ORGANISATIONAL LEARNING IN IRISH AGRICULTURE

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Abstract
Agriculture is an important industry for Ireland and within agriculture the dairy sector plays a prominent role. The Irish Food and Agriculture Authority (Teagasc) promotes the competitiveness and innovativeness of agriculture through its advisory extension services: one such extension service is monitor farms (MFs). However, little is known about knowledge and learning processes in relation to MFs and the wider farming community. This paper reports finding from the initial stages of a project that seeks to apply the concept of experiential learning (EL) and organisational learning (OL) to dairy industry MF activities. Specifically, findings from preliminary participatory observation fieldwork of MF activities are used to reflect on various aspects of the organisational learning literature.

Keywords: Experiential learning, organisational learning, dairy sector, monitor farms

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INTRODUCTION

Within the past two decades, the Irish economy popularly known as the 'Celtic Tiger' has experienced major economic change. Initially, robust Foreign Direct Investment (FDI), attracted by low costs and a favourable investment climate, boosted economic growth and development. However, in recent years, increased pressure from international competition has reduced Ireland's competitive edge and slowed growth. In response, Ireland's industrial policy has been refocusing on nurturing the agricultural sector, the largest industry, to make "[...] a very strong and high value added contribution to Irish economic activity" (Power 2007). Teagasc (the Irish Food and Agriculture Authority) has played a critical role in developing innovation and best practices in farm management based on research and in disseminating them to the farming population through its Extension Advisory Services (EAS). The EAS program provides advice and consultancy assistance to farmers on all aspects of farming and rural development. Within EAS, monitor farms (MFs)—set up in the dairy, drystock and tillage farming sectors—are crucial for disseminating innovation and best practices. Dairy farming has by far been the most commercialized and profitable of all farming sectors. Therefore, this research project mainly examines dairy MFs; its overall purpose is to determine the dynamics between MF extension services (MFES) and the remaining farming population in the dairy sector.

Applying the organisational learning (OL) approach to agriculture is a relatively novel idea. This paper applies the conceptual framework of OL to study learning processes in MFES. Building on an overview of learning and OL, this paper focuses on 'experiential learning' as one of the main mechanisms at work within the 'open organisation system' which comprises MFES and the wider farming community. Second, the usefulness of OL is further empirically demonstrated by comparing our preliminary findings from observing 'discussion group meetings' (DGM) and MF 'demonstration open days' (DOD) with the OL framework. Third, applying the OL to MFs helps formulate several important research hypotheses, notably regarding (i) the types of knowledge (e.g., artefact, tacit, explicit, practical, etc.) that are diffused through MFs to stakeholders; and (ii) the learning mechanisms, and factors that facilitate or impede them, of the various types of knowledge uncovered. Finally, the paper argues that these hypotheses must be addressed through a combination of qualitative research methods, in addition to participatory observation and survey used so far and with certain limitations.

The remainder of this paper is organized as follows. Section I provides an overview of the learning and organizational learning concepts, with special emphasis on 'experiential learning' as a key concept for MF. Section II applies OL to the processes within MFES which are characterized as 'open organisation systems'. Section III describes the findings from observations of DGM and DOD in MFs. Section IV discusses the implications of findings to (i) and (ii) and provides conclusions.

1 THEORETICAL BASIS

1.1 THE ROLE OF LEARNING

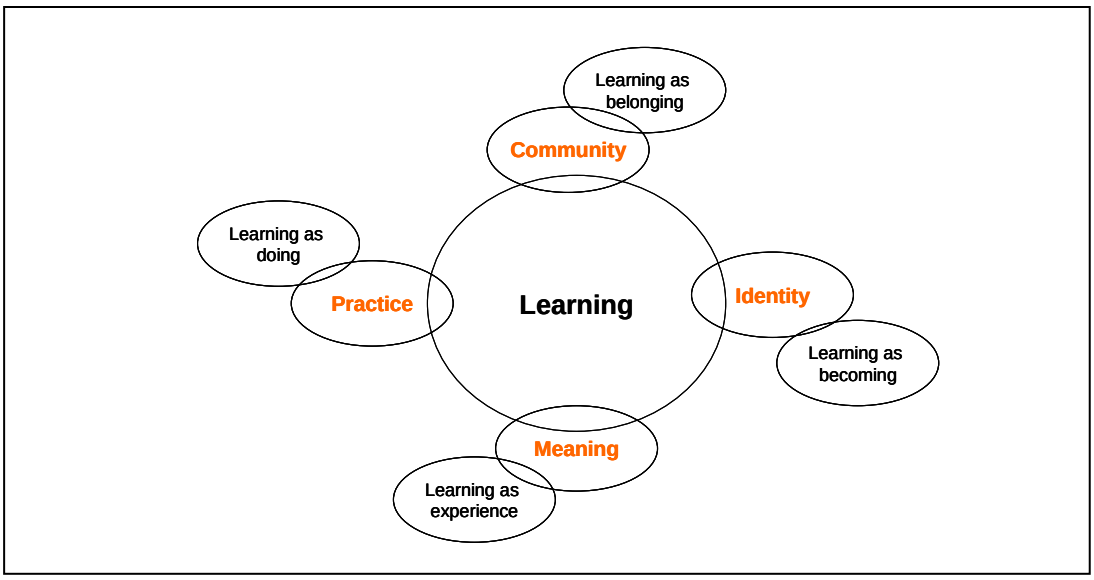
1.1.1 The concept of learning

The definition of learning has given rise to debate among scholars from various disciplines, in particular, as regards at which level learning takes place and should be analyzed: the individual, group, or wider social level. Nevertheless, a consensus exists that learning is the key driver in constructing new knowledge, competence, and skills while altering ways of thinking, ways of seeing, belief systems, and routines. It is also widely accepted that all knowledge is contextual – as it is created by interaction with the environment and is embedded in the practices and epistemologies of the actors (Latour 1987; Law 1994); learning is also contextual with regard to actors actively and deliberatively engaging in a learning process to develop knowledge pertinent to their specific circumstances (Jasper and Stuiver 2005). This study uses a definition whereby "learning is the process during which knowledge is created through the transformation of experience" (Kolb 1984 p.38).

In attempting to understand the processes of learning, different types of learning have been identified. Argyris and Schön (1978) make the distinction between single-loop and double-loop learning; in other words distinguish whether organisations respectively learn best from incremental changes and improvements, or from radical adjustments that resolve organisational tensions. They later added (1996) 'triple-loop' learning characterised by questioning current methods, techniques, and any form of feedback through which learning is organised, or learning about learning (Leeuwis 2004). Fiol and Lyles (1985 p.807-08) identify the difference between lower-level and higher-lever learning. The former takes place within a given organisational structure subject to a given set of rules. It enables the development of some elementary associations of behaviour and outcomes, which usually are of short duration and impact partly what the organisation does. The latter, on the other hand intends to correct overall rules and norms rather than particular activities or behaviours. Malerba (1992) proposes a taxonomy of learning processes comprised of six main elements that can be categorised either under internal or external stimuli including: (i) learning-by-doing; (ii) learning-by-using; (iii) learning-by-searching; (iv) learning-by-interacting; (v) learning from advances in science and technology; and (vi) learning from inter-industry spillovers.

Of particular interest in this study is the distinction between formal/intentional and non-formal/unintentional learning as observed in the workplace or 'communities of practice' (CoP). This approach further notes that most human learning is non-formal – characterised by implicit learning, reactive learning and deliberative learning – and that knowledge of context and organisations is often acquired through a socialisation process involving observation, induction and participation rather than formal inquiry (Eraut 2000; p.122). Furthermore, implicit knowledge is considered as often more powerful than extensive accessible explicit knowledge (Casey 2005). In the same line, Wenger's (1999) social theory of learning distinguishes four dimensions of learning: meaning, practice, community, and identity (Figure 1).

Figure 1. Components of a social theory of learning: an initial inventory



Source: Wenger (1999 p. 5).

1.1.2 The concept of experience

Drawing on Kolb's concept of 'experiential learning' and Eraut's and Wenger's emphasis on context, Dewey sees experience as the conceptual basis of learning whereby experience develops from an uncertain situation or unforeseen event and triggers learning (Dewey 1905 [1977], 1934 [1987]). The concept of experience also encompasses the movement between familiar and routine actions as well as between established and emergent social relations that instigate learning (Elkjaer 2004; Blacker and McDonald 2000). Dewey adds that experience is not viewed as an inner personal 'reservoir' of earlier experiences but rather results from continual interaction and transaction mutually formed between the individual and the environment and the product thereof. Following Dewey's earlier work, Kolb (1984) expanded the idea of experiential learning distinguishing four cyclical stages of learning: experience→reflection→conceptualization→application (adapted by Popper and Lipshitz (2000) by adding→ retention).[2] Notably, the process of experiential learning is embedded in Wenger's social theory of learning, i.e., takes place in the context of a community or organisation and involves learning as 'experience', as 'doing', and as 'belonging'. Section 2.1 applies the concept of experiential learning to processes observed in monitor farm extension services (MFES).

1.2 THE CONCEPT OF ORGANISATIONAL LEARNING

1.2.1 The concept of organisation

The concept of 'organisation' has been the subject of continuous debate and change since its emergence in the 19th century in Europe and the US during the industrial revolution and

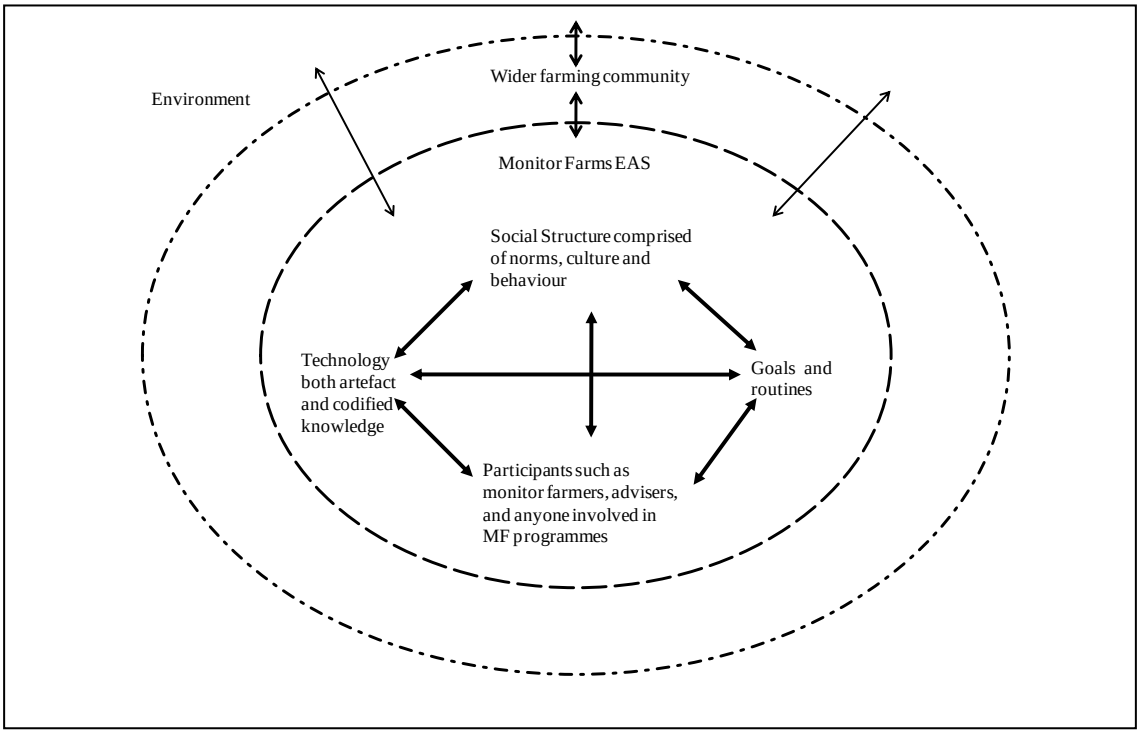
[2] This fifth phase enables the equivalence to organisational knowledge and belief systems in 'experiential organisational learning (OL)' as developed by Shaw and Perkins' (1992).

corresponding economic expansion. The meaning of organisation has varied over time and across disciplines (from academics to managers, governments, and stakeholders). There is nevertheless a consensus among scholars on key features of organisations: goals, boundaries, cooperation, coordination, interaction, and rules or division of labour; and their main attributes: having multiple parts; self-maintaining through interrelatedness; achieving specific objectives; and adaptive to the external environment (Schwartz 1999 p.58).

As part of this consensus, the analysis of organisations uses three paradigms (Kuhn 1962). The *rational system* perspective defines organisations as collectivities geared towards achieving specific goals and demonstrating relatively highly formalised social structures (Scott 2003 p.27). The *natural system* perspective considers organisations as collectivities whose participants have multiple (common and individual) goals and acknowledge the organisation as an important resource. It considers informal structure of relations developing among participants to have more impact on guiding their behaviour than the formal structure does (Scott 2003 p.28). In contrast with the first two perspectives which tend to view organisations as closed systems, separate from the environment and consisting of stable participants, the *open system* perspective takes into account the outside environment and sees organisations as aggregations of interdependent flows and activities that result in shifting coalitions of participants who are embedded in broader material-resource and institutional environments (Scott 2003 p.29).

Generally, all systems – characterised as "consciously coordinated activities or forces of two or more persons" Barnard (1956 p.75) – comprise of a combination of interrelated and interdependent parts, which vary from simple to complex, from stable to variable, and from nonreactive to reactive to the changes endured by the system they belong to (Scott 2003 p.82-3). In this paper, an organisation is considered as an open system because two of its key characteristics are also found in the farmer communities under study. The first is the *interdependence* between various components and actors of the system, i.e., the Teagasc, MFES and the wider farmer community. The second is the *interaction with the external environment* as well as the capacity for self-maintenance despite changes in that environment. Furthermore, boundaries within such context are determined based on different phases of collective learning process taking place (cf. Figure 2). While this paper uses the concept of *open organisational system* as most appropriate for MFES, it nevertheless acknowledges that any organisational system and its learning operate within a social system and culture, as emphasized by Wenger (cf. Section 1.1.1).

Figure 2. MFs EAS and the wider farming community as an open organisational system



Source: Adapted from Leavitt's (1965) diamond model of organisation.

1.2.2 The concept of organisational learning

The concept of organisational learning (OL) has been increasingly used since its introduction in early studies on organisations by March and Simon (1958) and Cyert and March (1963). Interest in OL in both the academic and business world is fuelled by the increasing role attributed to knowledge and learning in creating and sustaining competitive advantage (Nonaka 1994) in a world where information overload paradoxically coexists with persistent uncertainty (Morgan and Murdoch 2000). There is a variety of definitions of OL (Chiva and Alegre 2005). The early literature viewed OL as "individuals' acquisition of information and knowledge, analytical and communicative skills" (Argyris and Schön 1996; March and Simon 1958) while emphasising on individuals' ability to think of organisations as systems that gain competitive advantage based on the rate at which they can learn (Senge 1990; Senge *et al.* 1994; Senge *et al.* 1999). The more recent literature has some common factors which are useful for this study whereby OL is viewed as a tool for changing past experiences and adapting to a changing environment (Berends *et al.* 2003) and as a way of increasing the capacity of individuals to take effective action (Dixon 1994; Kim 1993) and be innovative (Gopalakrishnan and Damanpour 1997). Furthermore, understanding of OL is helped by insights derived from a variety of disciplines such as psychology, management science, production management, organisation theory, sociology, evolutionary economics and innovation management with the distinct at times leading to conceptual confusion around important topics, appropriate methods, and contributions (Easterby-Smith 1997).

This fragmentation of the field has inspired the idea of developing a comprehensive theory of OL (Shrivastava 1983; Huber 1991; Nicolini & Meznar 1995). However, with the multiple perspectives on offer this is likely unrealistic (Easterby-Smith 1997); at the same time, the emerging literature on *the learning organisation*, which is practical and action-oriented, stands in sharp contrast with the OL literature, which focuses on understanding learning processes. Therefore, the compromise (suggested by Easterby-Smith *et al.* (2004)) for OL researchers is to consider several parallel research agendas and complementary contributions from different perspectives, rather than a unified body of knowledge and practice (see Table 1). Overall, for this study, several dimensions of OL can be retained: (i) various levels and types of learning; (ii) the importance of informal learning within a certain context, organisation or community and of learning as experience; (iii) the importance of interdependence between actors and interaction with external environment; and (iv) the various phases of a collective learning process (Pawlowsky 2003 p.75). Section 2.2 applies the concept of OL to Irish farmers involved in MFES.

Table 1. Nature of contributions in the field of OL (Easterby-Smith et al. 2004).

Theory approach	New data	New theory	New methods
Single and double-loop learning		Repackaged existing ideas	
Espoused theory and theory in practice		Drew on psychoanalytic theory	
Unlearning		Counter-intuitive ideas	
Senge and the Learning Organisation	Practical cases	Blended Argyris and Forrester	
Socio-cultural perspective	Case studies	Social anthropology	Ethnography
Learning across boundaries	Cases and surveys	Adds cultural theory	Mixed methods
Knowledge, learning and competitiveness	Cases and surveys	Adds strategy, and resource-based view	

2 EXPERIENTIAL AND ORGANISATIONAL LEARNING IN MFES

This section discusses the use of the concepts of experiential learning and OL to Irish farmers through their involvement with MFES. It concludes that learning takes place above the level of the individual farmer and within the context of an organisation.

2.1 EXPERIENTIAL LEARNING AMONG FARMERS AND WITHIN MFES

From the literature, several elements of experiential learning appear relevant to farmers' learning through MF extension services (MFES). Percy (2005) draws parallels between experiential learning and participatory research and extension (PR&E) and found that three components are necessary in enabling farm management: (i) first- and second-order

experiences; (ii) reflection on past experience; and (iii) dialogue with others on experiences. *First-order experiences* correspond to familiar and routine actions and established and emergent social relations (cf. Dewey above). However, based on Malinen's (2000) study, Percy argues that first-order experiences are often incomplete and inadequate to promote experiential learning, which results from the connection between past and new experiences. *Second-order experiences* develop when first-order experiences are challenged by an uncertain and turbulent environment which prompts *reflection on past experience* and their modification. Overall, experiential learning involves ''modification of earlier constructions: re-organization, re-construction, re-defining, re-thinking, re-shaping, re-interpretation and re-formulation [...] aiming to establish renewed contact with something original'' (Malinen 2000 p.75). Thus, similarly to PR&E, MFES were developed to encounter risk-prone and rapidly changing environments that often render indigenous or past local knowledge obsolete. MFES advisors and facilitators help farmers reflect on and analyse their situations in alternative ways and help them identify solutions through experiential learning.

Finally, *dialogue with others* is essential for enabling farm management and has four stages: sharing, testing, justifying, and believing (Malinen 2000). Following these stages allows farmers involved in MFES to raise group awareness and empowerment. It should be noted, however, that the stages of dialogue in MFES, unlike PR&E, do not include scientists or involve co-experimentation between scientists, extension facilitators and farmers but merely implementation of knowledge from research. Furthermore, dialogue is more productive and enriching by allowing everyone's voice and suggestions to be heard and consensus on solutions to be built.

2.2 IRISH FARMERS AS ORGANISATIONAL LEARNERS THROUGH MFs

As noted above (section 1.2 and Figure 2), the farming community is seen as an *open organisational system* where learning occurs above the level of the individual and the OL definition most useful for MF is a *tool for change*. MF programmes encompass activities at both farmer-to-farmer and group level to inquire and resolve problems in response to a changing environment. The extension activity aims to assist both monitor farmers and the wider farming community in using, or reflecting on, first-order experiences to adapt to a changing environment, resulting in second-order experiences that enhance options further. Farmers involved in MF programmes essentially undergo experiential learning: they encode experiences into routines, procedures, conventions, strategies, rules and technologies that guide behaviour (Levitt and March 1988). Furthermore, the emphasis by OL on studying learning processes of and within organisations appears highly relevant through MFES (cf. Easterby-Smith 1997; *et al.* 2003). This focus on experience within an organisation contrasts with the view (e.g., Bandura 1969, 1977) that social learning is based on the idea that individual learning occurs through observation and individual behaviour changes mainly through observation of peer behaviour rather than own experience. This said, OL in MFES and the wider farming community has many characteristics of social learning as it captures both own experience and experience of others as well as the various levels of analysis, types of learning, and phases of collective learning processes in the farming community.

3 PRELIMINARY RESULTS FROM FIELDWORK

This section presents preliminary findings from field observations of MFs and seeks to confirm the applicability of the EL and OL conceptual frameworks to MFES.

3.1 THE EXTENSION ADVISORY SERVICE, INCLUDING MFs IN IRISH DAIRY

The dairy industry is one of the most attractive sectors in Ireland and accounts for 27% of agricultural output (Department of Agriculture and Food 2006) with roughly 5.35 million tonnes of milk produced per year. The dairy industry also plays a critical role in sustaining rural communities, with the dairy processing industry employing over 7000 people (Dillon *et al.* 2008). It has been progressive while embracing scientific research to enable the adoption of new technologies in a world of increasing competition. Raising productivity has become an imperative and required constant transfer and diffusion of new methods and processes to the dairy farming community.

As noted above, Teagasc plays a key role in developing best practice in farm management and its EAS are essential for transferring them to the farmers. Within EAS, MFs are the key vehicle for knowledge transfer locally at the farm level. EAS specialist advisors assist a small number of 'monitor farmers' (working full-time) in closely supervising their farm's performance. New practices produced on these farms are then diffused to the wider community of farmers through outreach activities such as farm visits or demonstration open days (DOD), discussion group meetings (DGM), farm walks, conferences, seminars, newsletters, and newspaper articles.

3.2 METHODOLOGY

The field work was preceded by a review of methodologies employed in 10 papers studying the concept of OL. The review showed that most papers used a qualitative approach as well as two strategies of inquiry: case studies and ethnography. Of interest were case studies used to mainly depict the dynamics – such as events, activities, processes, actors – present within single settings bounded by time, and applied qualitative techniques such as participatory inquiry, interview questionnaires, and diary keeping. The qualitative approach is useful in exploring dairy farmers' social world which encompasses a wide array of dimensions, such as "the textures and weave of everyday life, the understandings, experiences and imaginings of our research participants, the ways that social processes, institutions, discourses or relationships work, and the significance of the meanings that they generate" (Mason 2002 p.1).

The preliminary fieldwork focused on 15 dairy MFs, managed by full-time monitor farmers. It used the qualitative approach, mainly participatory observation, to study the dynamics of two MF activities: discussion group meetings (DGM) and demonstration open days (DOD). DGM regularly bring together monitor farmers involved in the same programme to discuss topical farm management issues on members' farms in rotation. DOD are held to demonstrate MF new practices to anyone attending the event. Participatory observation consists in observing social groupings through regular participation in their normal activities, notably recording attitudes, behaviours, or informal discussions among farmers and advisors.

During June-November 2008, 15 MFs were visited, five of which are part of the Teagasc/Glanbia programme and 10 of Teagasc/Dairygold, all in the southern part of the country. Observations were made at two DGM on two different MFs and at 13 public DOD events. In addition to participatory observation on all 15 MFs, a survey was conducted in the last 6 MF visits. On all MFs, Teagasc seeks to promote key technologies such as (i) grass land management; (ii) artificial insemination (AI)—genetics/ herd disease risk control; and (iii) labour saving management by farming smarter.

3.3 RESULTS

3.3.1 MF discussion group meetings (DGM)

In June 2008, two DGM, lasting between two to three hours, on two MFs under the Teagasc/Dairygold programme were attended. Each meeting took place on the MF (MF1 and MF2) and was hosted by the owning monitor farmer, the group facilitator, a specialist on cow therapy, and a member of the Teagasc/Dairygold programme board. The attendees included 10 out of the 13 other monitor farmers.

At the start, the host provided data on the farm's 2008 grass cover records and budget and compared them to the 2007 results. For example, the host of MF1 had improved grass cover since 2007 but had not reached the target for 2008. Then the other monitor farmers presented their own grass records and discussed their satisfactions and disappointments. The meeting then moved to an empty paddock where the farmers observed grass quality and discussed grass conditions and ways to improve quality, based on the application of seeds, fertiliser mix, and time of growth and mowing. Grass quality and corresponding regime is crucial for the animal's mental and physical health and hence for having good milk. Then the group went on to a paddock with grazing cows to discuss grass management relative to calf breeding, which should take place from January to May when grass is abundant and weather is mild so that cows can stay outside and eat more. The DGM on MF2 discussed grass management and budgeting, but also held a session on cow bacteria outbreaks and milk clots. The cow therapy specialist emphasized the importance of cleanliness to reduce tit infections and, as a last resort, giving antibiotics to the entire herd. This was crucial for the MF2 farmer whose all year round milking cow farm cannot afford interruptions. At the DGM, he benefited from the assistance of an advisor and the cow therapy specialist to resolve the herd bacteria problem that had affected his farm for 10 years.

From these observations – seen in light of the literature, notably Percy and Malinen – several conclusions emerge which confirm the relevance of EL and OL for MFs. First, DGM are collective *reflections* on specific topics and are problem-oriented; they do not aim to promote monitor farmers' learning on a range of issues. Second, the *interactions* are 'open' to other views and *outward-looking*, which is essential for adapting to change, and examine a range of suitable solutions. Third, the process of *dialogue* helps ensure that monitor farmers understand and are satisfied with the proposed actions. In sum, *experiential learning* is present in DGM, in modified form from Malinen's four-stage dialogue: (i) sharing; (ii) justifying; (iii) believing; and (iv) taking action, where possible.

3.3.2 MF demonstration open days (DOD)

Between June and November 2008, 13 open day demonstrations (on MF3 to MF15) under both Teagasc programmes were attended. Participants included Teagasc farmer clients, Teagasc non-client Teagasc farmers, local advisors, extension facilitators and dairy coop representatives, and any person interested in the event. Like with DGM, the idea of DOD is to communicate knowledge implemented on the host MF to visitors while walking on the farm. The resource persons tell visitors about the results of the host monitor farmer's management skills in each of the three key technologies that Teagasc is pushing.

The observations on MF DOD also show important differences with MF DGM. First, open days are not problem oriented since one of their main goals is to facilitate knowledge transfer implemented on MFs. Second, although reflection and dialogue are encouraged, ideas are not as easily shared. For example, a programme manager on one MF presented four paddock grazing techniques (not all recommended) and asked visitors which technique would be detrimental to the soil if used in wet conditions, but very few farmers took part in the discussion and the ones who did were mainly Teagasc clients. Third, as visitors attend open days mainly to observe agricultural best practice by monitor farmers (the models), social learning is predominant although not the only learning mechanism taking place (e.g., farmer to farmer informal linkages). Fourth, farmers attend the events for different reasons, implying different knowledge acquisition and learning mechanisms. For example, one visitor said he was there only to observe the demonstration of the slurry machine and another one attended only to learn about the characteristics of the breed after having bought a heifer from a MF. Finally, it is much harder to capture farmers' interpretation of knowledge sharing and transfer in MF programmes during DOD events than in DGM because participatory observation is clearly insufficient in the former; in other words, conversation with visiting farmers was limited. Therefore a survey was distributed to all farmers present on the DOD, but gave limited results. While the survey helped to find out the composition of attendees (on average, 82.5% were Teagasc clients, 17.5% were non-clients at the last six events), questions on knowledge sharing and transfer beyond DOD were all incomplete.

4 DISCUSSIONS AND CONCLUSIONS

4.1 IMPLICATIONS OF FINDINGS FOR RESEARCH QUESTIONS

Participatory observation enabled to clearly differentiate between DGM and DOD. On the one hand, it helped capture monitor farmers' interpretation of DGM in promoting learning. They all expressed enthusiasm and willingness to share and discuss and raised issues with each other, given that the activity aimed at improving their farm management skills thereby increasing their competitive edge. On the other hand, determining farmers' interpretations on DOD was far more challenging because visiting farmers reluctantly responded when asked to engage in a conversation. Understandably, they would rather focus on absorbing the knowledge being presented and inquire about it.

Analysis of DGM showed the presence of both codified and practical knowledge. The former corresponds to knowledge emanating from research and has been implemented on

MFs relative to their farming circumstances. This codified knowledge includes the main three that Teagasc is attempting to transfer through MFs. The practical element emerges from the combination of applied knowledge with monitor farmers' past experiences and farming circumstances which surfaces during discussions among monitor farmers. In contrast, DOD mainly comprise of codified knowledge (also including machinery or tool – or technology as artefact – demonstration) presented as key lessons throughout MF demonstrations. Practical knowledge may also be exchanged but it is not as evident since discussions occur less and priority is placed on learning by observing. Overall, two types of knowledge have been identified from observing the two settings (DGM and DOD). Furthermore, knowledge transferred beyond MF programmes and occurring through farmer-to-farmer interaction (at group level) implies some aspects of practical knowledge. An individual farmer reading about new practices published in newspaper articles absorbs codified knowledge; therefore, both formal and informal linkages are relevant. Furthermore, the types of knowledge acquired through MFs depend on the environment, types of activities taking place, and the actors involved.

Monitor farmers undergo experiential learning (EL) – including reflection and the four stage dialogue sequence: sharing →justifying →believing →action – while implementing research knowledge at MF levels. It is also suggested that farmers in the wider community are subject to the same mechanism as long as they alter their experiences as a result of knowledge acquisition and application from MF activities. Although EL is one key mechanism, knowledge dependency on context implies that learning mechanisms vary during knowledge transfer and diffusion through the various activities within the MFES and wider community organisation. For example, DGM promote group learning whereas MF DOD enable social learning both of which are embedded within OL. Social learning occurs during MF DOD when: (i) desired behaviour is rewarding, e.g., monitor farmers' application of new practices improving their farm management skills (cf. Wenger's learning by doing and as experience); (ii) the model is seen as positive, e.g., monitor farmers' willingness to share information; (iii) both the model and the observer are similar, i.e., other farmers learn best from monitor farmers (cf. Wenger's learning as belonging); (iv) the individual closely observes the model, e.g., other farmers closely listen to information conveyed by monitor farmers; (v) the model's behavioural capacity is attainable by the observer. Overall, different levels of analysis inevitably involve different learning mechanisms. Some integrative dimensions of OL are then identified whereby different levels (so far group and social) and types of learning (so far experiential) emerge, interdependence between Teagasc advisors, monitor farmers and wider farming population is important, informal linkages seem to take place, and transaction with the environment is inevitable.

4.2 WORK GOING FORWARD

Confronting the two broad research questions with the EL, open organisational system, and OL literature helps formulate two hypotheses. The identification of different types of knowledge and levels of learning leads to the first hypothesis (H1): what is the range and type of knowledge relative to the level of analysis encountered? Generally, it will be necessary to identify whether farmers exposed to MFES switch from first to second-order experiences, which is mirrored through a change in their routines and behaviours. Also, different learning mechanisms taking place during the MFES learning processes indicate

that understanding the role of farmer characteristics is pertinent. Therefore, the second emerging hypothesis (H2) is: what are farmers' capacities, existing knowledge, and learning preferences in making use of MF programmes?

A case study of dairy MFs – as an in-depth study of a process of social activities within MF programmes and the wider farming community – will be employed to address H1 and H2 while focusing on a specific technology. For example, a case study of grass land management implemented on MFs can be used by tracking its trajectory within the wider farming community. Covering all three technologies can be overwhelming, too broad, and requires a lot of time. In addition to participatory observation used so far, a combination of qualitative methods will be used such as in-depth semi-structured and open-ended interviews – as opposed to standardised questions – to avoid imposing pre-conceived ideas on farmers. Farmers' availability and full attention must be ensured to fully grasp their perspectives on these events in helping them learn. Another tool worth considering is to request farmers to use a diary for triangulation to report any activities where knowledge from MFs is acquired.

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