

Reaping the rewards of learning within agricultural knowledge systems: An account of a PhD learning system

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Abstract: *Despite the existence and application of mandatory agri-environmental policy for many decades, significant environmental sustainability problems remain attributable to the agricultural sector. Participatory types of extension practices are believed to have a potential to enable extension organisations to enhance the supports provided to farmers to help meet the requirements and objectives of these policies. To test this proposition, the PhD researcher used a learning systems approach for exploring the interplay between farmer subjectivities, the European Union's policy of cross compliance and the extension practices of Teagasc, the Irish Agriculture and Food Development Authority.*

Three learning sub-systems were employed in the investigation. The first used the principles of Participatory Action Research for revealing stakeholders' perceptions of Teagasc's cross compliance extension service. This process resulted in the attainment of rich insights about extension practices, however it also revealed that a significant number of farmers were experiencing socio-cultural difficulties with the application and enforcement of cross compliance. To better understand the implications of these subjectivities, a second sub-system was created to learn about farmers' experiences of the policy. This process surfaced diverse insights about farmers' personal experiences of cross compliance. A final sub-system employed systems thinking and practice for appraising the utility of the learning arising from the previous sub-systems for improving interactions between farmers, extension organisations and cross compliance.

The combined findings of the thesis indicate that there is considerable potential for extension organisations to use participatory practices for developing rich understandings of farmers' preferences for mandatory agri-environmental policy and its related extension practices. However, a limitation in realising participant preferences is that extension organisations appear to have little influence over the application and enforcement of mandatory agri-environmental policy. Overcoming this participatory barrier will require sustained collective learning targeted at understanding how stakeholders can work together to develop agri-environmental policies that are socially, financially and environmentally sustainable.

This paper explores how this 'sustained collective learning' may be realised taking a specific account of the learnings developed within and following the completion of the PhD Learning System. The insights elucidated will be of interest to scholars and extension practitioners involved in similar learning endeavours.

Keywords: Knowledge Systems, PhD Learning System, Extension Services, Cross Compliance, Learning, Rewards

Introduction

This paper presents the opportunities and challenges of using a learning systems approach for exploring how to improve and sustain learning interactions between farmers, extension

organisations and mandatory types of agri-environmental policy. It specifically focuses on a four-year doctoral study entitled ‘*Learning how to inform extension practice related to mandatory agri-environmental policy*’ which was undertaken by the first author and supervised by the remaining authors (Seale, 2017). This research process is known as the PhD Learning System. It involved the use of systems thinking as a means to theoretically ground praxis and research actions. Specifically, ideas from Soft Systems Methodology (SSM) including the use of learning cycles as epistemological constructs for exploring an identified problematic situation and how it might be improved were utilised (Checkland, 1981; Checkland and Poulter, 2010). The research approach was participatory in nature with over 200 active participants including 198 farmers, 26 non-farmer stakeholders, 20 farm advisors, two specialist advisors, the PhD researcher and her 5 doctoral supervisors involved in the learning system.

Three sub-questions were investigated. These were:

- i. How can using the principles of Participatory Action Research (PAR) strive to provide stakeholders with meaningful opportunities to contribute to a conversation about cross compliance extension practice?
- ii. What are the implications of using narrative inquiry to reveal farmers’ subjective experiences of cross compliance policy for extension practice?
- iii. What can multiple-loop learning add to understandings of the efficacy, efficiency and effectiveness of these PAR and narrative inquiry interventions?

These sub-questions, following the SSM logic, were determined as learning cycles and are referred to in this paper as learning sub-systems. Combined, they informed an overall PhD Learning System. For clarity, Figure 1 provides a visual model of this system of inquiry.

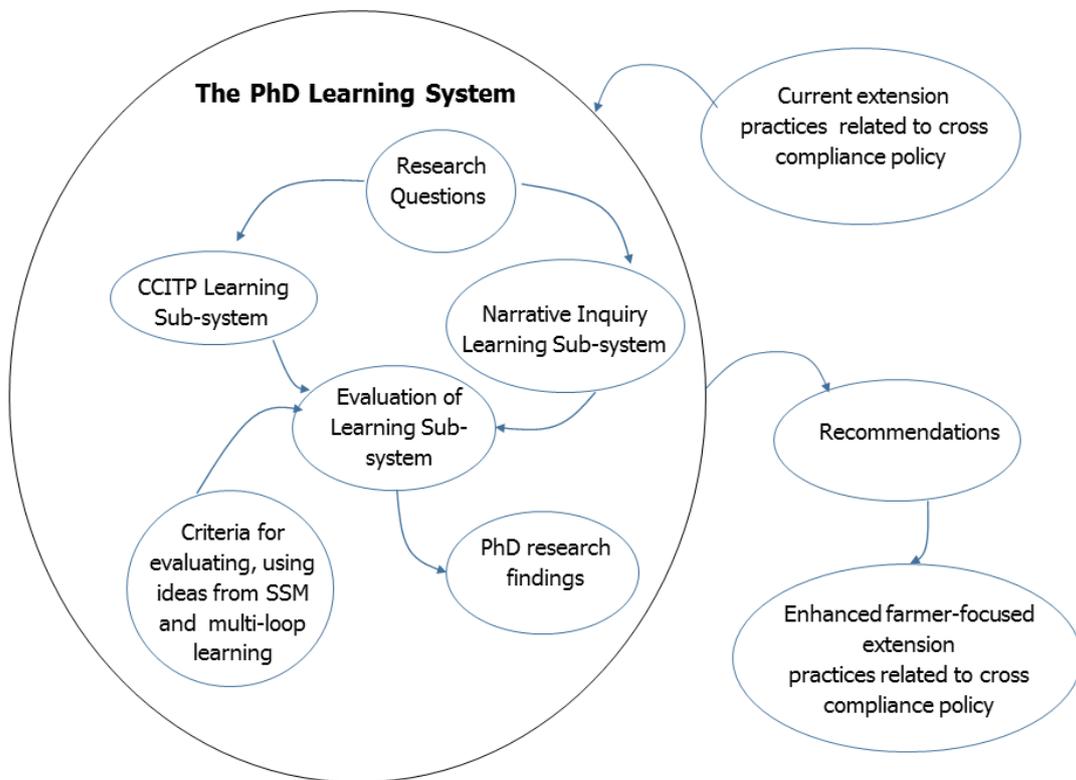


Figure 1: A conceptual model of the PhD Learning System

In the remainder of this paper, we will provide a comprehensive account of the approach and its outcomes. We briefly describe the context of the study, followed by a methodology section which details the use of the learning systems approach as a system for integrating multiple methods of inquiry. We next outline the main results in terms of their contribution to the context and the methodology. This section is followed by a reflection on what this learning might mean to farmers, extension services and researchers.

The study context: extension services supporting mandatory agri-environmental policy

Mandatory agri-environmental policy seeks to embed more environmentally sustainable types of production in the agriculture sector. However, despite the longstanding application of such policies in Ireland and across the EU, significant environmental sustainability problems remain. Extension organisations have a role in improving this situation particularly in mediating between the aims of policy and the practices and subjectivities of farmers (Juntti and Potter, 2002; RELU, 2012). In particular, there is a significant potential for extension organisations to use participatory practices for improving their understandings of what farmers consider necessary for the realisation of ‘sustainable agriculture’ (Pretty, 1995; Cerf *et al.*, 2000; Ison and Russell, 2000).

The EU policy of cross compliance was the particular focus of the PhD Learning System. This policy was introduced with the enactment of EC Regulation 1782/2003. It formally created a direct relationship between regulatory compliance and financial remuneration under the Common Agriculture Policy’s Basic Payment Scheme (BPS). The Department of Agriculture, Food and Marine (DAFM) undertakes the primary application and enforcement of the policy in the agriculture sector of the Republic of Ireland. This sector has approximately 139,860 farms, with an average size of 32.7 hectares. Available farmland is primarily used for pasture, hay, silage, and rough grazing, although there are also parcels allocated to tillage, forestry and other crop types (CSO, 2012).

Considerable claims are presented about the Irish Agricultural Sector as a ‘green’ sustainable food producer [cf. Food Harvest 2020 (DAFM, 2010) and Food Wise 2025 (DAFM, 2015b)]. While it is accepted that certain farming practices can have positive impacts on species diversity and ecosystem services (O’Rourke *et al.*, 2012, Maher *et al.*, 2015), it is apparent that significant biodiversity and water quality problems remain attributable to the sector (Copland, 2015; Daly and Deakin, 2015). Moreover, since the inception of cross compliance, the DAFM has consistently detected non-compliance issues on Irish farms (Murphy, 2013). Recent figures published by Agriland (2015) show that of 1,368 cross compliance inspections undertaken by the DAFM in 2014, 528 BPS recipients were found to be in breach of their requirements and received a monetary penalty or sanction, 490 inspections revealed a ‘minor breach’ with no monetary sanction applied, while 350 inspections did not result in the detection of a breach.

Little research has been undertaken to understand Irish farmers’ perceptions of this policy. An exception is McCormack (2012), who determined that a majority of the farmers surveyed (71%) were accepting of the conditionality between adherence to cross compliance requirements and payment through the BPS. Farmers were reported to be more likely to agree with the conditionality if they had previous experience of being involved in agri-environmental schemes, had higher education levels or were farming marginal land types. McCormack (2012) further noted that farmers were more likely to disagree with the conditionality if they were farming intensively, farming larger farms or when farming ‘better’ quality land. This research is notable as it highlights an anomaly between reported levels of acceptance and a continued high detection of non-compliances at farm inspections.

The largest provider of cross compliance support to farmers in the Republic of Ireland is Teagasc. This organisation forms a substantial component of the Irish Agricultural Knowledge and Innovation System (AKIS) with tripartite advisory, research and education divisions operating nationwide. An overview of this structure from Boyle (2014) is provided in Figure 2.

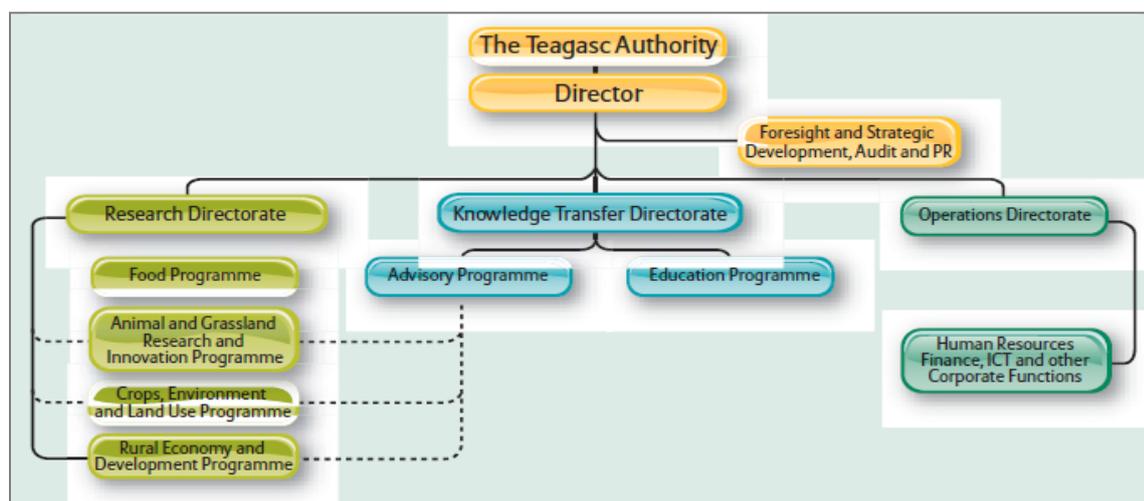


Figure 2: An impressionistic view of Teagasc's Research, Operations and Knowledge Transfer (KT) Directorates in the Irish AKIS

The cross compliance extension services provided by Teagasc include short educational courses, public meetings and dedicated discussion group meetings. Hyde (2013) reports that these services seek to help farmers understand the requirements of the policy, improve their compliance rates, reduce their level of penalties, improve the sector's performance in relation to environmental protection and animal welfare, enhance traceability and food safety requirements and provide a significant contribution to Ireland's 'green' image. In 2013, Teagasc funded a MA post-graduate project to develop a handbook and an accompanying training module to familiarise farmers with the requirements of cross compliance. The project employed a farmer-centred approach to develop a support which would use less technical language and an interactive format to make the requirements of the policy more accessible to all farmers (McKenna, 2012). The process resulted in the development and publication of a handbook known as the *Cross Compliance Workbook* (Teagasc, 2013). The handbook was extensively promoted across Teagasc's Advisory Regions through existing discussion groups and specially organised short courses (Cross Compliance Training Module). Additionally, a specific "*Cross Compliance Fortnight*" was delivered in November 2013. This focussed extension event delivered at least one Cross Compliance Training Module in each of the 26 counties. According to Hyde (2013), at the various extension events there was a strong farmer demand for the handbook and the training module. A further indication of its popularity was the need to organise a second print run of the publication.

The *Cross Compliance Workbook* and its associated module was a primary focus of the first learning sub-system. In turn, the findings of this learning sub-system served to guide the PhD Learning System and its concern with informing extension practices related to mandatory agri-environmental policy.

The methodology: a system for integrating methods of inquiry

To achieve its goal of informing extension practices, the PhD Learning System (Figure 1) utilised the learning process approach of Korten (1980) to create a system for integrating the inquiry methods of action research, narrative inquiry and systems thinking. It made particular use of systems thinking as a means to theoretically ground praxis and research actions. Specifically, ideas from SSM were used to understand the challenges arising from the use of participatory approaches for informing extension practices related to cross compliance.

It was understood that there is a tension with using participatory forms of extension for improving the implementation and application of agri-environmental policy (Bruges and Smith, 2008). This tension relates to the original design of participatory approaches and its concern with facilitating communities to work towards their vision of change. In this sense, it was recognised that participatory approaches were not envisaged as a way for public institutions to ease policy application or as a methodology for purely academic research (Pain and Francis, 2003). The researchers respected this stance, however it was

nonetheless concluded that participatory and learning systems approaches appeared to offer a potential for providing a venue for a participatory discourse regarding how farmers may be better supported to engage with cross-compliance legislation.

To promote dialogical diversity in the learning system, Participatory Action Research (PAR) and the narrative inquiry methodology of the Biographic-Narrative Interpretive Method - BNIM (Wengraf, 2001) - were selected as the data collection approaches. These choices were made based upon an expectation that they would enable the participants to reveal in their own terms their particular perspectives on and experiences of cross compliance. It was anticipated that providing participants with such an opportunity would increase understandings of 'what there is' (Heron and Reason, 1997). Moreover, this participatory ethos signified concurrence with the logic of incorporating farmers' ways of knowing into research about farmers (Röling and Pretty, 1997; Ison and Russell, 2000; Bruce, 2013; Prager and McKee, 2015). Equally, actively seeking the perspectives of a range of non-farmer actors heeded Vanclay's (2004) advice against romanticising local knowledge as the primary solution for resolving all of the sustainability issues associated with the agricultural sector. These additional non-farmer actors included cross compliance enforcers, farm advisors and farming organisations.

The first method of inquiry utilised was PAR. This approach is affiliated with the wider action research genre. It purposefully sets out to enable a group of people, concerned about or affected by an issue, to come together to take a lead role in producing knowledge about the issue, with an explicit intention of using the knowledge arising to devise a more desirable situation (Smith *et al.*, 2010; Pain *et al.*, 2012). The approach was taken to guide collaboration between the participants and the researchers in the first learning sub-system which was known as the Cross Compliance Information and Training Project (CCITP). This system is referred to as the CCITP Learning Sub-system in Figure 1.

The research process of the CCITP Learning Sub-system was emergent and involved identifying, engaging and capturing a range of perceptions and preferences for cross compliance and its related extension practices with specific reference to the newly published *Cross Compliance Workbook*. Firstly, to understand who could and should be invited to participate in the CCITP, a period of stakeholder analysis was undertaken using a combination of methods from systems thinking and corporate project management. As well as SSM this involved power/interest classification models, the boundary categories and questions of Critical Systems Heuristics – CSH - (Ulrich and Reynolds, 2010), and diagramming techniques. This diverse approach was progressed in recognition of the need to explore and respect the many different framings associated with sustainability issues (High and Nemes, 2009).

Following the identification and prioritisation of potential participants, formal data collection was initiated. Two engagement approaches were progressed with the farming participants. These were face-to-face engagement with 621 farmers at 12 cross compliance extension events and the publication of an 'invitation to participate' in Teagasc's *Today's Farm* magazine. Additionally, formal research participation invitations were extended to 75 non-farming actors using the medium of emails and letters. The combined findings arising from this farmer and non-farmer engagement were analysed using a thematic analysis approach (Bryman, 2008). Once this process was completed, the results were summarised and circulated as a 'research update' to all stakeholders (both farmers and non-farmers) who had expressed an interest in learning about the results of the CCITP. The findings were also presented at nine seminars and conferences between 2012 and 2014. Arguably, academic dissemination is a normal requirement of a PhD research process, however it was purposefully pursued in the PhD Learning System for the additional imperatives of peer checking and the enabling of action (Pretty, 1995). Finally, towards the end of the first learning sub-system, two BNIM interviews were conducted with the specialist advisors who had worked with the PhD researcher in the progression of the study. These interviews sought to uncover and learn from the specialist advisors' experiences of participating in the CCITP.

The second learning sub-system (referred to as the Narrative Inquiry Learning Sub-system in Figure 1) was subsequently developed in response to the research findings of the CCITP

Learning Sub-system. In particular, this sub-system utilised BNIM as a way to surface and learn from more nuanced understandings of farmers' subjective experiences of cross compliance. BNIM was purposefully chosen for this task as the approach assumes that narrative expression is representative of the conscious concerns and unconscious cultural, societal, and individual pre-suppositions and processes of the participant (Lewis-Beck *et al.*, 2003). Moreover, as the interview technique involved in BNIM places the researcher within the role of active listener with 'control' of the interview scene ceded to the interviewee (Fenge *et al.*, 2010), it was considered that this approach would reduce the potential for the researcher to steer the research direction and conversation.

Five farm cases were invited to participate in the interviews from the pool of participants who had taken part in the first learning sub-system. The process involved an information-orientated case selection. This type of selection process is based upon the premise that information rich cases will offer useful and interesting information pertaining to the research question (Flyvbjerg, 2006). Two selection criteria were used: enterprise type and variation in attitude to cross compliance. The first criterion was chosen because while it can be said that farming is a heterogeneous activity determined by an array of physical, social, economic and cultural factors, there are at the same time, certain commonalities between enterprises. The second criterion related to the evidence arising in the first learning sub-system to suggest a variation between farmers in their attitudes towards the policy of cross compliance. The five cases selected were not considered to be representative of any particular enterprise or perspective towards cross compliance, rather the cases were deemed to provide interesting/paradigmatic accounts of farmers' experiences of cross compliance. Four of the farm cases were interviewed in their home while a fifth was conducted by phone at the request of the farmer. The interviews were recorded, transcribed and analysed using a thematic analysis approach.

The third and final learning sub-system (labelled as Evaluation of Learning Sub-system in Figure 1) involved the progression of a multi-loop learning approach for understanding the efficacy, efficiency and effectiveness of the PAR and BNIM research process for informing extension practices related to cross compliance. The approach involved separate evaluations of the learning sub-systems using the idea of measures of systems performance, specifically the SSM criteria of efficacy, efficiency and effectiveness (Checkland, 1981; Checkland and Poulter, 2010) and the CSH logic of unfolding and questioning the 'facts', values and boundary judgements of the research situation (Ulrich and Reynolds, 2010). It also involved drawing upon Collins *et al.* (2009) and Vickers (1983) conceptions of a 'learning system' as an epistemic device for providing a way of knowing or doing. The evaluations made specific reference to the PhD researcher's practice and her perceptions of this practice. This allowed for a consideration of '*what it is that she did when she did what she did*' (adapted from Ison, 2010). Moreover, the third learning sub-system took an account of Argyris and Schon's (1978) logic that if a research intervention is to realise meaningful changes, it must move beyond a basic querying of whether the research activities realised their objectives, to deeper questions about the goals, values, plans and rules of the research and its purpose(s).

Combined, these three learning sub-systems formed the over-arching PhD Learning System (Figure 1). The remainder of this paper will outline the learnings realised within and as a result of this system of inquiry.

Learning gained about informing extension practice related to mandatory agri-environmental policy

In this section, we examine each learning sub-system in a little detail. A more comprehensive account of the findings of the PhD Learning System and what they might mean to extension and policy are provided in Seale (2017).

a) The CCITP Learning Sub-System

This first learning sub-system provided a range of perspectives about the *Cross Compliance Workbook*, cross compliance extension practices and cross compliance policy itself. Overall, the majority of participants seemed to be supportive of the introduction of the handbook.

Indeed, its usefulness and ease of use was highlighted by one farmer who stated that: *“book very helpful, I am recently bereaved and stressed out with all I need to do, so book will guide me as to requirements needed”*. Several farmers expressed an intention to use the handbook. For example, one commented: *“looking forward to reading up your workbook and checking out with my farm records etc.”* While another noted already using the handbook: *“got this workbook at Open Day and working towards sorting out incompliant areas. The booklet is very helpful and very well explained”*.

Participants were also primarily appreciative of the associated cross compliance training module although some did provide recommendations as to how Teagasc could improve its overall cross compliance extension services. There were variations in the content of these suggestions however they mainly related to requests for additional support and information as presented in Table 1.

<ul style="list-style-type: none"> i. More regular cross compliance events to keep farmers up to date with legislative changes ii. More on farm help in relation to cross compliance from farm advisors iii. More information on farmer rights during and after cross compliance inspections iv. Need for specific cross compliance record-keeping courses v. Need for more information in relation to nitrates, phosphorous and soiled water
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Table 1: Farmer recommendations for improving extension services

In addition to these contributions on the handbook and cross compliance extension, approximately one third of the farming participants provided a commentary on the application and enforcement of cross compliance policy. These contributions encompassed a variety of sentiments including one farmer who reported that *“everything was all right”*; however, the majority of the contributions related to negative sentiments and experiences of stress, fear and anxiety when engaging with the application and enforcement of cross compliance. Table 2 provides a sample of the perspectives shared.

<p><i>“I feel there are endless amounts of new regulations and hassle, year after year, for no financial gain to the farmer, which leaves farming not worth the work and effort”</i></p> <p><i>“Find things very stressful”</i></p> <p><i>“Hearing and reading about cross compliance is both frightening and daunting.”</i></p> <p><i>“Have a huge fear factor. Have heard all the horror stories”</i></p>

Table 2: Farmer perspectives on cross compliance enforcement

While it is well reported that some farmers can experience difficulties with the application of cross compliance (DEFRA, 2009), it was not expected that so many participants would use

the engagement processes of the CCITP to relate their negative experiences of fear, stress and anxiety when engaging with the application and enforcement of the policy. The revealing of these issues would seem to suggest significant social sustainability issues with the policy whilst they also support suggestions that extension organisations often have insufficient understandings of the different social and cultural phenomena affecting farmer engagement with the advocated practices and policies of ‘sustainable agriculture’ (Vanclay, 1997).

In addition to comments about their personal experience of the policy, a number of participants also highlighted areas where they believed that the application of the policy could be improved. For instance, it was suggested that cross compliance enforcement should be pursued in a way which did not automatically mean that the farmer would receive penalties if a non-compliance issue was detected on their farm. Equally, other farmers reported that cross compliance enforcers should engage with farmers with the intention of making the logic behind cross compliance more apparent. It was felt that this approach could lead to improved relations between farmers and enforcers.

b) The Narrative Inquiry Learning Sub-system

The second learning sub-system sought to better understand farmers’ subjective experiences of the policy. While the number of cases was small, the learning sub-system revealed considerable heterogeneity in the ways in which farmers can experience cross compliance. Diverse opinions were expressed about the efficacy of the link between the BPS and cross compliance, whilst mixed perceptions were also related about the ‘realities’ of farming, farm administration and the interrelations between cross compliance and farm management practices. The participating farmers also offered a range of insights as to why non-compliances can happen. These included farm finance issues, farmers not being aware or convinced that a non-compliant activity has negative environmental consequences, perceived arbitrariness of certain farming practices promoted by cross compliance, and the inevitability of human error. Some of the farmers even alluded to a reality whereby even with the best of intentions of a farmer, a fully compliant status was not always possible. For example, one farmer related that: *“some days things get in a mess because you can’t keep on top of it”*, while another noted that farmers, like all people, could make mistakes and he felt that it was unfair to expect that they should always get everything right: *“it’s cracked really, it’s a double standard”*.

There was also significant evidence to suggest that the participants considered that farming was a stressful occupation. One participant in particular reported that his experiences with the regulatory authorities had affected him greatly on a personal level and that they had *“marked me in the sense that they put a fear into you, you know that kind of thing”*. Indeed, all of the farmers related concerns with the social sustainability aspects of the policy. Moreover, there was a sense that the participants believed that those involved in the development and application of cross compliance and other such agri-environmental policies often had only a limited awareness of the realities of farming life. One participant reported that he believed that the policy had been *“dreamed up by someone sitting in a comfortable office trying to think how we could make this thing better. They never stood in a sheep pen and pated a sheep [hooves] in their lives”*. This notion was further highlighted by another participant, who reported that while he believed that regulatory policies were necessary, he felt that policy actors should make a greater effort to devise pragmatic policies. He related that: *“we have to have regulations but they have to be sensible and I would expect the people who devise regulations to put time and effort into making them sensible and to making them as easy as possible”*.

It was also evident that improving farmer engagement with cross compliance will require more than increasing the provision of information as the participating farmers were generally aware of their requirements under cross compliance. A related observation was that the participating farmers seemed to experience cross compliance as a whole farm policy and needed to prioritise their tasks based on their understandings of what was the most pressing concern at that time. For example, it was evident that animal welfare is a priority management practice amongst the farmers. This was illustrated in the narrative of one

farmer who reported that *“if there is an animal needing attention out in the yard, she gets priority in my book. You know she is more important than paperwork”*.

Moreover, one farmer highlighted his relationship with his Teagasc advisor and he related that it is *“very beneficial to have a man like that to send in all my applications online”*. At the same time however, some of the participants reported that Teagasc could improve its extension practices, particularly in relation to the supports provided to those farmers, who for either social or financial reasons, can have difficulties with meeting the requirements of cross compliance. In this sense, it would appear sensible that Teagasc and any other organisations with an interest in improving the sectoral application of mandatory agri-environmental policy would prioritise the provision of additional supports to farmers experiencing difficulties with the financial and social costs of cross compliance. This action appears logical as the costs of cross compliance can be associated with the farmer’s ability to adhere to the requirements of the policy (DEFRA, 2009). It may even be reasonable to suggest that farmers who are determined by an enforcement authority to be in breach of cross compliance requirement would automatically be provided with extension support to develop a plan to rectify their compliance issue.

c) Evaluation of Learning Sub-system

The third learning sub-system sought to understand the efficacy, efficiency and effectiveness of the PAR and BNIM research processes for informing extension practices related to cross compliance. It considered the findings arising in terms of their usefulness for informing enhanced extension practices.

Regarding the first sub-system, the evaluations determined that this research process had created learning opportunities for Teagasc about farmer preferences for cross compliance and its related extension practices. The efficacy of the process can be measured from the specialist advisors’ accounts of the process in their BNIM interviews. These interviews revealed that both specialist advisors believed that they had developed a better understanding of farmers’ ways of knowing cross compliance as a result of their participation in the research process. Actions to support this claimed learning included the publication of Hyde’s (2014) article -*‘Getting set for on-farm inspections’* which was published in response to the many queries regarding the inspection process in the farmer-engagement phase of the CCITP Learning Sub System. Equally, it reveals the potential of a PAR informed research process for enabling real-time improvements. This outcome was affirmed by one of the specialist advisors who related that he considered that the research had been different to normal *“observational studies”* in that it was *“actually making changes or suggesting changes along the way”*. Moreover, the other advisor reported that the research approach had allowed *“for a more open discussion”* that revealed *“issues that we obviously didn’t think were as important, things such as the stress and the fear factor”*.

The specialist advisors also appeared to be satisfied with the learning arising from the CCITP extension programme for cross compliance requirements. Indeed, one of the specialists reported that *“I wanted us to get a deeper understanding of farmers views on cross compliance and certainly that has been met and it’s a question of how we can actually use that knowledge and insight to develop new programmes and it’s not just specific to cross compliance either its relevant to all of our programmes”*. It was however highlighted that resource issues would likely be a factor in realising participant preferences for improvements to cross compliance extension as *“we are pulled every which way”*. This is a key learning arising from the learning systems approach as while the findings of the first learning sub-system suggested significant scope and acceptance of the need for improvements within Teagasc, at the same time it was observed, as previously noted in the literature, that seeking to implement change in the context of large public institutions is difficult as institutional constraints will almost always apply (Coghlan and Brannick, 2014).

Moreover, while the specialist advisors were appreciative of the revealing of farmers’ subjectivities in relation to the policy of cross compliance, it was unclear as to what Teagasc or indeed any other extension organisations could do to improve this perceived problematic situation. Furthermore, it would appear that extension organisations like Teagasc may seek

to avoid becoming involved in sensitive issues such as trying to influence the application and enforcement of policy, because of a risk that their actions would become politicised. This fear was referenced by one specialist advisor who related that *“Teagasc would say that they won’t get involved in that political type of storm”*. This type of caution was previously reported by Hage *et al.* (2010) who found that scientific and policy actors are usually reluctant to become involved in situations where ‘political power-play’ may arise.

There were also perceived limitations with the practicalities of using a PAR approach for informing extension practices. In particular, one specialist advisor noted finding that the approach was *“hard to master”*, while the other reported that *“I guess it is the sort of project that because of the iterative nature of it, you are not sure where you are actually going to end up, that has its benefits but also has its challenges in terms of your ability to chart out where you are going”*.

Finally, there were some indications that the non-farmer actors had improved their understandings of the ways in which farmers can experience cross compliance as a result of the circulation of the research update. One farm advisor specifically noted that *“hopefully we advisors can learn from some of the farmers’ recommendations”*, while a cross compliance enforcer reported sharing the update with ground staff responsible for undertaking farm inspections. Conversely, due to a lack of empirical evidence, it was not possible to offer similar observations about what the practitioner and academic dissemination process might have achieved.

The second sub-system continued the learning process about cross compliance with the development of intimate accounts of the various social, economic, technical and environmental phenomena affecting farmer decision-making in relation to the policy. The insights arising provide diverse learning opportunities for Teagasc and other interested individuals and agencies with an interest in creating more socially sustainable types of agri-environmental policy.

It was considered that the application of a narrative inquiry approach for developing these accounts was significant, specifically the way it allows participants to reveal in their own terms and in their own words, their particular experiences of cross compliance. Moreover, the way in which BNIM asks the interviewee to lead the research conversation allows the participant’s perceptions and not those of the researcher to guide the development of insights, thus providing a more farmer focussed approach.

The establishment of a previous research rapport between the participants and the PhD researcher in the first learning sub-system was also determined as useful in that it allowed her to approach the participants directly and she was therefore not reliant on the farm advisors as an intermediary or gatekeeper for the second round of engagement. This helped protect the anonymity of the participants, whilst it also allowed them to raise extension issues without a fear of offending their advisor. A weakness of the second learning sub-system is that it could perhaps be suggested that the farmers interviewed had a pro-cross compliance bias due to their initial recruitment at cross compliance extension events.

Finally, the third-learning sub-system allowed the PhD researcher to undertake a fruitful and sustained reflection on the findings. This moved beyond simply reporting on the findings, as it also led to new ways of understanding the findings. A key learning arising was the first author’s praxis particularly in relation to her improved understanding of the context. For instance, at the start of the research process, she considered that improving farmers’ awareness of the requirements of cross compliance would lead to an improved application of the policy; however at the end of the process she discovered that the problematic situation is more complicated than this initial correlation. It was apparent for example that non-compliances are more often related to a farmer’s ability to pay for additional farm staff or farm infrastructural improvements than their knowledge of the requirements of the policy. This insight may account for the discrepancies between the reasonable level of farmer acceptance of the principle of cross compliance (McCormack, 2012) and the continued detection of non-compliances during farm inspections (Agriland, 2015). It also demonstrates a need for the development of more complex reasoning as to why non-compliances continue

to be detected. This process will require closer relationships between researchers, practitioners and context stakeholders and relates to previous recommendations from Vanclay (2004) and Bruce (2013) that to be effective agri-environmental knowledge will need to be integrated with production considerations.

The reflections of the third learning sub-system also revealed difficulties with the efficacy of using participatory/learning approaches. Specifically, as Argyris and Schön (1989) note, participatory researchers are often faced with a dilemma of rigor and relevance. The PhD researcher also reported that while she found that the process of considering '*what it is that she did when she did what she did*' (adapted from Ison, 2010) was instrumental for informing the PhD Learning System, the development of this learning required considerable contemplation and emotional resilience on her behalf. This subjectivity is highlighted because she found that the process of pursuing reflection on her own practice, created its own tensions within the PhD Learning System. She specifically noted the complexities of providing an account of a legitimate academic process whilst at the same time acknowledging her own inefficiencies in the progression of this process. This experience of emotional complexity reflects previous reports that a reflection on one's own practice may be difficult in research environments where the problematic situation has a personal quality or is related to the organisation where the researcher works (Coghlan and Brannick, 2014). It may also be a reason as to why, as Ison (2010) notes, that many practitioners including researchers, scientists and policy makers can lack a reflexive understanding of their own practice and the rationalities (epistemologies) out of which they think and act

Reflections on learning about and within an agricultural knowledge system

In conclusion, this doctoral research did not uncover a magic solution for improving interactions between farmers, extension organisations and mandatory agri-environmental policy. Rather, it involved the creation and progression of a learning system concerned with informing the mandatory agri-environmental policy of cross compliance and its associated extension practices. This system did successfully generate a range of learnings relevant to informing extension practices related to mandatory agri-environmental policy. However, what, if any, were the rewards of this learning? We will conclude with some reflections on this question.

First, while there are indications of a potential for extension organisations to use participatory practices for developing rich understandings of farmers' preferences for mandatory agri-environmental policy and its related extension practices, it is a complex process with a range of challenges. In particular, there is the ability of extension organisations to address all recommendations surfaced in a participatory process. Related to this, is the likelihood that extension organisations will seek to avoid becoming involved in sensitive issues such as trying to influence the application and enforcement of policy, because of a risk that their actions would become politicised. Overcoming these participatory barriers will require an organisational commitment to sustained collective learning targeted at understanding how the various stakeholders can work together to develop agri-environmental policies which are more socially, financially and environmentally sustainable.

This is not to say that participatory approaches cannot be used for informing enhancement to extension practices related to mandatory agri-environmental policy. Rather, it signifies a need for a purposeful reflection on the potential of power relations to affect the process and outcomes of participatory processes (Zuber-Skerritt and Perry, 2002; Smith *et al.*, 2010). In particular, there is insufficient guidance regarding the role of extension organisations in resolving matters outside their usual organisational remit. CSH could offer a framework for undertaking such reflections. In particular, the CSH approach of unfolding and questioning the 'facts', values and boundary judgements circumscribing an 'improvement' to a particular system of interest (Ulrich and Reynolds, 2010) could provide opportunities for understanding the selectivity of the reference systems at work in determining who gets to say what is 'the right thing' in a particular situation (Reynolds, 2014). This type of approach could prove particularly apt in terms of decision-making about the role and function of extension supports.

Second, for learning to be truly rewarding and efficacious towards realising an environmentally and socially sustainable agriculture sector, (that is profitable for the farmer, whilst also being beneficial to all of 'us' and the 'environment') we need learning systems which are encouraged and sustained in context. This vision will require the development of extension and research approaches which encourage truth-telling, empathy and tolerance of perspective. It requires that farmers, advisors, researchers, policy actors, and all of the different people involved and affected by mandatory agri-environmental policy, will learn to accept or at least tolerate that there are different perspectives and ways of knowing the environmental sustainability issues affecting the agricultural sector. This type of approach could help with the development of more complex reasoning about why environmental sustainability problems continue to be detected in the sector.

Learning how to build empathy and sustain learning in context will be a massive challenge for functioning agricultural knowledge and innovations systems. It seems that the logic of Korten (1980) who reported that development work: '*calls not for more sophisticated skills in the preparation of detailed project plans, but rather for skills in building capacities for action through action*' (p.502) is perhaps more relevant than ever.

Finally, researchers will need to sustain their own learning and those they work with. The first author believes that her participation in the PhD Learning System has changed both her worldview of extension practices related to mandatory agri-environmental policy and participatory approaches in general, and that this learning has significantly influenced her present practice as a Community Water Officer with the Local Authorities Waters and Communities Office. An office which has been established by Local Authorities to promote public awareness, participation and knowledge sharing in the development and application of the River Basin Management Plans required under the EU Water Framework Directive 200/60/EC.

This last conclusion is particularly relevant to this PhD learning system, but any research study is limited in what it might achieve. All research participants, including the researchers will learn while the study is being conducted. However most participants will only learn about the learning sub-system that they participate in and they may not appreciate the learning of a full (PhD) learning system as was described here. While publications and presentations can detail processes and findings in abstract to others, these are less helpful in setting out the learning in context of the main participants. Some of the methods and techniques used in this research appear to sustain learning for individuals, especially the researchers. A bigger challenge is how to sustain learning and subsequent changes in practices of all participants in the longer term, which may be as much about fostering participatory practices in general as participatory research methods in particular.

Moreover, with significant numbers of doctoral students passing through the agricultural sector, there is a wider challenge prompted by this particular research endeavour. How might agricultural extension support better marshal resources from doctoral students regarded as 'apprentices' – including finance, partnerships, as well as infrastructural and supervisory support – for improved agricultural praxis? In other words, how might the PhD learning system approach reported on in this paper be scaled and adapted to serve as a significant sub-system for a more purposeful and sustainable agricultural learning system?

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