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Factors underlying farmers' intentions to adopt best practices: The case of paddock based grazing systems

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ABSTRACT

The Irish beef sector is expected to increase output as part of the most recent national agriculture strategy. General improvements in pasture production efficiency can be achieved by increasing grass utilisation. However, Irish beef production is primarily based on extensive pastoral grazing with low uptake of best management practices among farmers. An important step in facilitating innovation in the sector is to gain improved understanding of the innovative behaviour of farmers. Hence, this study uses psychological constructs to analyse factors that affect the adoption of paddock based grazing systems by Irish beef farmers (n = 382). Farmers were surveyed from different regions within Ireland and Principal Component Analysis used to empirically confirm the hypothesised Theory of Planned Behaviour (TPB) constructs. Cluster analysis was thereafter employed as classification criteria to cluster respondents into types. The TPB was subsequently applied to explain intention to implement the grazing practice. Three clusters of farmers were elicited based on their beliefs of paddock based grazing systems and labelled The Engaged, The Restricted, and The Partially Engaged. The Restricted cluster was particularly unlikely to uptake the grazing practice as they perceived they lacked the required resources to implement the innovation. This was of particular relevance as the practice can be implemented with relatively few resources and therefore signals a knowledge gap. The findings are relevant to policy as they provide insights on the factors influencing the process of targeting knowledge transfer through appropriate channels which can help build potential drivers for behavioural change.

1. Introduction

Agricultural production is forecast to expand significantly over the coming decades as the global population continues to rise. One of the major challenges facing the food system is the rapidly increasing demand for red meat and its associated environmental externalities (Godfray et al., 2010). The environmental impact of beef production is often determined by production efficiencies (Hyland et al., 2016). Hence, action is required throughout the sector to increase food provision while concurrently lowering environmental impacts. For this reason it is vitally important that farmers adopt best practices that increase productivity which can in turn reduce environmental damage. Therefore, management practices which allow farmers to sustainably intensify are particularly significant; i.e. increasing agricultural output without adverse environmental impacts and without the cultivation of more land (Garnett and Godfray, 2012; Smith, 2012). Effective grassland management is an innovation shown to increase productivity and income while reducing environment impacts (Borges et al., 2014). Taube et al. (2014) and Baumont et al. (2014) have suggested that general improvements in pasture production efficiency can be achieved by increasing pasture utilisation; placing less importance on inputs.

In many regions of Northern and Western Europe grass is the primary dietary constituent for beef production systems due to favourable temperate climatic conditions. Ireland presents characteristics that are applicable to many European beef farmers of similar climatic conditions. The topography of the country varies considerably, encapsulating an array of challenges and environments faced internationally by many in the sector. Irish beef cattle are fed predominantly on grazed grass with grass silage complimented with some concentrate fed during winter; sometimes high levels of concentrates are used in the finishing period (O'Mara, 2012). Ireland has a competitive advantage over many EU countries as it has the potential to grow grass forage over a long growing season. Consequently, 54% of the lifetime weight gain of beef cattle is typically derived from grazed grass and 24% from grass silage (O'Donovan et al., 2011).

The beef industry is an important component of the Irish agri-food

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sector and accounts for 30% of gross annual agricultural output. The vast majority of this output is destined for the export market (McGee and Crosson, 2016). Nevertheless, the industry faces numerous challenges such as the increasing cost of production, fluctuation of beef prices and an unstable international economic environment (Teagasc, 2016, 2017). The sector is characterised by a high dependency on subsidies, an ageing farmer profile, and small farms with low average farm incomes (Hennessy et al., 2013). Advancements in the productivity of the beef industry are therefore required in order to offset such pressures and to maintain profitably. Furthermore, industry output is expected to grow as part of the most recent national agriculture and food strategy Food Wise 2025 (DAFM, 2016). Increasing grass utilisation by 2 t/ha is one of the approaches which could assist the Irish beef industry improve productivity (DAFM, 2016). However, in order to improve grassland utilisation there is a need to adopt efficient grass management practices such as paddock systems.

Farmer's individual approaches to grazing may vary spatially and temporally (Bohnet et al., 2011). Nevertheless, there are likely to be consistent characteristics and patterns of value systems, motivations and social and economic factors which influence their respective grazing practices (Bohnet et al., 2011). On-farm grass utilisation among Irish farmers is low, with significant potential for expansion and increased efficiency (Creighton et al., 2011). Thus, paddock based grazing has been promoted as a best management practice with environmental benefits and associated higher revenue but its adoption rate remains low (Creighton et al., 2011). This poses a major challenge to policy makers and agricultural extension program designers who aspire for the maximum uptake of best management practices. Potential reasons for the non-adoption of best practices for cattle farmers include unfamiliarity, non-applicability, high cost, still considering adoption, and preference not to adopt (Gillespie et al., 2007).

The underlying psychological constructs which affect farmers' behaviour are often overlooked when evaluating the adoption of management practices (Blackstock et al., 2010). Farmers may be uncertain about technology adoption if faced with an innovation that involves conflicts between monetary, management, and social factors (Kim et al., 2008). Paddock grazing is a well-established technology with an expectation of diffusion given the identified benefits. Despite this, implementation of paddock based grazing has been poor on Irish beef farms despite extensive promotion (McGee and Crosson, 2016).

Research concerning farmer adoption of new and novel agricultural technologies has attained considerable attention; however, less focus has been directed towards the low adoption of well-established technologies. The use of landholder typologies has been recommended to improve the effectiveness of agricultural policies and extension programs (Emtage et al., 2007). The purpose of this study is to establish a typology of Irish beef farmers based on their perceptions of paddock based grazing systems and thereafter to use the Theory of Planned Behaviour to evaluate what factors determine their intention to implement the practice. This paper aims to use psychological constructs to analyse factors that affect the adoption of paddock systems by commercial beef farmers in Ireland. The findings may be extrapolated to aid policy-makers in other temperate regions to encourage farmers in adopting measures that aim to increase grass utilisation.

1.1. Paddock based grazing systems

The profitability of Irish beef farming is underpinned by the level of grass utilisation (O'Donovan et al., 2011). However, on-farm grass utilisation among Irish farmers is low, with significant potential for expansion and increased efficiency through adoption of grassland management technologies (Creighton et al., 2011). Paddock based grazing systems (also referred to as rotational grazing) are defined as where a paddock is grazed and rested regularly, either on a set calendar schedule or intermittently as needed. In contrast, continuous grazing is defined as where a paddock is stocked continuously at a generally consistent stocking density whether or not it is with the same animals (Sanderman et al., 2015). Paddock grazing allows an area to be grazed by a group of animals in a fast and planned manner, allowing the sward to rest and rejuvenate quickly post grazing (Creighton et al., 2011). The paddock system is a systematic rotational grazing system which is used on beef and sheep farms. It involves roughly equal-sized paddocks and dividing the herd into separate grazing groups to plan the spring grazing rotation. Some of the key benefits of such a system include: control of over grazing, higher grass production, improves grass quality and better access during wet weather (Teagasc, 2011; Undersander et al., 2014).

Paddock based grazing is an intensive management system and can be expensive as it requires capital investment in fencing, water and access routes (Clarke, 2016). However, this need not be the case and it can often be carried out inexpensively through temporary fencing and a radial plot design from existing water sources (Butterfield et al., 2006). The herd graze one paddock at a time, the farmer doesn't allow animals to bare the paddock completely, permitting faster grass recovery time (Allen et al., 2011). It is recommended that paddocks should be equal in size with water supplied to each grazing division (Clarke, 2016). There are many advantages to paddock based grazing systems as they promote higher grass production, improve grass quality, and ensure greater grass utilisation (Dorrough et al., 2004). Furthermore, rotational grazing can be effective in controlling pasture-borne parasites (Larsson et al., 2006). Animal performance is therefore increased when pasture is rotationally rather than continuously grazed (Marley et al., 2007).

1.2. Theoretical background: the theory of planned behaviour

The study attempts to explain the low rates of paddock based grazing adoption using the Theory of Planner Behaviour (TPB) as its conceptual framework (Ajzen, 1991). The main construct of the theory is that human behaviour can be explained through intention to behave in a particular way. Intention is the outcome of individual attitudes and beliefs, which are divided into three global categories: personal, normative and control. The three global beliefs are determined by numerous differential components; for instance attitude can be determined by indirect beliefs such as behavioural belief strength and evaluation of outcomes (Fig. 1). Personal beliefs relate to an individual's perception of the outcomes of a specific behaviour, normative belief are related to the perceived social pressure to perform a behaviour and control beliefs are associated with the individuals perception of how easy or difficult it is to perform the behaviour (Fig. 1). Therefore, adoption of a grassland management tool is directly related to a farmer's intention to adopt it, which in turn, is based on the farmers' beliefs about the grassland management tool.

The TPB has been used in agricultural research to explain the processes of farmers' decision making (de Lauwere et al., 2012; Mattison and Norris, 2007). The three central global constructs used in this study are Attitude (farmers' perceptions of paddock grazing), Subjective Norm (perceived social pressure upon farmers to implement paddock grazing), and Perceived Behavioural Control (farmers' perceptions about their capacity implement paddock grazing). The TPB is based on aggregating Attitude (A), Subjective Norms (SN), and Perceived Behavioural Control (PBC) beliefs and can be depicted in a model to explain behavioural intention (BI) in Eq. (1). In the TPB model, β represents the empirically determined weights that estimate each aggregated belief and ε is defined as an error term:

$$BI = \beta_1 \mathrm{A} + \beta_2 \mathrm{SN} + \beta_3 \mathrm{PBC} \ldots\ldots + \varepsilon \quad (1)$$

2. Methods

2.1. Questionnaire design and distribution

Teagasc is a national body providing integrated research, advisory