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How can marketing theory be applied to policy design to deliver on sustainable agriculture in England?[1]

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ABSTRACT

Marketing theory was applied to develop a qualitative tool to predict levels of compliance based on involvement with the issue (policy objective) and involvement with the intervention (regulation). Based on an understanding farmer decision-making, the I_3 Response Framework can help identify strategies that can strongly influence compliance, providing more efficient targeting of resources for policy. We report on further testing by application to the issue of water quality and the regulations around slurry storage as part of the Nitrate Pollution Prevention Regulations 2008 as applicable to dairy farmers in the Derwent catchment of North Yorkshire, England.

Keywords

Policy; I3 Response Framework; involvement; water quality; slurry storage; Nitrogen Vulnerable Zone; regulation; Nitrate Pollution Prevention Regulations 2008; NPPR2008

INTRODUCTION

Growing demands made on finite natural resources has meant that environmental regulation has become increasingly important to ensure these resources are used sustainably. Water is a case in point. In Europe, including the United Kingdom (UK), the Water Framework Directive 2000 (European Commission, 2000) has heralded a change

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in the management of water quality from a policy emphasis on chemical composition to the bio-ecological condition of water bodies. The focus in the UK has been on reducing nitrogen, phosphate and pesticide pollution in water bodies (surface and ground). With around 70% of nitrate loads within UK water bodies attributed to diffuse sources, mainly in the agricultural sector (Defra, 2002a) this sector has been the target for the recently invoked Nitrate Pollution Prevention Regulations 2008 (NPPR2008).

The NPPR2008 include requirements for slurry storage. This study looks at this aspect of the regulation in the context of dairy farming in the Derwent catchment, Yorkshire, to illustrate the role of a recently developed policy instrument that has been developed to better understand a target population's likely response prior to the implementation of policy interventions. This tool is the I_3 Response Framework.

The I_3 Response Framework

Using the marketing knowledge gathered around consumer purchase behaviour and the concept of involvement, and focusing on issues, policy interventions and involvement, economists, social scientists and policy makers in Victoria, Australia[7] and in New Zealand[8] have developed the I_3 Response Framework (involvement, intervention and issue) to assist policy makers to predict how a target population will respond to a regulation before it is implemented, thereby allowing more efficient allocation of resources to enhance compliance (Murdoch, Bewsell, Lourey, & Kaine, 2006).

The I_3 Response Framework is based on the concept of involvement. The idea is that an individual's perception of the importance of a decision to satisfy their needs represents their 'involvement' with that decision. Importance is evaluated consciously or sub-consciously to determine the amount of effort that should be invested in the decision-making process (Derbaix & Vanden Abeele, 1985) as cited in Murdoch, 2006). For an individual, the level of involvement will depend on a mix of external cues including context, price and promotion, while the internal cues include past experience, perception of risk, personal values and social norms (Assael, 1998).

According to Assael (1998) low involvement is characterised by a low attention to external cues and a low level of information search and processing. Conversely, high involvement is characterised by high attention to external cues, extensive information searching and processing, with substantial effort devoted decision making. In relation to this involvement, high involvement will occur in regard to decisions that are important to an individual because they are closely tied to ego and self image, involve some financial, social or personal risk. As such, an individual considers the investment of time and energy examining alternatives worthwhile. For low involvement decisions, the financial, social and psychological risks are less, and time spent in information search may not be considered worthwhile.

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Predicting behaviour with regard to regulation

When a regulation is introduced, the level of an individual's involvement will have a critical influence on that individual's awareness, attitude and decision making with respect to that regulation. Within the I_3 Response Framework, Murdoch et al (2006) have hypothesized that an individual's behaviour could be predicted by distinguishing between two key dimensions of involvement – involvement with the *issue* or policy objective, and involvement with the *intervention* or regulation designed to address the policy objective.

Involvement with the issue indicates the personal relevance of the issue or policy objective to the individual – how involving or motivating the issue is to the individual irrespective of the regulation (Murdoch, Bewsell, Lourey, & Kaine, Unpublished a) . Involvement with the intervention indicates the personal relevance of the regulation (Murdoch et al., 2006). The individual's level of involvement (based on involvement responses – investment of time, resources), dictates likely response to regulation, and determines placement within the quadrants of the I_3 Response Framework (Figure 1).

Figure 1: I_3 Response Framework outlining likely behavioural responses (Murdoch et al., 2006).

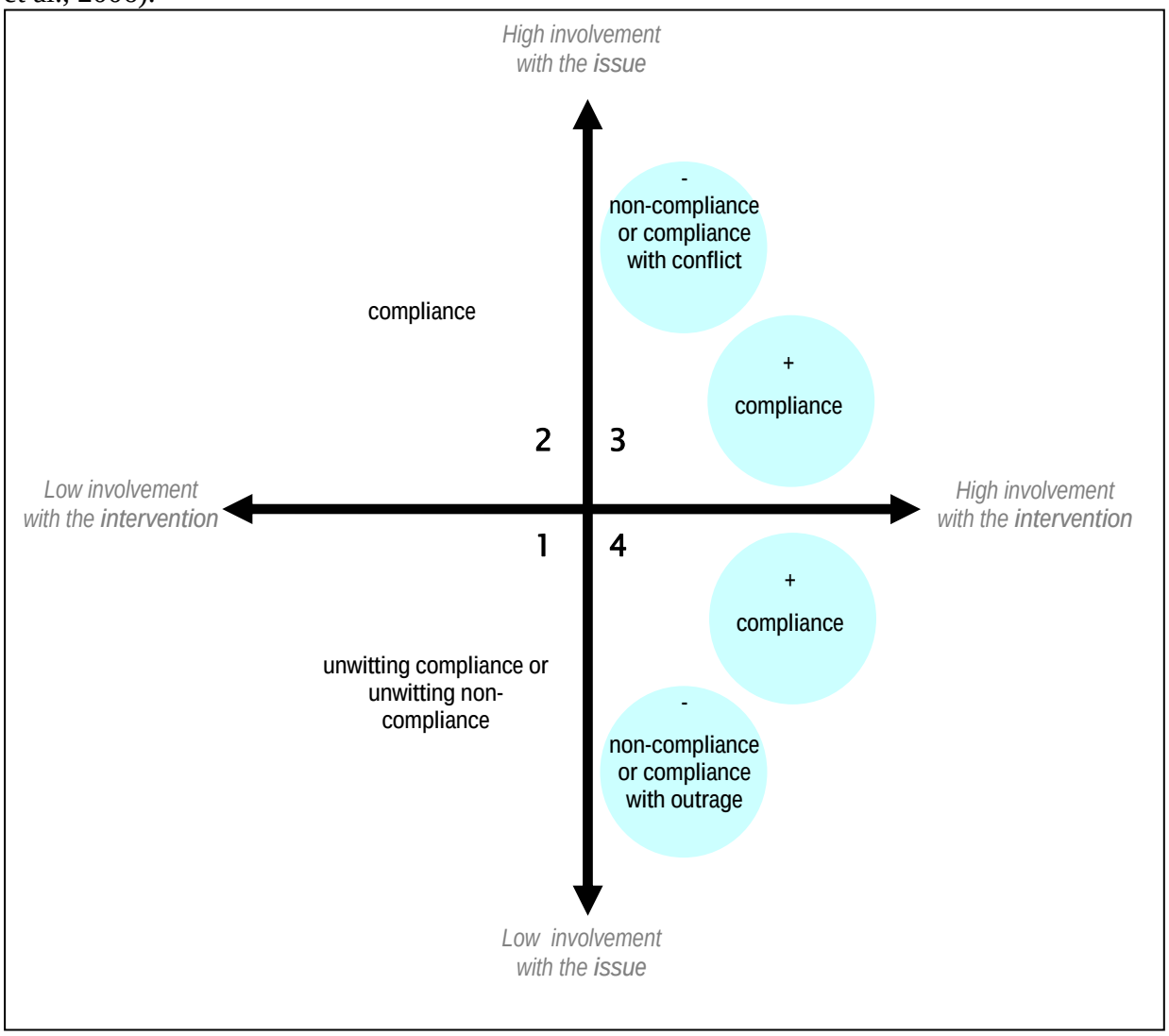


Figure 1 depicts involvement with the issue on a vertical plane with the horizontal plane depicting involvement with the intervention. The scale is represented by a continuum from low to high involvement from left to right and bottom to top for the issue and the intervention respectively. The four quadrants formed by the intersection of the two axis are characterised by distinctive types of behavioural responses. The quadrants are numbered clockwise from the bottom left corner and the behavioural responses identified on this basis. Depicted thus, involvement in an issue and intervention forms the I_3 Response Framework. Murdoch et al (2006) have suggested some behavioural responses associated with these differing levels of involvement.

- **Quadrant 1 Behavioural Response**
  Individuals in Quadrant 1 have low involvement with both the issue and the intervention. It is predicted that these individuals would be largely unaware of the

details of the issue and intervention obligations. As such they will not have evaluated their obligations in respect to the issue or intervention. Hence, it is predicted than an individual's response to a regulation will be unwitting compliance or non-compliance.

- **Quadrant 2 Behavioural Response**
  Individuals in Quadrant 2 have a high level of involvement with the issue, considering the issue relevant and important to them, while having a low level of involvement with the intervention. Consequently individuals in this quadrant are expected to comply with the regulation.

- **Quadrant 3 Behavioural Response**
  Individuals in Quadrant 3 have high involvement with both the issue and the intervention, however, there may be favourable (positive) or unfavourable (negative) attitudes towards the intervention. While favourable attitudes would be based on the expectation that benefits of complying would outweigh costs, unfavourable attitudes would be based on an expectation of net costs from complying, or that imposed obligations were not aligned with their views, or both. Benefits and costs are not necessarily monetary. Of these two groupings, those with favourable attitudes would be expected to comply, while those with unfavourable attitudes would not comply, or would comply with conflict(Murdoch et al., 2006). Behaviours that can be identified within compliance with conflict may be characterised by lobbying for regulatory change or forming groups to work against the regulation(Murdoch et al., 2006).

- **Quadrant 4 Behavioural Response**
  Individuals in Quadrant 4 have low involvement with the issue and high involvement with the intervention. As in Quadrant 3, individuals placed in Quadrant 4 can be subdivided into two groups based on favourable and unfavourable attitudes towards the intervention as a result of expected benefits and costs of compliance. While those individuals with higher net benefits would be expected to comply, those with higher net costs would not hold a favourable attitude, and with the low involvement with the issue, the response from this group is expected to be strong, described as 'outrage'. This group is described by Murdoch et al. as 'posing the greatest threat of demonstrating extreme types of behaviour' (2006, p.4). These behaviours include publicly demonstrating their disapproval of the government and its management, with the possibility of attracting broader community support for the issue.

The role of the I_3 Response Framework in policy analysis and design

Policy responses can be designed based on anticipated behavioural responses identified for each of the groups within the four quadrants of the I_3 Response Framework (Table 1). For example, Quadrant 1 respondents with low involvement with the issue and the intervention may or may not be complying, but in either instance they may well be unaware of the intervention or disinterested. A suggested policy response would include increasing the intensity of involvement by linking it to a more involving subject

(Murdoch et al., 2006). Quadrant 2 respondents are likely to comply due to their high involvement with the issue as its relevance for them in their business context. Consideration need only be given to regular promotion of the issue and interventions to maintain of compliance. Quadrant 3 respondents who hold favourable attitudes are likely to be self-regulating, only requiring monitoring and regular promotion of the issue and interventions. However, respondents in this quadrant with unfavourable attitudes may require enforcement strategies or the incorporation of alternative regulation. Quadrant 4 respondents with favourable attitudes will likely respond to regular promotion of policy objectives, low level monitoring and regulation. Enforcement that increases the likelihood of detection and incentives for compliance are recommended for Quadrant 4 respondents with unfavourable attitudes.

Table 1: Potential policy responses for each I_3 Response Framework quadrant

Quadrant	Individual Response	Potential Policy Responses
Quadrant 1	Unwitting compliance or unwitting non-compliance	• Change involvement • Reduce compliance effort
Quadrant 2	Compliance	• Promotion
Quadrant 3	Compliance due to favourable attitudes	• Self-regulation • Monitoring • Promotion
	Non-compliance or compliance with conflict due to unfavourable attitudes	• Regulation • Alternative interventions • Enforcement
Quadrant 4	Compliance due to favourable attitudes	• Promotion • Monitoring • Regulation
	Non-compliance or compliance with outrage due to unfavourable attitudes	• Enforcement • Incentives

Source: Modified from (Murdoch et al., 2006).

The I_3 Response Framework has been tested by application in the state of Victoria, Australia and in the Waikato region, New Zealand. Policy issues investigated have included zoning classification for the grapevine pest *Phylloxera* in the Grampians and Pyrenees Wine Regions in Victoria, Australia (Murdoch et al., 2006) ; non-compliance with effluent regulations by dairy farmers in the Waikato Region, New Zealand (Davies, Kaine, & Lourey, 2007); and management of nutrients in the Macalister Irrigation District, Gippsland, Victoria, Australia (Kaine et al., 2008).

This study takes the I_3 Response Framework beyond its Australian and New Zealand origins and tests the robustness of the concept in an English agricultural setting. Reported

here are the preliminary results from the dairy sector involvement with water quality and the slurry[9] storage capacity intervention, which form part of the NPPR2008.[10]

The Nitrate Pollution Prevention Regulations 2008

The NPPR2008 are to be enforced within Nitrate Vulnerable Zones (NVZs) as newly designated in 2008. While the NPPR 2008 substantially increased the requirements imposed upon farmers within NVZs, at the same time the zones themselves were altered and extended from 55% to 70% of England (ADAS, 2007). The NPPR2008 are likely to have substantial impacts across English Agriculture, particularly for livestock farmers who will be most affected in terms of the changes required to current farming practices relating to the storage and disposal of farm yard manure and slurry. The NPPR 2008 requirements include:

- Limitations on applications of organic and manufactured nitrogen to grasslands and crops;
- Controlling the mechanised spreading of nitrogen fertiliser;
- Closed periods for application of both manufactured and organic nitrogen fertiliser;
- Requirements for storage capacity for organic manure/slurry.

The latter requirements form the focus of the study reported here, the objective of which was to establish a contextual framework for dairy farmers within the Derwent Catchment within which to address the issue of involvement with slurry storage.

METHODS

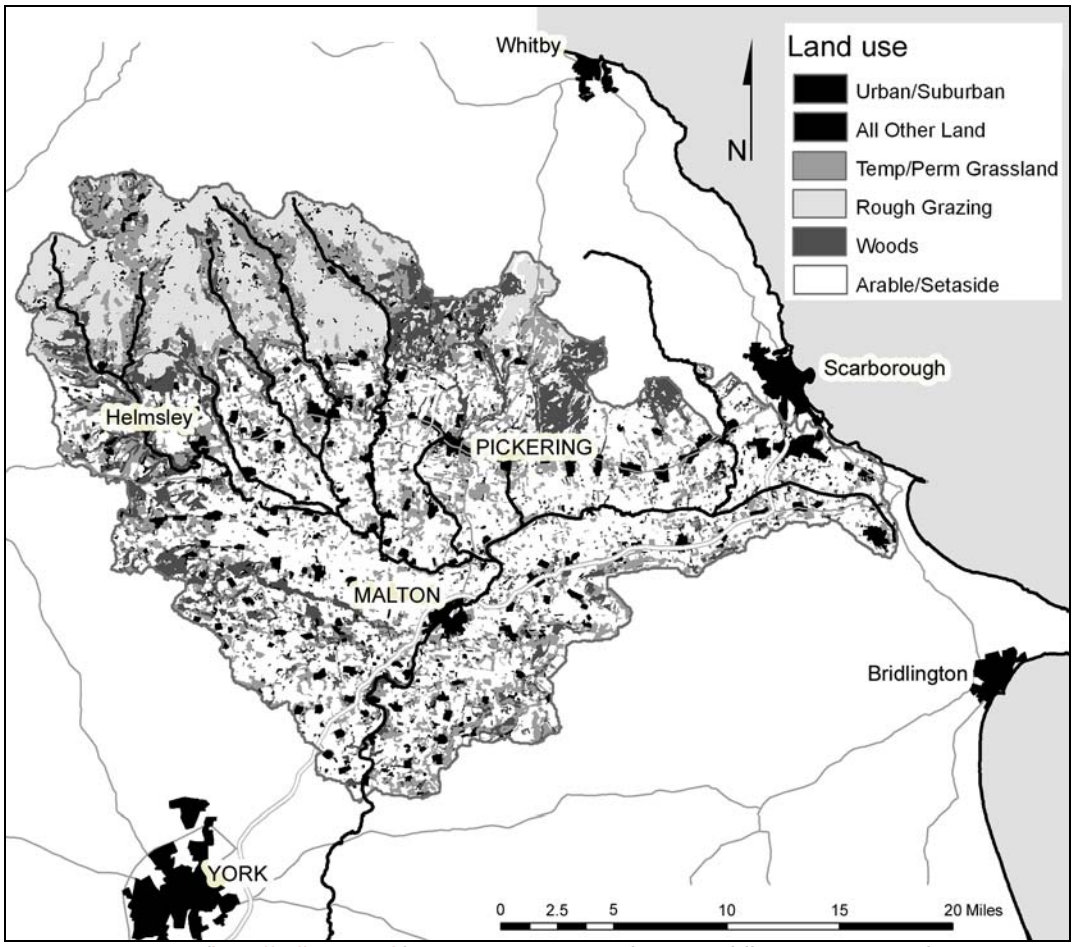
The study focused on dairy farmers in and around the Derwent catchment[11], Yorkshire, England (Figure 2). The Derwent catchment was chosen as offering good representation of the farm types and had been the focus are for previous studies on the impact of the Water Framework Directive (Fezzi et al., 2008a; Fezzi, Rigby, Bateman, Hadley, & Posen, 2008b). Much of the study area had entered the NVZ designated areas in 2008, and had areas within NVZs previously.

[9] Slurry is defined by Defra as 'excreta produced by livestock (other than poultry) while in a yard or building, including any bedding, rainwater and washings mixed with it), that has a consistency that allows it to be pumped or discharged by gravity. The liquid fraction of separated slurry is also defined as slurry.' (Defra, 2008a)

[10] NPPR2008, Part 7 (34).

[11] Three dairy farmers in the Humber catchment were also interviewed, in areas immediately adjacent to the Derwent catchment to extend representation of soil types.

Figure 2: The Derwent catchment and its sub-catchments



Sources: EDINA, (http://edina.ac.uk), UKBORDERS and OS Meridian 2, 1:50000 data sets © Crown Copyright and Land Cover Map 2000 from the Centre for Ecology and Hydrology.

In this study the interviewing was designed as a two-part process. The initial interviews were designed to gather contextual information about the dairy farming (context interviews). The second set of interviews (policy interviews) was designed to gather information on farmer involvement in the issue of water quality and the policy intervention – which included slurry storage, farm yard manure practices, closed periods for applying slurry and manufactured nitrogen and restrictions on the use of nitrogen.

Context interviews

To identify key themes in the farming context it was important to ensure a broad range of types of farming operations were covered. Input was sought from agri-business professionals and academics. The interviewees were selected using a combination of snowballing technique and purposive sampling (Patton, 1991), the latter to ensure that all relevant contexts were included, for example covering differing soil types, farm sizes and tenancy types (Murdoch et al., 2006).

The semi-structured nature of the interview process began with broad questioning, enabling the interviewer to gain an overview of the individual business. During the interview questions were asked by both interviewers and responses recorded manually. Laddering was used by the interviewers to explore the reasoning behind decision-making about which practices were (or weren't) used in the farm business decision making (Grunert & Grunert, 1995). The records were analysed using case analysis to assist in determining the relevant contexts for the second stage of the interview process – the policy interviews (Patton, 1991).

Policy interviews

The policy interviews were designed to measure the level of involvement with the issue (water quality) and the intervention (NPPR2008), specifically Part 7 of the regulation, which requires that:

> *If you keep livestock on your farm… you must provide, by the 1 January 2012, at least six months' storage capacity for poultry manures and pig slurry, and at least five months for slurry from other types of livestock.*

In addition to the above, storage capacity must allow for rainfall and wash water, with deductions for slurry exported and application to land with low risk of run-off. For farmers in previously designated NVZs (1996 or 2002), calculations for storage capacity must to be completed and recorded by 30 April 2009, while for those in NVZs designated in 2008, calculations have to be completed by 30 April 2010 (Defra, 2008a).

Dairy farmers were interviewed in relation to farming practices with respect to the issue of water quality and the NPPR2008 interventions. Interviewees were selected using the snowball technique and purposive sampling, the latter to ensure that all relevant contexts were included, for example covering differing soil types, farm sizes and tenancy types (Murdoch et al., 2006). The size of the sample was defined by the convergent interviewing process, whereby interviewing was continued until consistently recurring patterns and themes were identified (Dick, 1998).

The convergent interviewing technique involves comparing themes that emerge from interviews and where there is agreement looking for difference in subsequent interviews, while in areas of disagreement probing for explanations (Dick, 1998). Interviewing continues until convergence is achieved, that is, when new differences fail to emerge and all identified differences can be explained. Again laddering was used to follow the reasoning of interviewees and ensure a clear understanding of decision making (Grunert & Grunert, 1995). As with the context interviews, both interviewers participated in the questioning and manual recording of responses during the interview. Results were recorded in a database immediately following the interview for later cross case and case analysis.

Both the sets of interviews were piloted with staff in the Rural Business Research Unit at the Askham Bryan Agricultural College to ensure clarity of purpose and use of appropriate terminology.

RESULTS

Farming Context

Based on the analysis of topics focussed on by the four dairy farmer context interview and the subsequent 14 policy interviews, five themes were identified as representing an high involvement in farm management, with farmers referring to these as relevant in their decision making and developing of strategies to manage risk in relation to slurry storage capacity and slurry management (Table 2).

Table 2: Themes consistent in dairy farmer interviews in the Derwent catchment in 2009

Theme	Parameters
Planning	Long term accommodating change vs short term reactive to change
Succession	Farmer age, succession viability i.e. children interested/not interested in farming.
Farming focus	Animal (stock type, large vs small animal) or plant (arable, crop type)
Finance	Profitability, income, subsidies, debt
Soil	Quality (type – options) (improving vs mining)

A focus on long term planning was a feature of interviews with farmers who expressed a long term commitment to dairy farming. Those farmers talking about the importance of long term planning for them in response to slurry management –

- The last 6 years we expected this sort of change [to increasing slurry storage].
- [We will make the changes to slurry storage] big enough so we can increase production in the future - not just meeting current[slurry storage] targets.

Succession was very important to many of the farmers interviewed. Three of the farmers were the third generation on the same farm, two the second generation, and one the first generation. Issues of succession played a part in the decisions about how to proceed with slurry storage –

- Our daughter's not interested in farming - just saw us floggin' [struggling to make a profit from farming] really. [We] don't want debt at this age.
- If I'd had a son really keen to follow me it would be a different story…

Farmers identified themselves as either livestock farmers, with a strong interest in stock welfare, appearance and production, or as arable farmers. This limited their choices in regard to how they might respond to the slurry storage capacity regulation (which included changing farming types) –

- If not cows would [I'd] probably sell up completely... Don't know anything else – don't think I could make it pay.
- I'm a grass farmer not an arable farmer. I don't like machinery. I spend all day with animals not machinery.

The high costs associated with additional slurry storage capacity, and the ability to finance it in the long term, along with managing other operating costs in an uncertain market were a concern to most dairy farmers.

- *If we knew we were going to get paid a reasonable amount each year, putting £100,000 into slurry storage would be neither here nor there…*
- *With the way our dairy system works, completely at the mercy of the supermarkets, you wouldn't be keen to borrow a lot of money to put in [storage].*

For the farmers interviewed, their soil type limited options for changing farming type, or in developing strategies for managing risk within dairying, for example, ability to grow crops. The value of slurry as a fertiliser is well recognised by the farmers interviewed –

- *Can't half see which field I've been in [by the grass growth afterwards].*
- *I can see the difference the slurry makes on the grass [growth].*

The contextual themes were revisited and confirmed in the subsequent policy interviews.

Policy Interviews

Policy interviews were conducted with 14 dairy farmers. Farm sizes ranged from 150 to 650 acres (68 to 295 hectares), on land that ranged from predominantly flat to that which was rolling with some slopes more than 12 degrees. Twelve of the farms were either solely dairy breeding replacements by artificial insemination or using their own bull or dairy complemented by the raising the young stock born on the farm as store cattle or finishers. Two farms had additional cattle or sheep on the farm. For all farms the main income came from the dairy operation. All farms supplemented the cow's diet with some form of imported feed ('buffer') to manage feed deficits and maintain milk production. This was sourced by cost and proximity. The bulk of the cow diet in all cases was produced on farm in the form of varying proportions of cereal (predominantly winter wheat, winter barley with some maize) and grass silage. The range of bulk feed was from predominantly cereal to all grass and grass silage. Cow housing was either in stalls or pens and the time that the stock was under cover ranged from 5 - 12 months in a year. Cows were bedded indoors in barn systems or in cubicles, the former requiring straw which was 'bedded up' daily, while the cubicle systems used either straw, or a sawdust/straw mix. The barns and cubicles were cleaned out ('mucked out') every three to five weeks. Half the farmers interviewed were on land that was predominantly surface water Gley Soils characterised as formed over permeable materials as clayey or loamy clay mottled by periodic waterlogging by a fluctuating ground water table (Cranfield University, 2009). These were termed locally as 'heavy land' or 'man's land'. The other half of farmers interviewed were on land that was predominantly Brown Soils ranging from sandy to loamy and referred locally as 'light soils' (Cranfield University, 2009), or in North Yorkshire terms, 'lad's land'.

The farmers interviewed were either owner-operators or held long term tenancy agreements (mostly three generational agreements), with most farmers having additional acreages under shorter term agreements, ranging from annual to 10 year contracts.

Systems for managing slurry included storage included collection yards, tanks and lagoons. Capacity ranged from a few days to sufficient for five to six months. Lagoons were either clay lined, plastic lined, or unlined. One lagoon had a concrete base and clay sides. Farmers also operated systems using straw to convert slurry into farm yard manure (FYM), exported slurry or traded it with neighbours for straw. In several cases separators or weeping wall systems were used to reduce the storage capacity required for slurry. Rainwater entering storage systems was seen by many farmers to be a barrier to achieving better results with their current storage capacity.

The frequency and timing of spreading slurry was wholly dependent on slurry storage capacity, farmers with little slurry capacity having limited choice about when to spread. Slurry was dispersed onto paddocks by tractor-drawn spreader tanker on farms with little storage capacity, while farms with larger capacity generally used contractors with umbilical systems, or bigger tankers. Spreading when frosty to prevent rutting of the paddocks was a common theme.

- Only time you can go on land [with equipment] in winter is when it's frosty.
- I need to apply when frosted otherwise I can't get the tractor on to the paddocks.

The umbilical system – dispersing slurry using a single tractor on low pressure tyres with a spray system towing a hose connected to a pump sited at the slurry store – is gaining favour for spreading slurry, because of the lower impact of the machinery on the soils. Other systems used for spreading include spraying from the farm slurry wagon (pulled by farm tractor), and spreading by contractor with similar equipment. Access can be an issue for getting heavy machinery onto the fields without damaging the soil.

Issue Involvement

Quadrant placement – the issue (water quality)
From the interviews, all individuals were assessed as having low involvement with the issue of water quality. Some questioned whether water quality was an issue that needed addressing, and many farmers believed that it was already improving, so no more regulation was necessary. There was general agreement that farming was being unjustly singled out –

- Is water such a big issue?
- …We do what we're supposed to do. We don't spread muck [slurry] near [rivers].
- I don't think that farmers are 100% of why we have a water problem…there's an awful lot of people live on this little island [England] that tend to live in urban areas…'
- Lampreys [fish] come up the river. They only come to where the rivers are really clean. Don't know why they put an NVZ here.

Cross-case analysis placed all farmers interviewed in Quadrants 1 and 4 of the I_3 Response Framework, reflecting little or no involvement in the issue of water quality in the context of their business.

Intervention involvement

The intervention being slurry storage regulations within the NPPR2008.

Low issue involvement, low intervention involvement
Individuals placed in Quadrant 1 were assessed to have low involvement with both the issue and the intervention.

Low involvement was characterised by little knowledge of the scope of the NPPR2008 regulation or how it might affect their business. Some of these farmers were previously in the 2002 NVZs, and had not given much consideration to the changes with the NPPR2008. They were aware they needed to reduce slurry or increase storage, but had invested neither time nor effort investigating options for their own farm situations.

Farmers within this group had between a few days and two months' slurry storage capacity. During the interviews none of these farmers described attending meetings, investigating options, or considering how they might manage slurry into the future, to meet the new regulations.

One farmer in this group said he had firm plans to exit the industry within the next year. While the need to install more slurry storage capacity as a result of the zoning was not the major driver for this decision, it had contributed to the timing of the decision.

Low issue involvement, high intervention involvement
As with those placed in Quadrant 1, farmers in Quadrant 4 did not see water quality as an issue that had relevance to them.

Farmers in this group had between 2-3 days to five months slurry storage capacity. Most of the farmers were in the newly designated NVZs (2008), while one farmer had been in a NVZ since 2002 and had had an inspection on his farm, and two others described their farms as being 'half in and half out' prior to the 2008 boundary changes, but now were wholly in the NVZs.

All the farmers placed within Quadrant 4 had investigated various options for reducing slurry or increasing storage that would work in their particular farm situation, consistent with high involvement (Assael, 1998). The range of options included increasing storage capacity directly, reducing slurry through exporting off the farm, reducing slurry by importing straw and converting animal faecal matter to farm yard manure.

While all farmers interviewed described positive benefits associated with applying slurry to the land, one farmer in the group described positive net benefits from the regulation,

associated with the ability to store the larger quantity of slurry and therefore was able to apply it to the land when he considered it was ready by recording daily soil temperatures.

- I am saving £30-40,000 [a year] in work - labour, machinery and fertiliser, [putting in slurry storage is] paying for itself in 2 years.

The closed periods for slurry disposal imposed by NPPR2008 are set by dates rather than by soil temperatures and was seen to detract somewhat from the benefits for farmers on sandy or shallow soils-

- …I can't put slurry on at back end [autumn] then grass is not so strong going into winter... [I] expect to have to reseed again because of this.
- [It's] warmer …in October and November than in April, but we can't put fertiliser in fields in the back end [autumn]'

Individuals perceiving positive net benefits are likely to be self-regulating, requiring only promotion of the regulation and monitoring (Murdoch et al., Unpublished a).

Other farmers in Quadrant 4 described investigating options for their specific farm situation. However, these farmers considered the regulatory requirement would result in a net cost to their farming operation. Options under consideration by these farmers included:

- Increasing slurry storage capacity
- Reducing cow numbers to fit current slurry storage capacity
- Exporting slurry
- Implementing straw systems to enable the slurry to be disposed of as farm yard manure

Increasing storage was a viable option if the farmers saw dairy farming as a long term investment for themselves or their family, and were able to consider increasing debt levels.

- With the way our [English] dairy system [market] works, completely at the mercy of the supermarkets, you wouldn't be keen to borrow a lot of money to put in [slurry storage].
- … if you put a slurry store in now for £80,000 you'd stay in [the dairy industry]

However, some farmers were considering reducing livestock numbers to reduce slurry and enable them to use their current storage system to comply with the regulation.

- Only options are to reduce the cow numbers or to get rid of them altogether…
- …so would keep less cows…

Farmers in Quadrant 4, with higher perceived net costs, are either likely not to comply or to comply with outrage, possibly seeking to influence the general public in support of

their case (Murdoch, Bewsell, Lourey, & Kaine, Unpublished). However, in the case of the farmers interviewed, they didn't have an expectation of public supports –

- Blaggin' [criticising] farmers in England is a national hobby.
-… [Putting in a lagoon] - That would really go down well with the villagers. When we put slurry on they're complaining that it smells.

DISCUSSION

Dairy farmer involvement with the issue of water quality in the Derwent catchment was consistently low. However, statements from farmers interviewed suggested that some farmers saw themselves as environmentally aware, with farming contributing positively to the environment -

- [There was] a bird survey - none over the road [in the National Park], but lots of birds of many varieties here [on the farm].
- I think half the time no-ones ever counted these… birds…we actually feed them three times a week [spreading the slurry].
- [There's a] spring near the house… [I] try to keep it clean, [there are] frogs and newts in it.

It may be that disparity exists between the Department for the Environment and Rural Affair's (Defra) concept of water quality based on reduced nitrate pollution and that of farmers who would appear to have a different view of environmental quality based on their interpretation of visual evidence on their land. Comments about numbers and diversity of bird species and the role of habitat and predation were common and interpreted that farmers were involved in their working environment. However, farmers comments along the lines that the drains (tile drains) had never been seen to run brown was interpreted that a visual association between the colour of the effluent from slurry spread on paddocks and the presence of nitrates in drainage water may not be one and the same thing. Those farmers that had taken the trouble to have their surface and ground water tested reported no evidence of nitrates in these water bodies and their contribution to the debate as to farmers' responsibility for nitrate pollution of water bodies may appear to other farmers as more credible than that of Defra.

As a policy response to low issue – low intervention involvement, Murdoch et al. (2006) suggests linking the issue to a subject that is more involving – the new subject would have to be highly involving and relevant, and leading to favourable attitudes. With farmers in Quadrant 1 of the I_3 Response Framework, it may be appropriate to link their slurry application to soil quality enabling farmers to relate directly to benefits such as improved soil structure and increased populations of earthworms that might accrue from better management of slurry. From the farmer interviews undertaken for this study it was clear that the issue of soil compaction (poaching), particularly the detrimental effects on soil structure, drainage and productivity were well understood. This understanding could be used as a basis to promote a wider concept of soil health leading to better soil quality.

For farmers in Quadrant 1 cross case analysis revealed very low levels of investigation, little commitment to long term planning/succession and insecurity with respect to their future in the dairy industry. Farmers in this group had considered exiting the industry in the past twelve months. Two of the above farmers had been in a NVZ designated area since 2002 and possibly a degree of complacency existed as to the resolve of Defra to take the nitrate policy to regulation. It may be that given that storage capacity does not have to be in place until 1 January 2012, farmer's existing knowledge of the regulation, and the linkage to Single Farm Payments (Defra, 2002c), there is good reason to expect that those in Quadrant 1 who do not move out of the industry are likely to invest more time and effort and increase their personal involvement over the next three years.[12]

A range of responses to the intervention were being considered by farmers in Quadrant 4 in part dictated by the availability of material resources. As one of the alternatives to increasing slurry storage capacity, an increased number of straw-based systems are likely to put more pressure on this resource, particularly in wet autumns. However, those farmers with adequate storage were looking to move away from straw systems to sand or sawdust because of current issues around obtaining sufficient quantities of straw at reasonable prices.

- [I get] straw from neighbour – muck [slurry] for straw arrangement - works quite well except he still insists on charging me for the straw…
- Straw, [I] buy off arable guys towards Malton. This year [we had] problems because of [wet autumn] weather…
-Getting hard to get hold of straw so we're thinking of going to a sand system...benefits in health...cleaner...less disease spread

A possible policy response for farmers in Quadrant 4 who perceive higher costs than benefits with the regulation, may be the provision of incentives. In some areas of the United Kingdom farmers are being assisted to comply with the NPPR2008 regulations, for example Scotland (Scottish Government, 2008). However, in England Defra has not made incentives available to farmers for this, although some funding is available in priority catchments through Catchment Sensitive Farming initiatives for projects that decrease diffuse pollution, and some farmers may be eligible for this.

In England Defra has linked the regulation to the Single Payment Scheme, where failure to comply with the new rules could result in deductions from the Single Farm Payment (Defra, 2002c). Based on the Farm Business Survey, in 2007/08 the Single Farm Payment to Yorkshire dairy farmers made up an average of 41% of income (Defra, 2008b), making it less likely a farmer would openly flout the regulation, provided the risk of being caught and penalised was seen as sufficiently high. A cost to implementing the policy in this way will be ensuring adequate monitoring and enforcement.

[12] Although NVZ record keeping required farmers in newly designated NVZs to record the volume of slurry produced by anticipated stock during the storage period by 1 April 2009, along with storage capacity required and existing storage capacity (Defra, 2008a).

In 2013 the Single Payment Scheme is due to be renegotiated, and is anticipated by some to come to an end not too long after that time (Gallent, Juntti, Kidd, & Shaw, 2008). If this were the case, then Defra may have to reconsider replacing what may prove to be a very effective tool with some other form of incentive for newcomers to the industry, or those who have not yet complied.

Slurry as a tradable commodity has emerged as dairy farmers better appreciate its value as a fertiliser especially as the costs of manufactured fertiliser rise. Trading may take the form of barter, for example for straw, or in one case the investment in very large storage capacity to in part enable a market off farm to be developed.

It would appear that for simplicity the policy intervention NPPR2008 has been designed as a one size fits all parcel of regulations. The regulations closely tie slurry storage to application closed periods. The capacity for storage is to ensure that a (dairy) farmer does not have to apply slurry during winter months when soil temperatures are deemed to be too low for plant growth hence little for interception of nitrates before they enter water bodies. Accommodation for geographical changes in annual temperatures with respect to latitude has not been allowed, neither has the possible impact of climate warming.

An aspect of involvement currently being explored is source (Murdoch, Lourey, Kaine, & Johnson, Unpublished b). Laurent and Kapferer (1985) identified five sources of involvement being importance (perceived importance) risk importance (the perceived importance of negative consequences of a wrong decision), risk probability (the subjective probability of a wrong decision), sign (perceived value placed on social status) and hedonic (perceived value placed on emotional involvement). The intention is to discover whether identifying and quantifying the source of involvement may be useful in confirming quadrant placement, and understanding how policy might be better targeted to groups based on their sources of involvement.

CONCLUSIONS

This study shows the I_3 Response Framework has the potential to enable better targeting of policy resources by identifying the likely range of dairy farmer responses to the NVZ regulation dictating the capacity of slurry storage. By determining the level of farmer involvement in the issue of water quality and in the regulation of slurry storage, policy actions can be identified that should result in greater farmer acceptance.

Lack of farmer involvement in the issue of water quality reflects that the relevance of the regulation for their business activities hasn't been communicated to them, or may not exist. Changing involvement through the linkage of the regulation with issues that are important to farmers has the potential to increase compliance.

The general depth of knowledge and the energy and resources expended by farmers seeking information on the intervention of slurry storage reflects general high levels of involvement with the intervention. In most cases the farmer perception was that the

regulation could only be complied with at a net cost which would result in compliance with outrage or non-compliance. The I_3 Response Framework would suggest that incentives, or severe penalties and enforcement would be required to achieve the policy objective. However, with the link to the Single Payment Scheme in place, the threat of deductions for non-compliance may prove an adequate motivator until 2012.

Further testing of the robustness of the methodology is required to determine the impact of regional differences in farm practice. The current project of which this paper reports some initial results is focused on the Derwent catchment in North Yorkshire.

The I_3 Response Framework is useful in predicting the behavioural responses of individuals to regulation, and can be used to identify strategies to enhance compliance, providing more efficient targeting of resources.

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