

## **Promoting Farmer occupational safety and health (OSH) services through Extension**

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**Abstract.** Strategies for improving OSH in European agriculture are urgently required given the high level of reported injuries and ill health in the sector. The agriculture sector in Europe is enormous in scale and diverse in production systems. A dispersed labour force is deployed in the sector, predominantly using family labour, which is self-employed. Accordingly, a large proportion of the agricultural workforce is outside the scope of EU directives on occupational safety and health (OSH). The aim of this paper is to examine the role and engagement of the discipline of agricultural extension in promoting OSH in agriculture and consider methodologies that this discipline can use most effectively to gain OSH adoption. The paper compares regulatory and extension approaches to consider their respective roles in promoting OSH in agriculture. EU developments related to extension and OSH are then outlined. Regarding extension engagement, findings of a survey among extension and OSH professionals throughout Europe found that OSH is considered an important topic and worthwhile for inclusion in extension but it indicates that currently the level of extension programming is limited. Irish data on OSH extension methodologies indicates that advisors consider that a range of extension approaches are available to motivate farmers on OSH adoption with TV victim testimonials, on-farm social learning discussion groups and on-farm demonstrations having the highest preferences. Data presented indicates that Irish farmers expressed good satisfaction ratings with OSH extension relevance to their farms. Overall, the study advocates giving more consideration of the role of extension in promoting agricultural OSH.

**Key words:** agriculture, ergonomics, extension, regulation.

### **INTRODUCTION**

Agriculture is a hazardous sector with high levels of occupational injury occurring in the sector (Merisalu et al., 2019). These authors also reported that great variation in reported fatal and non-fatal workplace injury levels in EU (28). Workplace injury causes tragedy, suffering and disability also leads to economic losses that could jeopardise the livelihoods of farming families (Whelan et al., 2009).

Throughout European agriculture family labour predominates, with the majority (91%) of the 22.2 M regular labour force being in this category (Merisalu et al., 2019). The average age of farmers is higher than in other sectors and engagement in a wide range of farming commodity enterprises takes place (EU-OSHA, 2020).

Improving OSH of farmers in Europe has received increased attention recently with the award in 2016 of an EU COST Action (CA16123), or expert network, to examine means of improving the Culture and Risk Management of Agriculture (acronym: SACURIMA). Also in 2020, an EU OSHA Foresight Report was published on the Future of the Agriculture and Forestry sectors and its Implications for OSH (EU-OSHA, 2020).

However, the EU OSH Framework Directive (89/391/EEC) for worker protection applies to employed workers only and is not applicable to the majority of the EU agricultural workforce who are predominantly family workers and self-employed. Thus, approaches complimentary to regulation are required to assist self-employed farmers with OSH management.

Improving farmers' capability to manage OSH has been shown to be crucial to gain adoption of OSH control measures (McNamara, 2015). In other work sectors, the so-called '3E' approach has been effectively used to gain OSH adoption which uses a combination of Education, Engineering (i.e. workplace physical standards including ergonomics) and Enforcement (internally or externally) (Murphy, 2003). Extension is the scientific discipline used in agriculture and other sectors to gain voluntary change through provision of advice and adult education, based on research evidence (Paine, 1999). Thus, this discipline may have utility in assisting farmers with OSH management.

The aim of this paper is to explore the utility of the discipline of agricultural extension in assisting farmers to improve OSH performance. The paper, firstly, describes both regulation and agricultural extension and compares and contrasts the use of these approaches. It then outlines the findings of a pan European survey among persons associated with extension engagement in OSH. It then provides data from two Irish surveys on the various approaches used by the discipline of agricultural extension related to OSH. The paper concludes with discussion and conclusions of the findings related to promoting OSH in Agriculture.

## **REVIEW OF REGULATORY AND EXTENSION THEORY**

### **Regulation**

Regulation has been described as 'control exercised by a public agency over activities that are valued by society' (Selznick, 1985) with regulatory agencies generally obtaining their authority from legislation (Gormley, 1998). Regulators, in seeking desired standards, need to gain a balance between the following: 'deterrence' and 'bargaining' (Ayres & Braithwaite, 1992). For successful regulation, these authors envisage enforcement strategies as equal layers of a triangle from the base: self-regulation, enforced self-regulation, command regulation and with sanctions associated with each layer. They considered that regulation should allocate resources, in terms of time and effort, in proportion to space allocated for each layer in the triangle. This suggests using more resources to communicate standards and practices to the target population to gain compliance while reserving enforcement and penalties for non-compliance.

Gunningham (2002) comprehensively reviewed the application of OSH regulation in the agriculture sector in Australia to determine the optimal policy mix to gain OSH improvement. He considered that farmers must know of the existence of regulatory instruments, without which they have very limited effect. He advocated disseminating ‘codes of practice’ as he considered that small enterprises require much more specific guidance on OSH requirements than larger ones having formal OSH systems in place. Such codes, he considered, provide practical guidance on how to achieve compliance. Gunningham (2002), further considered that sources trusted by farmers need to disseminate OSH information in a face-to-face fashion to gain uptake.

Regulation can vary in its approach in terms of the balance of enforcement and guidance provided. Kelsey (1994) reported on implementation of OSH regulation in USA which led the counterproductive result of it being suspended for small-scale farmers. Sinclair et al. (2013), in USA, considered that it is imperative for regulators to work with intermediaries, such as extension, to make progress with OSH in small and medium enterprises.

In the UK, Knowles (2002) found that the majority (74%) of farmers preferred obtaining OSH advice rather than use of regulatory approaches. He also noted the concern of UK farmers in seeking advice from an OSH regulator, while Gerrard (1998) found that 66% of UK farmers would not seek advice from an OSH regulator. In Ireland, Finnegan & Phelan (2003) found that 67% of farmers expressed a preference for obtaining OSH information from an advisory service.

This review for this study indicates that OSH regulation through legislation has a powerful role to play in gaining standards and practice adoption. It provides a message from society to farmers regarding the importance of OSH and it mandates the application of resources for regulatory systems. However, it is clear that regulation on its own is not likely to provide the optimum solution, and that a linkage with intermediaries such as extension has potential to enhance OSH adoption.

Social Insurance systems for the agriculture sector are in place in a number of in European countries on a statutory basis. An insurance premium is payable annually to provide for the future cost of such benefits as retirement, disability pension and workplace injury and ill benefits. Prevention services related to OSH can also be provided and a particular advantage of social insurance systems is that injury and ill health information is available to assist with targeting prevention initiatives (Jacobs & Goddard, 2000; ENASP, 2021).

### **Extension**

Agricultural extension is the discipline of provision of advice or adult education and training to farmers. There are many variants in extension provision including public or private, independent or commercial. The term ‘extension’ is an internationally used term which originally arose the USA Land Grant Universities where agriculture research and education were conducted, and the term ‘extension service’ as adopted to describe outreach advisory and training activities among the farming community (Jones & Garforth, 1997). Extension is considered to be the ‘conscious use of communication of innovation to help people form sound opinions and make good decisions’ (van den Ban & Hawkins, 1996). Paine (1999) believed that the attainment of voluntary behaviour change is the universal goal of extension organisations. Black (2000) proposed that extension may be classified under the following four prominent paradigms each

requiring increasing people skills: (1) transfer of technology, (2) problem-solving, (3) adult education, and (4) human development.

### **Transfer of technology (TOT)**

Transfer of Technology (TOT), also referred to as the linear approach, is described as extension endeavour aimed at changing behaviour by promoting adoption of new (externally developed and tested) technology or management practices by providing information, opportunity and persuasion (Bergevoet & van Woekum, 2006). They state that while the TOT model is still a commonly used paradigm it has been subject to the following major criticisms: it promotes a standardized approach and may not be adapted to, of suitable for, the specific farm situations; it promotes single-component technologies and may not serve to facilitate a holistic change processes and that it is a 'top-down' approach that ignores the knowledge, skills and adaptive abilities of farmers themselves.

### **Problem solving approach**

Bergevoet & van Woekum (2006) described extension or advisory work as assisting farmers to find solutions to technological or management problems and accordingly, this form of extension is a form of knowledge transfer (KT) or knowledge exchange. The problem solving approach relies on the use the farmer having the competence to decide on what advice is needed and the advisor having the knowledge needed to solve the problem (Bergevoet & van Woekum, 2006). Studies by Hogeveen et al. (1992) and Peters et al. (1994) indicated that farmers availing of advice out-perform in farm business output measures the results of those that do not avail of advice. However, Hogeveen et al. (1992) noted that maintaining an advisory relationship is necessary to maintain progress.

### **Adult learning**

Adult learning theories are considered to have relevance to learning among farmers (Bergevoet & van Woerkum (2006). Learning can take place based on individual reflection or in-group situations as contact with other persons can provide a stimulus to reflect on situations and experiences described by others and lead to learning experiences among group members (Bergevoet & van Woekum, 2006).

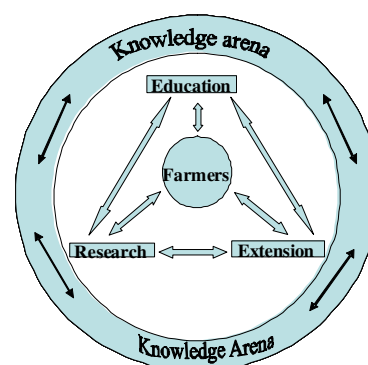
### **Human Development approach**

Regarding human development, Coutts (1995) described the role of extension as a means to 'facilitate and stimulate' individuals and groups to take the initiative in problem definition and seek solutions, which is considered a participatory 'bottom-up' approach. Its advantages include: that it draws upon accumulated knowledge and experience; it acknowledges the value of farmers sharing ideas and information and it makes use of the group process of learning (Black, 2000).

### **Agricultural Knowledge and Information System (AKIS)**

The Agricultural Knowledge and Information System (AKIS), has been a key model of extension, which suggests that multiple flows of knowledge and information occur within extension problem solving (Rivera et al., 2001). In this model, the farmer is the central actor, who interacts with education, research and extension within a

knowledge arena. In this model (Fig. 1), the farmer is positioned in the centre with access to multiple sources of knowledge and information from research, extension and education. A two-way flow occurs in the model between each source and farmers while research, extension and education interact in the development of knowledge and the model is grounded in a knowledge arena arising from many sources where knowledge is actively developed and used.



**Figure 1.** Agricultural Knowledge and Information System (AKIS).

(Source: Adapted from Rivera et al., 2001).

### **Diffusion of Innovations**

The Theory of Diffusion of Innovations, first proposed by Rogers in 1962, is an influential theory in the field agricultural extension. It proposes the following five-step diffusion process of innovation adoption: knowledge gain, persuasion, decision, implementation and confirmation (Rogers, 2003). Diffusion is seen as a process where innovation is communicated through various communications channels over time among members of a social system. Rogers (2003) identified that uptake of an innovation can be partitioned into the following discreet and mutually exclusive categories related to adoption pace: innovators (2.5%); early adopters (13.5%); early majority 34%; late majority 34%; laggards, 16%. Rogers (2003) also found that Innovators possess a mental ability to cope with uncertainty while later adopters tended to observe the results of innovators and early adopters.

Regarding preventative innovations in public health and OSH arenas, a relatively slow rate of adoption has been noted (Rogers, 2003) and this is attributed to the perceptions of a person towards implementing the adoption relative to the probability of occurrence of a future unwanted event such as an injury or ill health. Application of this theory indicates that extension has to deal with a wide range of farmers at various adoption categories. It also indicates that making progress with adoption requires persistence over time.

### **Extension and OSH advice provision**

Many studies have identified collaboration with extension as a cost-effective and potentially effective strategy to promote OSH due to its trustful relationship with farmers that allows it to be a practical source of OSH advice and information (Seiz & Downey, 2001; Neufeld & Cinnamon, 2004; Sampson et al., 2020). A recent USA study, using Social Network Analysis, identified agricultural extension being delivered by a small number of organisations, that were central in OSH network partnerships (Beseler et al., 2020).

Demand for OSH extension services, however, from farmers has been shown to be low in an Irish study (Finnegan & Phelan, 2003) which found that 5% of Irish farmers annually sought OSH advice, with the state extension service (Teagasc) being the organisation from whom a majority of farmers (67%) would seek OSH advice. Thus,

provision of OSH extension needs some form of pro-active leadership and incentivisation to gain on-going engagement.

In conclusion, it is evident that regulation and extension have different characteristics. Regulation is based on its policy-guided mandate and focuses on gaining implementation of statutory provisions. Extension on the other hand relies on voluntary responses of farmers, is broadly based and is focused on assisting farmers to achieve their farming goals and to provide advice related to overall farm success.

### **Recent developments in Extension in Europe**

The European Commission has recently published a comprehensive strategy document entitled: 'Preparing for Future AKIS in Europe' (EC, 2019). This document outlines a new way of working with advisors within the AKIS required by the Common Agricultural Policy (CAP) Strategic Plans (particularly Regulations 13 & 72). These requirements state that 'all advisors shall be integrated within the AKIS in an inclusive way, to be able to cover economic, environmental and social dimensions and to deliver up-to-date technological and scientific information developed by Research and Innovation. Advisors must be impartial and be able to deliver innovation support'. The new approach requires a move away from a linear TOT approach towards an interactive approach where listening and discussions are emphasised, referred to as co-creation. This approach reflects individual farming requirements and involves strong dialogue between farmers and advisors.

EU member states are obliged to have a Farm Advisory Service (FAS) in place, which covers EU schemes under both CAP Pillars. FAS advisors are required to undergo regular training related to CAP Schemes (EU- Regulation No1305/2013).

At a voluntary level, a professional body has been established in 2013 for qualified advisors who work in various consultancies and extension (advisory) services known as the Europe European Forum for Agricultural and Rural Advisory Services (EUFRAS, 2021) (<https://www.eufRAS.eu/>). EUFRAS estimates that there are about 40,000 advisors in Europe working in a huge diversity of public and private organisations and also working on a diversity of activities.

Also established recently is a competence development programme leading to the award of a 'Certificate for European Consultants in Rural Areas' (CECRA) (<https://www.cecra.net/>). This programme for advisors and consultants working in rural areas combines practical training in tested advisory techniques. To achieve certification advisors choose from a suite of modules (currently 17) and have the opportunity to interact with colleagues in other regions and countries.

### **Agricultural Extension in Ireland**

As the agri-food sector is a large component of the Irish economy accounting for 7.5% of Modified Gross National Income (excludes globalisation effects) a significant public agricultural extension service is in place. The components of this service are described on the EU Project 'i2Connect - Connecting Advisors to boost Innovation in Agriculture and Forestry' (Web site <https://i2connect-h2020.eu/>).

A salient feature of the Irish service includes an integrated Research and Knowledge Transfer (KT) model (Knierim & Prager, 2015). Research linkages are also in place with universities and higher level institutions through post-graduate research

programmes. The KT component includes vocational and adult education and training and advisory services. OSH is included in all elements of the model.

A Joint Prevention Initiative is operated between the Irish Health and Safety Authority (H.S.A.), which is the statutory authority for guidance and regulation of OSH in all workplaces and the state public agricultural extension service (Teagasc). An evaluation of implementation of this initiative has been published (McNamara, 2015). Farmer implementation of OSH and extension engagement in this area have been incentivised by state and EU support (DAFM, 2021). A module on OSH is provided to future agricultural extensionists at the principal Irish university school of agriculture and food science (University College Dublin).

### **Extension related to Ergonomics in Ireland**

By way of example of Irish extension engagement in ergonomics, the following measures are examples of approaches being implemented: Research on musculoskeletal disorders (MSDs) has been conducted in association with a university physiotherapy school and published (Osborne et al., 2012; Osborne et al., 2014). Advisors provide advice on farm workplace, buildings and facilities design work efficiency and ergonomics based on national state Department of Agriculture, Food and the Marine (DAFM) specifications. Trainees engaging in vocational education receive training on MSDs prevention. Most recently, coinciding with the commencement of the EU-OSHA Campaign to Prevent MSDs, communications nationally with farmers occurred on preventing MSDs (Teagasc, 2020). The measures undertaken are in line with the approach of the EU Manual Handling Directive (Directive 90/269/EEC).

In summary, before examining the study experimental data, it is evident that tackling OSH in agriculture is a formidable task requiring a multi-agency approach, but that extension has a significant potential role to play in engaging with farmers to gain improvements.

## **MATERIALS AND METHODS**

This paper provides the results of the following three surveys: (1) a pan European survey related to extension engagement in agricultural OSH conducted in year 2019; (2) a survey of Irish extension advisors related to their opinions of extension methods, which motivate farmers to adopt OSH measures conducted in 2014, and (3) a survey of a sample of farmers on their satisfaction with OSH advice conducted in year 2020.

The pan European Survey was undertaken at two events, an EU COST Action Management Committee (SACURIMA) and a EUFRAS Meeting. Participants included advisors and OSH experts with knowledge of the agriculture sector in their country. In total 33 persons responded were from 18 countries with 6, 5 and 4 respondents respectively from Ireland, Poland and Estonia. For the Irish advisors survey, 128 completed it at in-service training events, which is circa 45% of the national cohort of public sector farm advisors. Advisors serviced either dairying or drystock (beef cattle and sheep) enterprises and a comparison was made between advisor type and their opinions of extension in OSH using an SPSS Statistical package (SPSS.V.14). For Survey 3, the findings related to satisfaction with extension services in OSH is from 428 respondents from a survey of public extension farmer clients in one diverse region of Ireland.

Regarding ethics approval, Surveys 1 and 3 were conducted within the statutory remit of the state agricultural extension service (Teagasc), while Survey 2 was conducted within the ethics framework for research studies at University College Dublin (UCD, 2010). All national data protection and data storage requirements were implemented.

## RESULTS AND DISCUSSION

### Pan European survey related to Extension engagement in agricultural OSH (Survey 1)

The pan European survey (Survey 1) found that 97% of respondents agreed that farm OSH management is an important part of overall farm management (mean score of 4.7) and 87% agreed that it would be worthwhile to provide an OSH extension service to farmers (mean score 4.5) (Table 1). However, 40% of respondents reported that an extension service including OSH was not provided in their country to the best of their knowledge (Table 2). Seventy four percent and 54%, respectively, indicated that OSH training or advice were available to farmers. Among respondents, 42% and 50% respectively, reported OSH training provision at undergraduate or in-service training, levels while 62% indicated that an organisation other than the one employing the respondent provided an OSH extension service to farmers. Overall, while respondents were positive to inclusion of OSH in extension, this survey indicates limitations in delivery of OSH services to farmers due to lack of service provision and lack of training of extension staff.

**Table 1.** Distribution of Respondents (%) by scored Importance of OSH management/ provision of extension service ( $n = 33$ )

Opinion	5	4	3	2	1	Mean Score
1.OSH important part of farm management	81	16	0	0	3	4.7
2.Worthwhile to offer OSH extension service	71	16	3	0	10	4.5

5 = Strongly Agree: 4 = Agree: 3 = Neither: 2 = Disagree: 1 = Strongly Disagree.

**Table 2.** Distribution of Respondents (%) related to agricultural OSH extension provision

Response	Yes % (n)	No % (n)
1. Does Extension provide OSH service in your country ( $n = 30$ )	60 (18)	40 (12)
2. If Q1 yes: Training of farmers/operatives ( $n = 23$ )	74 (17)	26 (6)
3. If Q1 yes: Provision of advice ( $n = 21$ )	54 (12)	46 (9)
4. Extension Officers OSH training: Undergraduate level ( $n = 24$ )	42 (10)	58 (14)
5. Extension Officers OSH training: In-service Training ( $n = 28$ )	50 (14)	50 (14)
6. Another organisation providing extension OSH service ( $n = 31$ )	62 (19)	38(12)

### Survey of Irish Extension advisors related to their opinions of extension methods (Survey 2)

This survey was undertaken among Irish state (Teagasc) advisors (Table 3) and provides Likert-type scales and Mean Scores for extension methods related to advisors opinions on what could motivate OSH adoption with higher scores reflecting positive opinions. Mean Scores were as follows: media victim testimonials (3.62); on-farm group discussions (3.61); on-farm demonstrations (3.58); DVD of victim testimonials (3.11); half-day training (3.05); radio (2.45); posters (2.13); newspaper articles/newsletters (2.04).



**Table 3.** Advisors' opinions of the various extension approaches in terms of motivating farmers to adopt farm OSH practices

Approach	Advisor type	Opinion - Scale <sup>1</sup>					Mean Score	Significance <sup>2</sup>
		5	4	3	2	1		
1. Television - Victim testimonials	Drystock ( <i>n</i> = 75)	34.7	22.7	17.3	18.7	6.7	3.62	<i>P</i> = 0.942 (NS); <i>Chi Sq.</i> = 0.777; <i>df.</i> = 4
	Dairy ( <i>n</i> = 50)	34	24	22	14	6		
	Total ( <i>n</i> = 125)	34.4	23.2	19.2	16.8	6.4		
2. Discussion groups meetings	Drystock ( <i>n</i> = 76)	23.7	31.6	23.7	15.8	5.3	3.61	<i>P</i> = 0.876 (NS); <i>Chi Sq.</i> = 1.216; <i>df.</i> = 4
	Dairy ( <i>n</i> = 52)	26.9	34.6	23.1	13.5	1.9		
	Total ( <i>n</i> = 128)	25.0	32.8	23.4	14.8	3.9		
3. On farm demonstrations of OSH	Drystock ( <i>n</i> = 72)	37.5	20.8	12.5	18.1	11.1	3.58	<i>P</i> = 0.012 * <i>Chi Sq.</i> = 12.817; <i>df.</i> = 4
	Dairy ( <i>n</i> = 50)	24	38	26	4.0	8.0		
	Total ( <i>n</i> = 122)	32	27.9	18	12.3	9.8		
4. Showing short DVD with real life cases	Drystock ( <i>n</i> = 69)	26.1	20.3	11.6	18.8	23.2	3.11	<i>P</i> = 0.252 (NS); <i>Chi Sq.</i> = 5.361; <i>df.</i> = 4
	Dairy ( <i>n</i> = 44)	20.5	22.7	25	20.5	11.4		
	Total ( <i>n</i> = 113)	23.9	21.2	16.8	19.5	18.6		
5. Short half-day OSH courses	Drystock ( <i>n</i> = 72)	16.7	16.7	33.3	22.2	11.1	3.05	<i>P</i> = 0.593 (NS); <i>Chi Sq.</i> = 2.791; <i>df.</i> = 4
	Dairy ( <i>n</i> = 49)	22.4	18.4	20.4	28.6	10.2		
	Total ( <i>n</i> = 121)	19	17.4	28.1	24.8	10.7		
6. Radio usage	Drystock ( <i>n</i> = 56)	7.1	12.5	28.6	23.2	28.6	2.45	<i>P</i> = 0.740 (NS); <i>Chi Sq.</i> = 1.979; <i>df.</i> = 4
	Dairy ( <i>n</i> = 42)	2.4	19.0	28.6	19	31		
	Total ( <i>n</i> = 98)	5.1	15.3	28.6	21.4	29.6		
7. Posters display	Drystock ( <i>n</i> = 48)	6.3	10.4	16.7	25	41.7	2.13	<i>P</i> = 0.912 (NS); <i>Chi Sq.</i> = 0.983; <i>df.</i> = 4
	Dairy ( <i>n</i> = 34)	5.9	5.9	23.5	23.5	41.2		
	Total ( <i>n</i> = 82)	6.1	8.5	19.5	24.4	41.5		
8. Newspapers Articles/ Newsletters	Drystock ( <i>n</i> = 55)	7.3	10.9	14.5	30.9	36.4	2.04	<i>P</i> = 0.123 (NS); <i>Chi Sq.</i> = 7.257; <i>df.</i> = 4
	Dairy ( <i>n</i> = 41)	2.4	0.0	22	26.8	48.8		
	Total ( <i>n</i> = 96)	5.2	6.3	17.7	29.2	41.7		

<sup>1</sup> 5 point scale scored from 5 (most effective) to 1 (least effective); <sup>2</sup> Significance *P* < 0.05\*; NS = Non-Significant.

Advisor opinions indicate that TV-disseminated victim testimonials along with practical on-farm approaches including OSH inclusion at on-farm discussion group meetings and on-farm demonstrations as the most motivating approaches for farm adoption of practices.

Advisor opinions were similar among dairy and drystock advisors with the exception of opinion on on-farm demonstrations of OSH where dairy advisors had an overall higher rating of this approach. Overall, the information indicates that a wide range of approaches may be used by extension to motivate farmer OSH adoption.

### Survey of Farmers related to their satisfaction levels with OSH advice (Survey 3)

The survey of farmers' levels of satisfaction with OSH advice indicates a relatively high satisfaction level for OSH relevance to their farm and information at events mean scores of 4.04 and 4.05 respectively (Table 4). However, just 26% indicated that they were highly satisfied for both opinions indicating that potential exists to increase satisfaction ratings.

**Table 4.** Distribution of Farmers (%) by scored satisfaction with Irish State advisory service advice in OSH relevant to their farm ( $n = 447$ )

OSH advice characteristic	5	4	3	2	1	Mean Score
1. OSH Advice relevant to your farm	26	58	11	3	2	4.04
2. OSH at Advisory Events relevant to your Farm	26	58	12	3	1	4.05

5 = Highly Satisfied; 4 = Satisfied; 3 = Neither; 2 = Dissatisfied; 1 = Very Dissatisfied.

## DISCUSSION

The starting point of this paper has been to consider approaches, including regulation and agricultural extension, to assist farmers across Europe with improving OSH management to reduce the high levels of occupational injury reported (Merisalu et al., 2019). In particular, this paper explores the contribution that agricultural extension could make to alleviating the OSH problem.

The Social-Ecologic Model (SEM) (Runyan, 2003) is considered a suitable model to examine the wide-ranging influences on farmers related to OSH adoption (McNamara, 2015; O'Connor, 2020). This model describes various levels of the social environment, integrating intrapersonal, interpersonal, institutional and cultural elements associated with OSH improvement. Recent reports provide both 'big picture' information and recommendations related to improving OSH in agriculture (EU-OSHA, 2020; EU COST Sacurima, 2020). However, McNamara (2015) concluded that influencing individual farmers' OSH management capabilities has a disproportionately high influence on farm OSH standards and practices. This finding highlights the importance of using both influential persons and organizations (Hon & Gruning, 1999) who are trusted by farmers to assist with OSH improvement.

The review undertaken of regulation and extension indicates that there are clear distinctions between these approaches, with extension relying on its voluntary, trustful and ongoing working relationships with farmers and using a range of communications approaches based on research and co-creation. The limitations of regulation include that it does not have on-going personal contact and that individual inspections are highly resource intensive and challenging to implement among largely family run farms (Barnetson, 2012). However, as illustrated by the Irish Prevention Initiative (McNamara, 2015), the possibility of regulatory and extension organisations working in co-operation and with farming organisations exists to implement the common goal of improving agricultural OSH. Farmers are influenced by many sources, and given the predominant family employment structure and culture of the sector, engaging with influential sources is important for OSH progress (Beseler et al., 2020). The review of extension also indicates that significant developments in extension are in progress in Europe at both official and voluntary levels, which have potential to support promotion of agricultural OSH.

The short pan European survey of current OSH inclusion in extension (Survey 1) indicates that OSH is considered an important topic and that it would be worthwhile to include this topic in extension. This finding mirrors earlier research in Ireland (Fox, 2014; McNamara, 2015) which indicates that both farmers and advisors support OSH inclusion in extension programmes. This finding indicates that OSH programming would be positively received provided it is appropriately designed and implemented. However, the pan European survey would suggest that agricultural advisors and OSH experts see a substantial gap in the provision of OSH extension services to farmers and

that there is scope to improve both training of advisors and provision of advice and training to farmers. It is suggested that OSH inclusion in extension deserves greater consideration at a European level on a systematic basis given its importance and relevance to farmer wellbeing and farm sustainability (Whelan et al., 2009).

Extension leadership profoundly influences the quality of services delivered (Harder et al., 2010) and several studies have indicated that extension engagement could be more effective with training provision in OSH principles, more time allocated to OSH service delivery and availability of better resource materials for use with farmers (Chapman et al., 1996; Mincemoyer & Kelsey, 1999; Carrabba et al., 2001). Professional training of extension professionals, both under-graduate and in-service training, is necessary to develop competencies for success in extension (Scheer et al., 2006). Also, use of the social skills of relationship building has been more highly ranked than technical skills for competence in extension (Harder et al., 2010). In Ireland, provision of OSH training to advisors led to increased reported inclusion in a range of approaches including advisor one-to-one farm visits, office consultations, and on-farm discussion groups and on farm events (McNamara, 2015).

The advisor opinions data on extension approaches for motivating farmers in OSH (Survey 2) indicates the range of approaches available but that: TV victim testimonials; on-farm discussion groups and on-farm demonstrations gained the highest preferences of the options offered. It is clear that extension has a wide range of communications approaches to communicate with farmers regarding OSH. Apart from TV victim testimonials, a positive finding from this survey is the high ranking of advisors for participatory events such as discussion groups and on-farm events. Engaging farmers in their workplace settings is crucial for success with OSH training (Holte & Fallo, 2018). It has been shown that farmer discussion group OSH inclusion is associated with increased intention to take OSH action (O'Connor, 2020). In a farmer environmental study, participatory extension programmes have been shown to influence practices, beliefs and values and thus can help facilitate effective practice change (Knook & Turner, 2020). It has been shown also that it is possible to motivate farmers to increase injury prevention adoption through media promotion, short training and farm audit visits but that an extended time period may be needed to measure progress with injury reduction (Alwall Svennefelt & Lundqvist, 2020). Thus, participatory extension approaches can lead to a cultural shift towards OSH adoption among farmers over-time.

While digital technologies were not covered in the advisors survey (Survey 2) due to its relatively low usage at the time (Wims & Byrne, 2015), it is likely that these technologies will be increasingly used in extension in the future (EU FAIRshare 2018-2023: <https://www.h2020fairshare.eu/>)

Irish farmer extension clients indicated a high satisfaction with OSH messages available from Irish public extension service (Survey 3). One of the most important concepts in customer satisfaction leadership is 'contact surface'. This is the point of engagement of a service organisation to the client including: personnel contacts, e.g. extension contacts with farmers; product contacts, e.g. information on farm technology and practices ; support system contacts, e.g. help to access schemes and incentives, and ambience contacts, e.g. friendliness of the extension staff (Ganpat, 2014). It is evident that efforts should continuously be made to increase satisfaction levels with extension OSH delivery.

However, as farmers seek limited advice in Ireland on farm OSH (Finnegan & Phelan, 2003), it is suggested that pro-active measures are required to gain both extension and farmer engagement in extension OSH. In the USA it has been shown that, incentives lead to increased uptake of specific practices such as farm vehicle Roll Over Protection Structure fitting (Hallman et al., 2005). In Ireland OSH inclusion occurs in a range of government schemes and programmes and some OSH training to is provided through the Farm Advisory Service (FAS) as required under EU Rural Development Programme regulation 1305/2013 (DAFM, 2021).

This study acknowledges the limitation of the relatively low level of participation in the pan European study related to agricultural extension engagement in OSH. It is suggested that it would be worthwhile that a comprehensive audit of extension engagement in OSH throughout Europe be completed.

## CONCLUSIONS

Improving the OSH record on the agriculture sector throughout Europe represents a considerable challenge given the numbers of persons working in the sector and the nature of agricultural workplaces which predominantly use family labour. This paper having examined the role extension in improving OSH in agriculture finds that it has a potentially pivotal role to play as its participatory methods have potential to influence farmer practices, beliefs and values. However, the study data indicates that OSH is incorporated in extension to a variable extent throughout Europe and suggests that organisational structures need to be enhanced to increase extension engagement in OSH. Current official and voluntary developments with extension in Europe have potential to provide opportunities for greater OSH engagement of this discipline into the future.

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