make financial contributions towards the provision of advice, it was, therefore, timely to explore whether they would be willing to do so. As the purveyors of this advice, it was also important to gain insights from farm advisors themselves to elucidate whether they believe farmers would contribute financially. This was expected to reveal nuances and whether advisors believe farmers would pay even where they initially stated they would not be willing to do so. Whilst there have been studies exploring the ability of privatised advisory entities to influence farmer behaviour (Sutherland et al., 2013), there has been limited empirical research exploring how farmers would

respond to making financial contributions towards environmental advice. This paper uses an empirical approach to explore farmer and advisor attitudes towards the concept of making financial contributions towards CSF advice for managing water quality problems. We hypothesised that farmers would convey a reluctance to contribute financially towards the delivery of DWPA advice.

Theoretical approach: credibility, relevance, and legitimacy

Understanding farmer behaviour was crucial when exploring their willingness to pay towards DWPA advice. Figure 1 provides an overview of the factors expected to affect whether farmers engage with DWPA advice. Where advice which was previously free at the point of delivery becomes charged-for, all of these themes are likely to be affected.

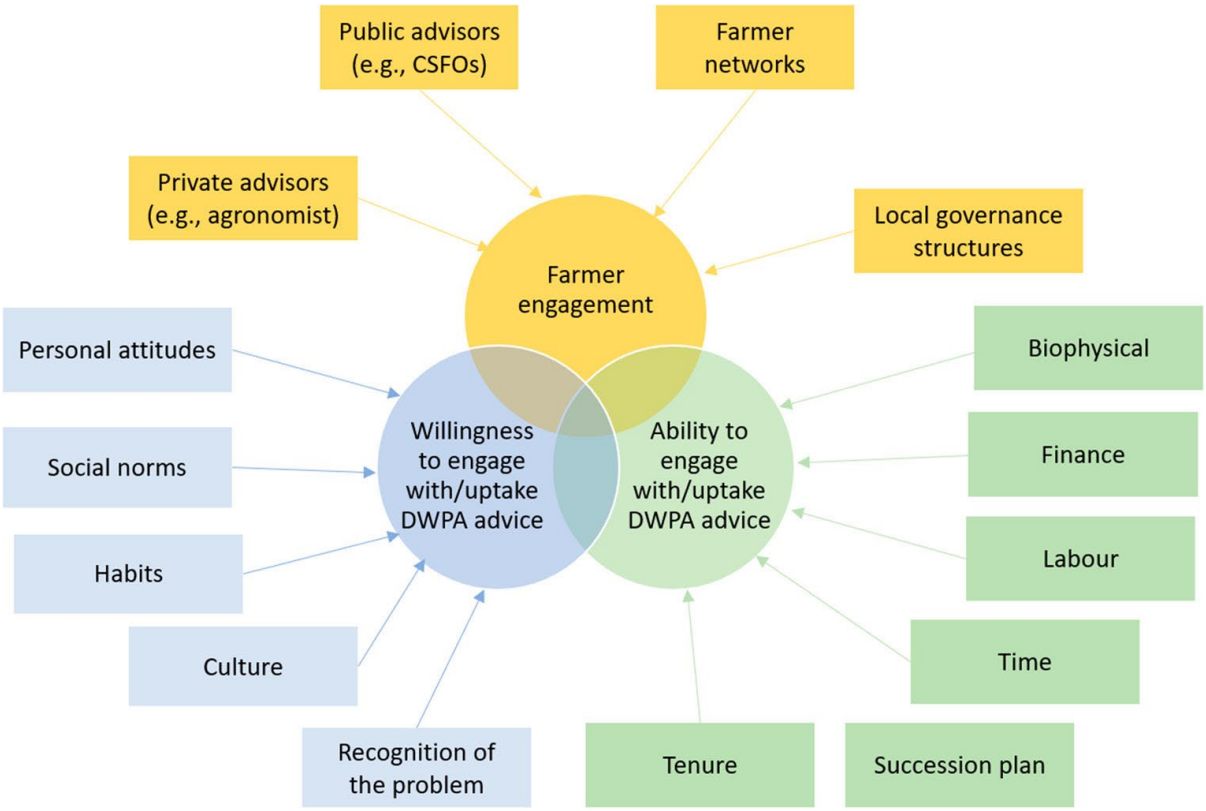

Figure 1 Factors affecting farmer behaviour in relation to DWPA advice. Adapted from Dwyer et al. (2007) and Mills et al (2017).

The factors above are likely to be affected by credibility, relevance and legitimacy. These three attributes comprise the conceptual framework used for this study: 'CRELE' (Cash et al. 2002, 2003). CRELE derives from earlier boundaries work which explored the intersection between science and non-science (see Gieryn 1983; 1995; Jasanoff 1990). The framework has since been used in several contexts, primarily by those examining ways of improving communication between scientists and policymakers (see Heink et al. 2015; Dunn and Laing 2017). CRELE has also been used in

agricultural research; Ingram et al. (2016) applied CRELE when exploring ways of communicating soil carbon to farmers whilst Thomas, Riley, and Spees (2020) adopted CRELE to understand how different knowledges are used and shared when engaging with CSF.

In the context of this research, Credibility is achieved where information is seen as local, accurate, valid, high quality, and characterised by plausible technical evidence. This attribute includes trust, which is built over time (Vanclay 2004) and is crucial for achieving engagement and behaviour change when delivering agricultural advice (Sutherland et al., 2013).

Relevance, often referred to as 'goodness-of-fit' and used interchangeably with 'salience', is vital for encouraging uptake of best practice measures (Pannell et al. 2006; Wilson and Hart 2001). Relevance presents a particular challenge in the context of DWPA because of the difficulties which arise when reliably attributing water pollution sources due to the complexities of the source-pathway-receptor continuum (Haygarth et al. 2005; Collins and McGonigle 2008). CSF advice was expected to be perceived as relevant where it is specific and makes recommendations that are practical for individual farm holdings (Chapman and Tripp 2003; Leeuwis 2004; Prager et al. 2016). As shown by Fish (2014), advice is unlikely to be seen as relevant where farmers' business needs are not considered. Agency to engage with DWPA advice is also a component of relevance, with farmers who are unable to pay towards DWPA advice hypothesised as perceiving it as less relevant.

Finally, legitimacy refers to how respectful and unbiased knowledge production has been, whilst considering the divergent beliefs and values of actors (Hegger et al. 2012; Cash et al. 2002). It is important to note that different actors (e.g. farmers and farm advisors) may define each of these attributes slightly differently and that they are not mutually exclusive (Cash et al. 2002). For example, a change to the credibility of advice is likely to have implications for the relevance and legitimacy of advice.

Table 1 provides an overview of the behavioural factors which affect farmer behaviour in the context of CRELE. Where farmers are expected to pay towards advice, it was hypothesised that it would become more challenging to meet the thresholds of each CRELE attribute.

When operationalising CRELE, it is important to note that abstract thresholds exist for each attribute. In this context, where DWPA advice is deemed as meeting these thresholds, it is hypothesised that farmers will exhibit more willingness to pay towards its delivery. It is, however, important to note that these thresholds are dynamic over time; circumstantial changes may affect how high the thresholds are at any one time. Sudden failure to reach the CRELE attributes can occur due to a single interaction or event (Schut, van Paassen, and Leeuwis 2013). Whereas advice may be relevant enough to be received by farmers for free, beginning to charge for its delivery may result in a sudden loss of relevance. In addition, where just one of the CRELE attributes is unmet, it is hypothesised that efforts to charge farmers towards DWPA advice will be ineffective (Cash et al. 2002). Trade-offs and complementarities may also exist between the CRELE attributes (Lusiana et al. 2011; Van Voorn et

al. 2016). For example, efforts to reach the 'credibility' threshold may affect the likelihood of the 'relevance' threshold being met.

Table 1 Factors which affect farmer behaviour and how they link to CRELE attributes.

Factor affecting behaviour	**CRELE attribute(s)**
Willingness to engage with or adopt DWPA advice	
Farming culture	Credibility, Relevance
Personal attitudes	Credibility, Relevance
Social norms	Credibility
Policy environment (e.g. presence of regulations, likelihood of enforcement)	Relevance, Legitimacy
Perceived or real capacity (agency) to engage with or adopt advice	
Farm type	Relevance
Farm size	Relevance
Tenure and land ownership	Relevance
Educational background	Relevance
Age of the main decision-making farmer	Relevance
Succession status	Relevance
Time constraints	Relevance
Existing infrastructure	Relevance
Financial circumstances	Relevance
Business needs	Relevance
Nature and quality of the scheme, practice or innovation (DWPA advice)	
Aims of the initiative	Credibility, Relevance
Advice delivery	Credibility, Relevance, Legitimacy
Transparency and plausibility of evidence used	Legitimacy
Requirements of the farmer	Relevance
Perceived quality of the advisor	Credibility, Relevance
Negotation skills of the advisor	Relevance
Financial incentives	Relevance
Perceived co-benefits of uptake of recommended measures	Relevance
Power imbalances	Legitimacy
Extent to which advice aligns with pre-existing views	Credibility, Relevance

Methods

A mixed-methods approach

A sequential mixed-methods approach was used to identify detailed narratives surrounding farmers' willingness to contribute financially towards CSF advice. These methods consisted of a preliminary online questionnaire survey (OQS) of farmers to gather initial insights, followed by in-depth telephone interviews with both farmers and agricultural advisors. All farmer participants were asked a set of characteristic questions (outlined below).

Purveyors of DWPA advice were interviewed alongside farmers. Though the stated intentions of farmers, as gathered here, are generally reliable enough to draw findings from (Harvey 2000; Tranter et al. 2004; Gorton et al. 2008), it is important to note that observed behaviours do not always align with intentions (see Weber and Gillespie 1998; Ajzen, Brown, and Carvajal 2004), including amongst farmers (Väre, Weiss, and Pietola 2004, Herath 2013). It was hypothesised that some farmers would display a categorical unwillingness to pay towards advice delivered by CSF as this was the first time they'd been exposed to the idea. In reality, however, it was hypothesised that if there was no choice but to pay, they may end up doing so, albeit reluctantly. This justifies the need to ask farm advisors how they believe farmers would respond to the notion, as they are key for encouraging behaviour change (Labarthe et al. 2013; Dwyer et al. 2007). This makes them uniquely well-placed for understanding farmer behaviour as they often observe how farmers change behaviour over time. Advisors were also expected to be key for identifying the factors which may dissuade or encourage farmers to be wiling to pay (WTP) towards advice, including the perceived risk of inspections and the quality of advice being offered. Moreover, it was important to know how advisors would respond to advice becoming charged-for as they would undoubtedly be affected by this change; for example, in terms of how proactive they need to be when attempting to engage with farmers.

Online questionnaire survey of farmers

The OQS was published on the JISC online survey platform (JISC 2019) from 02/10/2018-04/02/2019 and was incentivised with a £100 voucher prize draw. The OQS enabled the cost-effective recruitment of a widely spatially-distributed sample of farmers across England, thus ensuring that a relatively large sample of farmers (n = 220) with various holding characteristics was gathered. The recruitment strategy involved sharing the survey across various social media outlets (Twitter, Facebook, LinkedIn, and online farming forums) and through a paid-for advertisement campaign with Farmers' Weekly. This strategy was not selective in terms of sampling as the goal was to gather insights from a relatively large number of farmers across England.

OQS questions relating to WTP towards CSF delivery began with the question: 'Would you ever be willing to pay towards advice surrounding diffuse water pollution?'. Respondents were able to answer with 'yes', 'no', or 'I don't know'. Those farmers who answered 'yes' were routed to a free-text question asking why this is the case, whilst those who answered 'no' were routed to a free-text question asking why they would not be WTP towards DWPA advice. Those who answered 'I don't know' were routed directly to the next topic. The survey ended with a series of questions to capture respondent characteristics, including farm type, size, tenure status, age, gender, and economic performance. The aforementioned questions were not mandatory for participants as they may not have been relevant for some farmers (e.g. those who never engage with advice). Readers should, therefore, note that overall sample sizes vary slightly throughout this paper as a result.

Telephone interviews of farmers and farm advisors

Farmer telephone interviews (FTIs) were conducted to add qualitative richness to the study. The FTIs (n = 60) were conducted between 16/11/2018 and 20/11/2019 and carried out with farmers recruited at various farm walks and events. During the FTIs, participants were asked: 'Would you ever consider paying towards advice about water pollution from farming (e.g. from a Catchment Sensitive Farming Officer)?'. They were then encouraged to elaborate on their answers[1] with probing questions.

Advisor telephone interviews (ATIs) (n = 50) were conducted between 30/07/2018 and 21/06/2019 to explore how they believe farmers may respond to paying towards DWPA advice. It was hypothesised that advisors would respond less negatively towards the concept of CSF becoming a chargeable service than farmers. Participants were recruited through networking and inviting them to participate through publicly available contact details. ATI participants were asked 'Hypothetically, on a scale of 1-5, how willing do you think farmers would be to pay towards advice relating to water pollution from agriculture (1 = completely unwilling, 5 = completely willing)?' before being asked to elaborate. They were then asked how they believe farmers' expectations of CSF advice would change if they had to pay for its delivery at the point of service. These questions were kept relatively broad, with answers coded to each relevant CRELE attribute during analysis.

Data analysis

Quantitative data were analysed using SPSS (IBM SPSS edition 25). Upon confirming that data were not normally distributed, chi-squared testing was conducted. The initial quantitative question on WTP, where respondents indicated 'yes', 'no', and 'I don't know' against farmer characteristics were tested for associations. In addition, proxy variables were created based on the themes identified in the follow-up qualitative question and again compared against farmer characteristics. However, the relatively small sample sizes and level of detail gathered in terms of participant characteristics meant that >20% of cells had expected counts of <5. As recommended by van Van Emden (2008), alternative tests were necessary as conflating the cells to increase the robustness of the test led to the loss of meaningful detail. Fisher's exact tests were conducted instead; however, the memory intensive nature of this approach meant that exact P values could not be calculated. As recommended by Mehta and Patel (2012), Monte Carlo iterations offer an alternative approach. The Fishers' exact p values derived from these iterations were suitable for interpretation. Qualitative data were analysed using NVivo 12 Plus, whereby exploratory thematic analysis identified key themes (see Gale et al. 2013). Separate codes were created to represent each of the CRELE attributes. Comparisons were made between the views of participants against structural characteristics.

Ethical considerations

Ethical approval was obtained from the University of Exeter. All methods were compliant with GDPR (General Data Protection Regulation 2016/679, 2018). Research participants were offered the opportunity to receive research outputs.

Results

Online questionnaire survey

Structural characteristics of OQS respondents

The OQS was completed by 225 farmers across England. Of these completions, 220 were deemed usable after checking entries for reliability and consistency. ArcMap 10.6 was used to map the distribution of farm holdings and to produce a point density heat map (Figure 2). The counties with the highest levels of survey participation were Yorkshire (12.4%) and Devon (10.6%). Just two counties, Surrey and Middlesex, lacked farmer participants. The two postcodes located inside the Welsh border were considered usable due to the respondents' knowledge of CSF, indicating that they may farm some land inside England. The mean age of OQS respondents was 48.3 (range = 19-81).

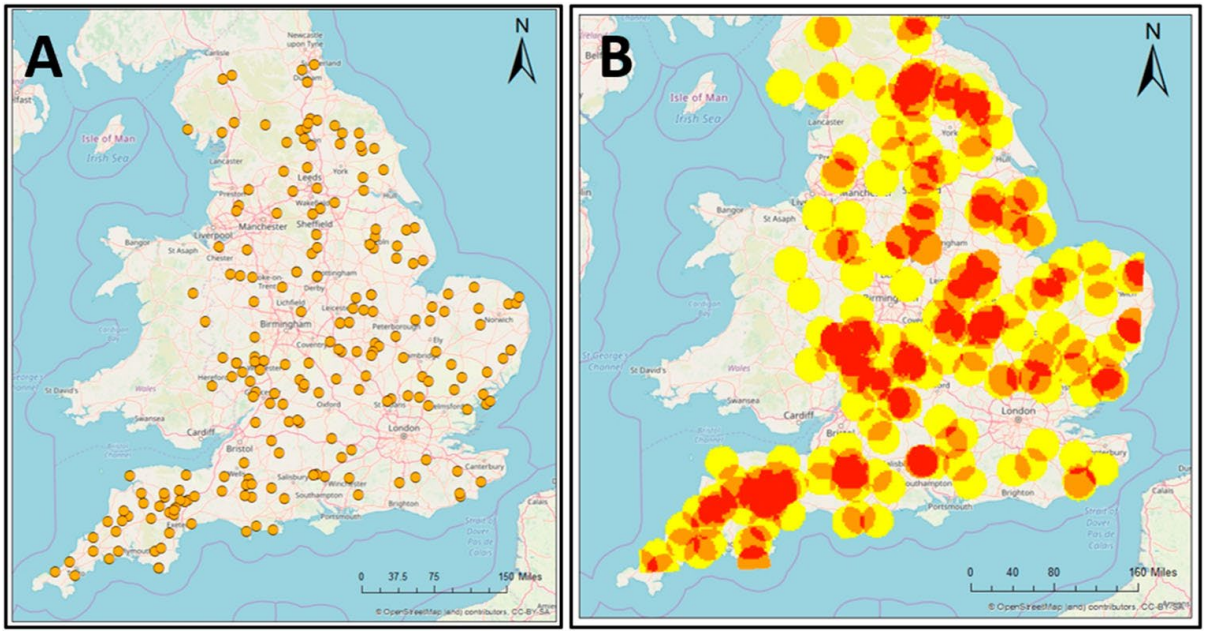

Figure 2 A: The distribution of OQS farmer respondents (n = 225); B: Heatmap showing densities of farmer participation in the OQS.

OQS participants provided their % of sales from different farming types. These data were compared against a national dataset (Defra 2018c) (Figure 3) which used standard output coefficients

(SO) to calculate farm business types (Defra, 2019b). These SOs define 'mixed' farms as those where a single enterprise constitutes less than 2/3rds of the farming business (see Defra 2018d). The framing of our question did not allow a direct comparison but % of sales was deemed an adequate sufficient proxy, thus enabling the identification of the under- or over-representation of particular farming types. The OQS was over-represented by large farmers; whilst the average size of respondents' farms was 281 ha (n = 214), the average farm holding size in England is 87 ha (Defra 2019a). The differences here may, in part, be because a single farm may, in some cases, consist of several holdings.

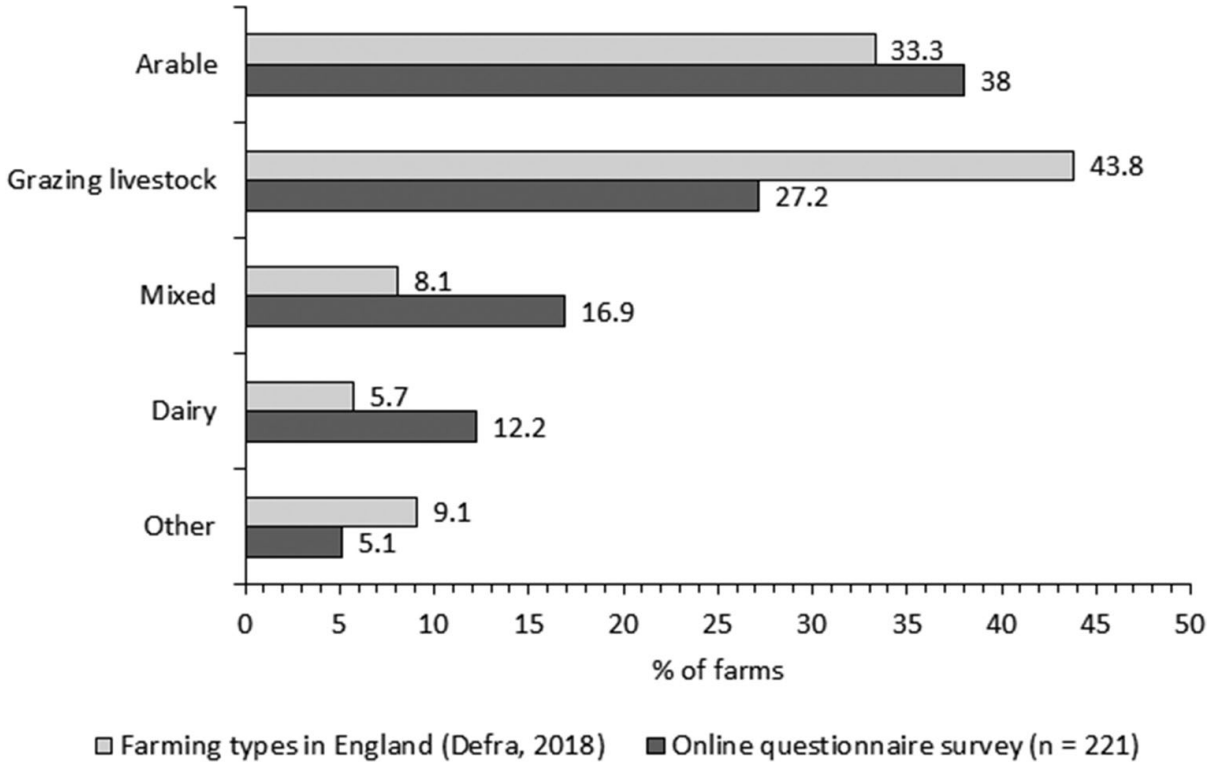

Figure 3 OQS farmer participant dominant farming enterprises against the standard outputs of farms in England according to Defra (2018c).

Results of the OQS of farmers

Of the 220 OQS respondents who answered the question '*would you ever be willing to pay for advice about water pollution from farming*?', 10% (n = 22) said 'yes', 66% (n = 145) said 'no', and 24% (n = 33) answered 'I don't know'. Several significant associations were found between WTP and farmers' characteristics (Table 2). The largest farms in terms of both hectarage and number of full-time equivalents exhibited the most WTP for CSF advice. No other characteristics were significantly associated with the WTP of OQS respondents.

OQS participants were asked to explain their answers. This revealed the following themes:

Financial constraints (n = 45, 36.8%): 'You've got to look at all the other areas in which farmers are being charged. Lots of little amounts soon add up. Farmers are cash strapped and that's

why a lot of environmental grants aren't taken up, farmers have to fork out money first which they don't have' (OQS #5, 101-200ha, mixed); 'Extremely negatively. It's a fight to remain profitable at the moment. We don't need people working out how to milk us further' (OQS #152, 301ha+, arable) (see also appendix, quotes 59-85). Farmers with 'poor' economic prospects were significantly more likely to mention financial constraints as a barrier to paying towards CSF advice both in terms of current economic prospects and perceived prospects for the next 5 years (see table 2).

Categorical unwillingness (n = 48, 39.3%): These participants indicated that they would not be WTP for CSF advice under any circumstances (appendix, q1-9). Grazing livestock farmers were the most vocal in this unwillingness: 'sod off' (OQS #86, GL, 65ha), 'Be very pissed off' (OQS #81, GL, unknown farm size). Significant associations were found between categorical unwillingness and current economic prospects ($\chi 2$ (6, n = 189) 14.998, p 0.010) alongside perceived economic prospects for the next 5 years ($\chi 2$ (6, n = 189) 11.688, p 0.051).

A lack of perceived accountability for water quality problems (n = 25, 20.5%): These farmers extricated themselves from holding responsibility for covering the costs of DWPA advice (appendix, q30-52), largely due to the presence of other sources of pollution: 'Farmers are always the easiest targets. There are other pesticide users e.g. local authorities, environment agency, amenity users etc.' (OQS #179, arable, 201-300ha). Water companies were held responsible both due to their contributions to water quality problems and the recognition that clean water increases their profit margins. Some participants also argued that there is a lack of robust scientific evidence proving their contributions to water pollution (appendix, q.53-58). No significant associations were found between this perceived lack of accountability and any other factors.

The presence of alternative sources of advice (n = 18, 14.8%): These farmers said they would use alternative sources of DWPA advice if CSF became directly chargeable, including from various NGOs; '*I'd work with the Rivers Trust who have been so much more interested and knowledgeable*', and from online sources of information; '*we would not pay when we live in a world of social media and Google where we can find all the information we need*'. Some also suggested that if they were to pay for DWPA advice, CSF would not be the initiative they would engage with; '*If I was going to pay, I would go somewhere better and more knowledgeable than CSF*'. No significant associations were found between this theme and any other characteristics.

Other negative sentiments included the risk of excluding farmers from gaining advice/information (n = 16): 'The vast majority are more concentrated on production rather than on the environment. These guys would only come on board if free advice is given' (OQS #198, 101-200ha, arable, Devon) alongside a lack of perceived need for DWPA advice (n = 9), and time constraints (n = 3). The perceived lack of need for DWPA advice (appendix, quotes 92-103) may be misguided in some cases and justified in others. Whilst some farmers have completed farm management accreditations such as FACTS/BASIS (see BASIS 2019), others believed they didn't need advice due to traditional epistemologies; e.g. 'We've always done it this way'.

Table 2 Associations between the WTP of OQS respondents for CSF advice and their characteristics (calculated using Monte Carlo iterations to estimate Fishers' exact test results).

Demographic factor vs. OQS participants' WTP for CSF advice	**Chi-squared test statistic (bold = significant association)**
Farmers' status (full-time/part time)	χ^2 (8, n = 220) 19.697, p 0.05
Type of farmer (e.g. partner, manager etc.)	χ^2 (16, n = 220) 29.888, p 0.07
Number of full-time equivalents on-farm	χ^2 (32, n = 220) 52.704, p 0.012
Total farmed area	χ^2 (10, n = 220) 18.236, p 0.039
Predicted economic prospects on the farm in 5 years' time	χ^2 (12, n = 220) 22.255, p 0.016
Farmers' age	χ^2 (8, n = 220) 6.165, p 0.0581
Region of the farm holding	χ^2 (14, n = 215) 15.644, p 0.277
Gender of the farmer participant	χ^2 (4, n = 220) 4.494, p 0.288
Time spent in farming (years)	χ^2 (12, n = 220) 18.796, p 0.062
Level of education	χ^2 (12, n = 220) 11.693, p 0.422
Current business performance	χ^2 (10, n = 220) 14.264, p 0.100
Organic status	χ^2 (6, n = 220) 4.489, p 0.553

Many farmers (n = 97, 43.9%) provided qualifying statements which indicate what may encourage them to pay towards CSF advice. These sentiments related to two overarching themes:

1. The business benefits of engaging (n = 46, 47.4%), 'It would have to demonstrate a genuine benefit to the farm profit rather than just a 'public good', however desirable that may be' (OQS #45, GL farmer) (see also appendix, quotes 79-84). The main 'business benefit' cited was obtaining grant funding. Meanwhile, others referred to non-specific benefits to farming; 'If it was a reasonable cost and would be beneficial improvement to farming, I would agree. However, the make or break deal would be on cost.' (OQS #212, unknown farmer).
2. The quality of the advice (n = 38, 39.2%), with these farmers stating that the quality of CSF advice delivery would have to be high(er) to warrant paying towards it (see appendix, quotes 10-29). According to these farmers, 'high quality' advice is localised, relevant, practicable, and delivered by highly experienced advisors; 'If they are worth their mustard, then farmers would be willing to pay' (OQS #80, dairy, 101-200ha). Others saw the quality of existing advice as insufficient for encouraging them to engage: 'I don't think the advice they provide is worth paying for!' (OQS #221, arable, 301 + ha). There were no significant associations between any OQS respondent characteristics and their reference to the quality of advice as a qualifier affecting their WTP.

Several OQS respondents (n = 32) expressed some WTP towards DWPA advice due to a perception that engaging would save them money. Whilst some (n = 10, 10.3%) saw paying towards DWPA advice as cheaper than the alternative, e.g. regulatory fines: '*The only way we would have to pay for it would be when threatened by fines*' (OQS #220, 301 + ha, Dairy, Hampshire), others (n =

22, 9.9%) recognised that seeking DWPA advice has some value to their farm businesses: '*I would be willing as it's an important issue and valuable to my business*' (OQS #195, dairy, 301 + ha, Devon). No significant associations were found between positivity towards WTP and any farmer characteristics.

Figure 4 Distribution of FTI respondents (n = 60) across England.

Farmer telephone interviews

Characteristics of the FTI participants

The FTIs (n = 60) were carried out across England (Figure 4). They lasted for 16 min on average (8-40 min). The average age of participant was 52.3 (20-84), with an average time spent in farming of 29.6 years (3-69 years). The average farm size was 378 ha, ranging from 12 to 2500 ha. The dominant farming enterprises of FTI participants included grazing livestock (GL) (n = 24) and arable (n = 20), dairy (n = 8), mixed (n = 7), and specialist poultry (n = 1). The FTIs gathered a higher proportion of GL farmers than the OQS, likely because these farmers prefer participating in offline methods. Some FTI participants operated some or all of their farms organically (n = 4, 6.7%), and participants had an average of 2.7 FTE s (range 1-11) working on their holdings. Most (n = 23, 38%).

FTI results

FTI participants (n = 60) were asked: 'Hypothetically, if Catchment Sensitive Farming advice were no longer provided free of charge, how would your attitudes towards it or expectations of it change?' followed by probing questions. Most FTI participants (n = 43, 71.7%) responded negatively. The negative themes identified were:

- **The presence of other sources of DWPA advice** (n = 11, 25.6%): 'CSF might not be the first port of call if you're having to pay (…) people would probably get more out of their agronomists' (FTI #34, arable, 850ha)
- **Financial constraints** (n = 7, 16.3%): 'The profitability in farming's so restricted I don't think people would afford to pay for it, they would just carry on as they're doing now! If you want change, it needs to be freely and easily available' (FTI #33, GL, 32ha)
- **The perception that charging farmers for DWPA advice is unfair** (n = 7, 16.3%): some farmers pointed out the external nature of water quality problems, arguing that as healthy water is a public good, it should be paid for by the state. Others also contended that water companies should pay towards advice due to their vested interest in improving water quality.

Minor themes relating to negative sentiments surrounding WTP included the notion that it may exclude the already 'hard to reach' farmers (n = 6, 14%), views relating to accountability (n = 5, 11.6%), concern that CSF may become biased/agenda-based if it were privatised (n = 3, 7%) and the notion that some farmers (n = 3, 7%) would stop seeking environmental advice and instead, only adhere to regulations to avoid prosecution.

Many FTI participants (n = 34, 56.7%) shared qualifications which may affect their WTP, suggesting that they may be more inclined to pay towards CSF advice if certain requirements were met. The main qualifiers were:

- **The business benefits of engaging** (n = 15, 44.1%), for example, where CSF becomes more likely to result in grant funding (n = 8); 'It's the carrot that has made me get engaged and the reward has been securing grant funding for capital items'. (FTI #49, mixed, 150ha).
- **The quality of CSF advice** (n = 12, 35.3%), with some arguing that advice would need to be more relevant (n = 4) and specific (n = 3): 'We would probably look more at very specific, relevant things that we wanted or needed to know to comply with legislation'. (FTI #19, arable, 700ha).
- **The necessity of engaging with CSF** (n = 6, 17.6%); these farmers suggested that they would only pay for CSF advice if it was required to become compliant with regulations: 'Not unless someone's waving a stick and saying you need to engage with these people and you have to pay for it' (FTI #34, arable, 850ha)
- **The affordability of the advice** (n = 5, 14.7%), with these farmers saying that their WTP was dependent on how much of a financial contribution they'd be expected to make for CSF advice; 'I'd like to hope that the advice was sensibly priced; if we had to pay a nominal charge to go to a meeting, fair enough' (FTI #10, dairy, 220ha).

Just 8 (13.3%) FTI participants responded positively to the prospect of paying towards CSF advice. Of these, some stated that paid-for advice may be valued more highly (n = 3, 37.5%) whilst others recognised a need to engage with environmental advice (n = 2, 25%).

Advisor telephone interviews

The ATIs (n = 50) were carried out between 30/07/2018 and 21/06/2019 and lasted 16-127 min (average = 32 min). Advisors from 24 advisory organisations across England participated, including CSF officers (n = 15, 30%), advisors from various governmental bodies (n = 1, 2%), water companies (n = 10, 20%), NGOs (including various regional Rivers' Trusts (n = 8, 16%), the Farming and Wildlife Advisory Group (FWAG) (n = 3, 6%), Wildlife Trusts (n = 1, 2%) and others (n = 4, 8%)), private companies (n = 6, 12%), and private agronomists (n = 2, 4%). Advisor participants had been in their roles for 0.5-35 years (average = 10.7 years).

ATI results

Advisors were asked to indicate the likelihood of farmers paying towards various types of advice delivery. Most participants believed that farmers would be unlikely to pay for any type of advice, with bespoke reports most likely to encourage WTP. The following negative themes were identified:

Categorical unwillingness to pay (n = 26, 52%): These advisors maintained that farmers would refuse to pay (SI, quotes 1-9): 'A lot of farmers just go [to events] for the free lunch! (laughs) so to ask them to start paying for it I think they'll be quite reluctant! (laughs)' (ATI #2, Rivers Trusts). Many advisors also argued that it's unfair to expect farmers to pay towards DWPA advice: 'Taking away subsidies and then charging them for stuff that they've had for free is quite a double whammy!' (ATI #30, CSFO)

Further exclusion of 'hard to reach' farmers (n = 24, 48%), with these advisors concerned that charging for CSF advice may alienate farmers who are already unengaged with DWPA advice; '*We've already got a lot of the people who are willing and able to change their behaviours and do stuff (…) we've got the low hanging fruit. The other ones I don't think would be willing to pay, they're the guys being naughty and who need chasing up*' (ATI #23, CSFO). Some advisors also referred to the Agricultural Development and Advisory Service (ADAS), a historic case of commercialisation, to illustrate the unwillingness of the hard to reach farmers to pay towards advice: '*When ADAS was the free of charge government advisory service, the advice was sourced by a lot of farmers because it was free. Once it became a charged for service, the farms that continued to use ADAS were probably those that didn't need it!*' (ATI #27, CSFO).

Alternative sources of advice (n = 13, 26%): These advisors, similarly to FTI participants, referred to the availability of alternative DWPA advice: '*As long as people are giving this advice for free, then you're not going to get a farmer to pay for anything*' (ATI #18, Rivers Trusts). Several (n = 8) advisors also suggested that if farmers were to pay for advice, CSF may not be their first choice: '*I think farmers who wanted advice would pay an agent*' (ATI #40, ADAS). The internet was also mentioned as a source of free DWPA advice and information.

Financial constraints (n = 11, 22%): This theme largely related to the notion that many farmers are already in difficult financial situations, with some unable to afford to pay for CSF advice: '*With the economy, politics, uncertainty…we've had a very bad year, it would just be a nail in the coffin for a lot of farmers. They need that support for the next 4 or 5 years*' (ATI #16, CSFO). This advisor also recognised that current uncertainty due to post-Brexit policy changes may increase the reluctance of farmers to pay for advice.

Some advisors provided qualifications which may affect farmers' WTP towards CSF advice, again, relating to the quality of advice (n = 29, 58%) and the likelihood of engaged farmers accruing business benefits such as grant availability and assurance schemes (n = 37, 74%): '*It's got to be value for money but if there are things like grant schemes available then there's a benefit (…) we charge farmers to put together CS applications which they don't mind paying for because they're getting 5 years' worth of funding!*' (ATI #28, FWAG). Some advisors also recognised becoming compliant with legislation as a business benefit: '*They would want to get something tangible from it, for example, a report that means they are compliant with legislation* (…)' (ATI #40, ADAS).

A few advisors (n = 3, 6%) also highlighted that CSF becoming charged-for at the point of delivery may lead to its delivery becoming increasingly business-oriented: '*If our primary purpose is to make a difference to water quality, then we should not contemplate turning it into a charged for service because we will fall into the same pitfall that the commercial farm advice service provides which is they must make financial savings for their clients otherwise they're not going to be invited back. If we do that, we are not always going to focus on what's best for the environment.*' (ATI #27, CSFO). Although only a few advisors interviewed referred to this theme, all advisor participants (n = 19) within three focus groups carried out separately to this publication expressed concern that CSF may lose its ability to promote environmental measures if it were to become charged-for.

Some advisors (n = 17, 34%) shared positive sentiments, suggesting that farmers may place higher value on CSF advice they've paid towards: 'It would be good in that they'd listen to it more' (ATI #22, Rivers Trusts). A couple of advisors also contended that farmers already pay for advice on several topics (e.g. from ADAS, Rivera & Zijp, 200), thus may be willing to pay for CSF delivery too.

Triangulated results

Data from all three research methods were triangulated to identify convergent and divergent themes and how they coincide with credibility, relevance, and legitimacy.

In total, 63.3% (n = 208) of the 330 farmer and advisor research participants shared negative sentiments towards paying towards CSF advice at the point of delivery, rising to 78% (n = 86) in the telephone interviews (n = 110). The most prominent negative themes across all methods were: categorical unwillingness (n = 92, 44.2% of all negative sentiments), financial constraints (n = 63, 30.3%), the presence of alternative sources of DWPA advice which are either free or perceived as more CRELE than CSF (n = 42, 20.2%), the accountability of farmers for water quality issues leading to the perception that charging farmers for CSF advice at the point of delivery is illegitimate (n = 29), and exclusion risk (n = 24, 11.5%), a concern mostly shared by ATI participants (Figure 5).

Overall, no significant association was found between dominant farming types and WTP. This is surprising as it had been expected that livestock farmers would show less WTP than arable farmers due to their lower incomes (£21,900-28,300/year vs £64,200-93,300; Defra 2018c). Smaller farms (1-100ha) were, however, significantly less willing to pay towards CSF advice than larger (>300ha) farms (χ^2(8, N = 214) 18.11, p 0.02), potentially due to their lower gross margins (Coleman et al. 2010).

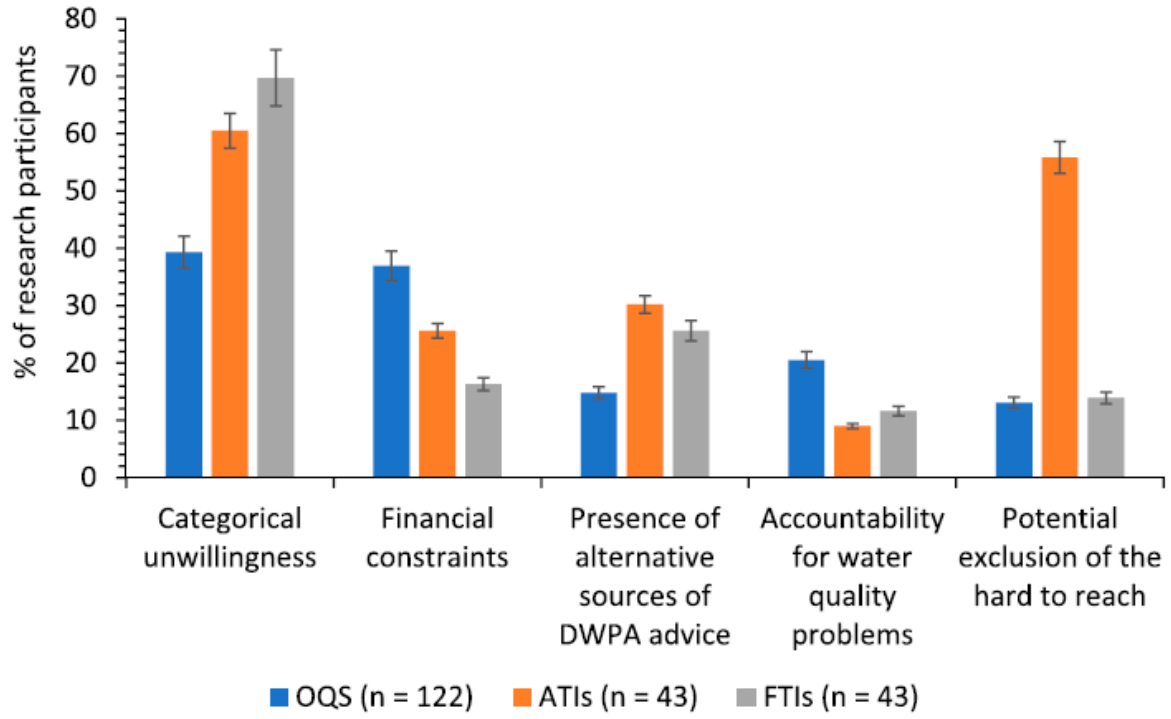

Figure 5 The main consistent themes among research participants who shared negative sentiments towards the prospect of farmers paying towards CSF advice at the point of delivery.

Discussion

This research has explored how farmers may respond to the prospect of paying towards CSF advice. Through gathering the thoughts of 330 farmers and advisors, it has been revealed that DWPA advice does not meet the CRELE thresholds enough to warrant paying for its delivery unless it results in direct benefits for the farmer. Some participants from all of the research methods mentioned the quality of advice as an explanatory factor for WTP, agreeing with O'Flynn et al. (2018), where one farmer participant said '*you get someone from the city that comes over to do something, but they don't know anything about [the area]…you need local knowledge*'.

Financially constrained farmers saw CSF advice as lacking enough relevance to warrant paying towards its delivery. Though many farmers aim to conserve the environment as part of their identity as good farmers (McGuire, Morton, and Cast 2013), with many undertaking unsubsidised environmental practices (Mills et al., 2018), they may not have the agency to do so where they are in challenging financial straits. Many farmers in England, and across Europe, earn relatively low incomes due to the weather, volatile market prices, and high input prices; for example, grazing livestock farmers in England had incomes of just £12,500-15,500 in 2018/19 (Defra 2019a). It was, therefore, unsurprising that financial constraints were often a reason given by farmers for being unwilling to pay towards CSF advice. Charging farmers may restrict the accessibility of information relating to DWPA, thus reducing compliance with water quality regulations (Pray and Umali-Deininger 1998; Sumane et al. 2018). As commercial businesses, private extensionists are likely to

target clients who are most willing to pay; typically large, arable farms (Kidd et al. 2000; Hanson and Just 2001; Katz 2002; Leeuwis 2004). When the extension system in Thuringia (Germany) was commercialised, the proportion of farmers gaining advice fell from 80 to 13%, with most advice-seekers deriving from large farms (>500 ha) (Chapman and Tripp 2003). This is likely exacerbated where extensionists are sufficiently preoccupied with these farmers (Leeuwis 2004).

OQS farmer participants expecting to have 'poor' economic prospects in 5 years' time showed significantly less WTP for advice ($\chi 2(12, n = 220)$ 22.255, p 0.016). Advisors were slightly less likely to refer to financial constraints than farmers. This illustrates the importance of ensuring that funding opportunities associated with engaging with CSF (e.g. CS water quality capital grant) are well-advertised to farmers and that the potential win-wins of best practice measure uptake are explained to farmers.

In agreement with Charatsari, Papadaki-Klavdianou, and Michailidis (2011), both farmers and advisors contended that advice paid for at the point of delivery must lead to tangible benefits for farm businesses. In many cases, best practice measures for mitigating DWPA (e.g. those which reduce runoff losses of costly inputs) lead to 'win-win' scenarios whereby farm businesses benefit from implementing certain measures (McGonigle et al. 2012). It is, therefore, vital that advisors express the co-benefits of adoption to their clients. Instead of seeking commercialised environmental advice, farmers may, however, seek productivity-focused private advice (Hermans, Klerkx, and Roep 2015) through agronomists, land agents, and private advisors. The resulting advice may, therefore, become less likely to result in water quality improvements, thus failing to meet the objectives of CSF. For example, 12 stakeholder-preferred measures for reducing DPWA were both costly and unlikely to result in significant reductions in nitrate and sediment loadings to rivers in England (Collins et al. 2018).

Similarly to Darnhofer and Strauss (2015), some participants also suggested that farmers would consider paying towards CSF advice if it led to accreditations ('*If it was heavily regulation-driven so if you didn't go, you can't get a spray operator's license*' – FTI #18, GL, 160ha) or qualifications (e.g. FACTS/BASIS points). Many existing initiatives including CSF already award these points at some of their farmer training events; thus, farmers may be more likely to pay a small fee to attend these than for other modes of delivery.

Many farmers and advisors (n = 42, 12.7%) also suggested that farmers would seek alternative sources of advice/information if CSF was no longer delivered free of charge, through various NGOs (e.g. FWAG, the Rivers Trusts), agrochemical and machinery companies, or water companies (Hermans, Klerkx, and Roep 2015). Water companies are increasingly offering free advice to farmers, largely because remediating pollution at the source is less costly than downstream engineered treatment (Sharma, Sanghi, and Mudho 2012).

Advisors frequently referred to the risk of excluding 'hard to reach' farmers by charging for DWPA advice. The risk of the 'hard to reach' farmers contributing to DWPA may already have

increased due to ongoing government cuts to the Environment Agency (EA) which have meant that farm inspections have dropped by over a third in the last four years (Unearthed 2018). This may have led to a perception that there is a lack of enforcement of regulations, thus reducing the perceived need to engage with advice due to a loss of relevance.

Some farmers and advisors referred to using the internet as an alternative to CSF as it offers a wealth of free information (Chapman and Tripp 2003). Farmers must, however, wear a sceptical lens when utilising the internet as online sources can be a source of misinformation, overload, and bias (Fritch and Cromwell 2001; Rieh 2014; Chen, Conroy, and Rubin 2016). Increased reliance on the internet for advice also risks excluding non-internet using farmers (Coleman et al. 2010; Oreszcyzyn, Lane, and Carr 2010; Butler and Lobley 2012; Farrington et al. 2015; Kinsella 2018). Overall, the internet and other digital approaches to extension do, however, offer the opportunity to maintain some public delivery of advice as it is cheap to deliver to large audiences (Chapman and Slaymaker 2002).

As aforementioned, water pollution is a widespread externality of agriculture (Hanley et al. 2012), manifesting at a catchment level due to cumulative contributions. Several OQS and FTI participants argued that maintaining watercourses is a public good and should, therefore, be government-funded, whilst others contended that water companies who directly profit from clean source water should hold more responsibility. Advisors did not refer to accountability as a barrier to farmers' WTP for advice as often as farmers did, likely due to their more informed awareness of the significance of DWPA for water quality problems in the majority of waterbodies across England.

Many farmers and advisors (n = 92, 27.8%) stated that farmers would be unwilling to pay towards CSF advice, with a tight coupling of all three CRELE attributes observed within their sentiments. This aligns with literature surrounding science-policy interfaces which found that the CRELE attributes are closely linked, often with tensions arising between them (Cash et al. 2002; Hegger et al. 2012). The finding that many farmers (n = 92, 44.2%) respond to the prospect of paying towards CSF with categorical unwillingness is, in part, due to farmers' attitudes, some of which remain focused on production and situational constraints (e.g. financial), indicating that the advice lacks relevance.

Categorical unwillingness to pay towards CSF advice may have been overplayed by farmer participants as the survey questions asked about their intended actions rather than actual behaviour. Despite a farmer reacting angrily to the prospect of paying towards CSF advice, they may perhaps pay if they feel it meets the CRELE requirements, albeit reluctantly. Increasing the relevance of paying towards CSF advice would likely be due to a lack of choice rather than attitudinal change; for example, through stricter enforcement of regulations or a requirement to engage with CSF advice to gain accreditations or when applying for upcoming Environmental Land Management (ELM) payments. Even if these unwilling farmers did pay towards CSF advice, it is hypothesised that this could result in resentment and distrust, with farmers engaging as little as possible (i.e. to comply with legislation).

Unlike Dunn and Laing (2017), who adopted the CRELE framework and found that legitimacy rarely arose spontaneously, this study finds that instead of legitimacy being the attribute that arises the least, credibility rarely arose. This may be because CSF advice itself is seen as a credible source of information (as indicated by the CSF evaluation report, 2019). Regardless of its credibility, farmers remained reluctant to consider contributing financially towards its delivery. This finding reiterates the flexibility of the CRELE framework and illustrates how different attributes may become dominant under different contexts.

Policy recommendations

A key issue in the design of agricultural policy is recognising the heterogeneity of farming, which means that a 'one size fits all' approach is unlikely to achieve CRELE for all farmers. In the case of the work reported here, however, there is a consensus that farmers from all backgrounds are not willing to pay towards CSF advice under its current model. Unless engaging with DWPA advice becomes a requirement, we recommend that the government should continue to provide CSF for free at the point of delivery, particularly if water quality improvements are to be achieved.

Conclusions

This study found that farmers and advisors may not perceive current CSF advice delivery as credible or relevant enough to warrant paying towards it, largely due to the view that the subject of DWPA itself lacks relevance. In addition, many farmers questioned the legitimacy of expecting farmers to pay. Besides, participants exhibited concern that charging for CSF advice at the point of delivery may alienate farmers, resulting in distrust and disengagement (cf. Hall and Pretty 2008; Christoplos 2010). Removing publicly funded environmental farming advice is likely to further alienate 'hard to reach' farmers, many of which are isolated, small-scale, traditionally managed family farms with low incomes (Labarthe and Laurent 2013) who are typically unengaged with advisory schemes and initiatives (Kinsella 2018). Although direct payment by farmers may not be a rigid barrier to advice uptake, free provision of advice is likely to act as a catalyst (Coleman et al. 2010; Rivera 2011), particularly in the case of environmentally focused advice. There were, however, two key conditions that affected WTP: the quality of CSF advice and the business benefits of engaging with the initiative. If both of these conditions were addressed, farmers may exhibit more WTP for CSF advice. For now, however, the sample data reported herein suggest it is crucial that CSF advice remains free at the point of delivery, or else 'hard to reach' farmers may become the 'impossible to reach'. However, recipients of free CSF advice should be expected to make progress towards and adhere to minimum expectations for good agricultural and environmental condition as well as any corresponding regulations.

[1] OQS participants were routed to a free-text question depending on their initial categorical answer.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by BBSRC: [Grant Number BBS/E/C/000I0330]; Environment Agency: [Grant Number 19936]; University of Exeter.

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Professor Adie Collins –

Adie's research interests broadly encompass the sustainability of agriculture. They specifically include a number of themes: 1) characterising pollutant emissions to water and air; 2) the development and application of pollutant source tracing procedures; 3) understanding cross-sector water pollution at different scales and the development of screening tools for contextualising the role of agriculture in water quality problems; 4) the impacts of agricultural pollution on aquatic ecology; 5) measuring and modelling the efficacy of on-farm interventions for managing agricultural sustainability; and 6) scenario-based evaluation of technically feasible mitigation impacts for policy support. His expertise includes hydro-chemical monitoring at multiple scales, integrating empirical and modelling approaches for scaling up, and pollutant source fingerprinting. Since 2009, Adie has

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