Journal of Rural Studies 39 (2015) 74–84

Contents lists available at ScienceDirect

Journal of Rural Studies

journal homepage: www.elsevier.com/locate/jrurstud

Researching farmer behaviour in climate change adaptation and sustainable agriculture: Lessons learned from five case studies

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ARTICLE INFO

Article history:
Received 20 September 2014
Received in revised form
16 February 2015
Accepted 8 March 2015
Available online

Keywords:
Agriculture
Adaptation
Sustainability
Decision-making
Behaviour
Interdisciplinarity

ABSTRACT

Understanding farmer behaviour is needed for local agricultural systems to produce food sustainably while facing multiple pressures. We synthesize existing literature to identify three fundamental questions that correspond to three distinct areas of knowledge necessary to understand farmer behaviour: 1) decision-making model; 2) cross-scale and cross-level pressures; and 3) temporal dynamics. We use this framework to compare five interdisciplinary case studies of agricultural systems in distinct geographical contexts across the globe. We find that these three areas of knowledge are important to understanding farmer behaviour, and can be used to guide the interdisciplinary design and interpretation of studies in the future. Most importantly, we find that these three areas need to be addressed simultaneously in order to understand farmer behaviour. We also identify three methodological challenges hindering this understanding: the suitability of theoretical frameworks, the trade-offs among methods and the limited timeframe of typical research projects. We propose that a triangulation research strategy that makes use of mixed methods, or collaborations between researchers across mixed disciplines, can be used to successfully address all three areas simultaneously and show how this strategy has been achieved in the case studies. The framework facilitates interdisciplinary research on farmer behaviour by opening up spaces of structured dialogue on assumptions, research questions and methods employed in investigation.

1. Introduction

This paper examines the challenge of researching the complexity of farmer behaviour in the face of increasing and simultaneous ecological, economic, and social pressures, and in the dynamic frame of their institutional context, biophysical environment, power relations, and social networks. We are concerned with identifying what to investigate regarding farmer behaviour, and how to do it, to generate the knowledge needed to inform adaptation to global environmental change and transitions to sustainable agriculture. With this aim, we identify three areas of knowledge that are necessary to understand farmer behaviour, examine the utility of an integrated and interdisciplinary approach, and discuss related methodological challenges by applying it to five case studies.

Agriculture is exposed to multiple, simultaneous and interconnected ecological, economic and social pressures (O'Brien and Leichenko, 2000). Increased economic interconnections in a globalized world create unpredictable dynamics and conditions of price volatility, which can affect agricultural incomes and livelihoods (Fader et al., 2013). Moreover, pressures on agricultural systems include the competition between different land uses (Smith et al., 2010) and different uses for agricultural land (Cassidy et al., 2013), the global shift in consumption patterns towards a more dairy and meat-based diet (Popkin, 2001), and the diversification of rural livelihoods in the South (Reardon et al., 2007). Adaptation in agricultural systems to these multiple pressures is therefore an urgent need.

On the other hand, agricultural activities are themselves major contributors to a range of environmental issues, including

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http://dx.doi.org/10.1016/j.jrurstud.2015.03.009
0743-0167/

greenhouse gas emissions, biodiversity loss, deforestation, water and soil pollution, and soil erosion (Foley et al., 2011; IPCC, 2013). In the face of a greater challenge of producing food while preserving the environment, a sustainable and fair global food system will require a new approach to food production, distribution, and consumption (Ingram et al., 2010; Horlings and Marsden, 2011).

Understanding farmer behaviour[1] is central to enhancing adaptive capacity and promoting sustainable agriculture. Farmers are the agents undertaking adaptation and sustainability policies and programs, so their behaviour influences how and with what success these programs are realized on the ground (e.g., Home et al., 2014; Moon and Cocklin, 2011). Understanding farmer actions in their social-ecological context is essential to identify cases where intervention is needed, and the type of policies that can effectively promote socio-technical change and innovation. This can inform the design and implementation of measures such as incentives (e.g., Home et al., 2014), regulations (e.g., Bartel and Barclay, 2011), or institutional reforms (e.g., Ziervogel and Ericksen, 2010). Furthermore, a systematic understanding of farmers' adaptive behaviour can provide a basis for drawing the boundaries of policies or external aid, that is, to identify when *not* to intervene. This will avoid wasting resources on planned adaptation policies where bottom-up, autonomous adaptation (i.e., adaptation undertaken "as a regular part of on-going management" and not "consciously and specifically planned in light of a climate-related risks" (Smit and Skinner, 2002, p.93)) is already imminent or effective (Mortimore and Adams, 2001).

However, while farmer behaviour is a key determinant of agricultural systems' adaptability, too often research relies on theories and methods that do not capture the complexity of farmer behaviour. This then translates into ineffective adaptation or sustainability policies (Vanclay, 2004; Barnes et al., 2013). Furthermore, understanding farmer behaviour is plagued by the common difficulty in communicating and conducting collaborative research on sustainability and global change across disciplines and paradigms (Feola and Binder, 2010a; Podestá et al., 2013). Finally, the role of on-the-ground decision-making by individual farmers is often studied in individual cases to determine its environmental, economic, and social effects. There have been few efforts to link across studies in a way that provides opportunities to better understand empirical farmer behaviour, design effective adaptation and sustainable agriculture policies, and be able to aggregate from case studies to a broader level.

As an author team, we realized some of these shortcomings when we came together as part of a meeting of Coupled Human and Natural System (CHANS) Fellows,[2] an event designed to encourage synthesis in research on coupled human and natural systems. We were encouraged by this focus on synthesis to take the case-level empirical material from our recent fieldwork on farmer behaviour and develop an integrated way of looking at it more rigorously and in a broader context.

In this paper, we first develop a framework comprising three areas of knowledge on farmer behaviour that we have identified as critical based on previous literature: decision-making model, cross-scale and cross-level pressures, and temporal dynamics. By developing this framework we do not aim to propose a new theory of farmer behaviour, but use the framework to compare five previously conducted case studies to illustrate how these areas of knowledge can be investigated in different geographical areas, agricultural systems, and from different disciplinary perspectives to understand farmer behaviour. Finally, we compare and discuss the five case studies to draw general lessons and identify avenues for future research. The framework and the lessons learned from this analysis can facilitate interdisciplinary research on farmer behaviour by opening up spaces of structured dialogue on assumptions, research questions and methods employed in investigation.

2. Conceptual framework

In this section, we briefly review the recent literature and recognize three areas of knowledge that we identify as a conceptual model to understand the complexity of farmer behaviour, namely: 1) decision-making model; 2) cross-scale and cross-level pressures; and 3) temporal dynamics (Fig. 1). While these areas overlap in practice, they are constructs that can be useful in examining farmer behaviour analytically from three complementary perspectives. They correspond to three distinct broad research questions, as shown in Fig. 1. In this brief review, we also highlight some of the most common disciplinary differences in each of the three areas, demonstrating that they are traditionally approached from different disciplines and rarely integrated. In fact, each of these areas of knowledge is addressed in the literature by a range of different theories, albeit with limited dialogue across disciplines and paradigms.

A caveat is in order. Due to obvious space limits, we cannot comprehensively review the existing literature and its achievements. Instead we focus here on a subset of studies within the three areas of knowledge that have been identified for future research. The framework does not represent a new theory on farmer behaviour or decision-making, but rather informs the critical analysis of the case studies to identify best practices, limitations and open issues involved in studying farmer behaviour, and lessons learned that may inform future research on farmer behaviour.

2.1. Decision-making model

Different research approaches on farmer behaviour (e.g., innovation studies, conservation agriculture, rural studies) and disciplines (e.g. sociology, social psychology, economics, cultural studies, political science) have contributed to identifying the intrinsic and extrinsic factors that may influence farmer behaviour in different contexts, including agronomic, cultural, social, psychological, and economic factors (e.g. Burton, 2004; Edwards-Jones, 2006; Siebert et al., 2006; Ilbery et al., 2013).

However, it has been argued that existing research too often relies on theoretical models that do not capture the complexity of farmer behaviour (Edwards-Jones, 2006; Galt, 2008; Feola and Binder, 2010a; Wolf, 2011). Early concerns regarding the over-simplified representation of farmer behaviour and lack of solid theoretical basis (e.g., Schneider et al., 2000; Risbey et al., 1999; Krandilkar and Risbey, 2000) do not seem to have been addressed fully (e.g., Edwards-Jones, 2006; Galt, 2013). First, studies of farmer behaviour rooted in specific disciplines often fail to integrate different types of factors and focus on a particular set of factors (e.g., biophysical, economic, or psychological) (Feola and Binder, 2010a; Jain et al., 2015). Second, studies often assume models of 'rational action' drawn from economic theory, where

[1] In this paper, the term "behaviour" refers to an action or a series of actions. An "action", or "social action", refers to a series of acts enacted by a social actor, selected among possible alternatives, on the basis of a plan which can evolve in the course of the action itself. The social action aims at a goal, given a situation or context shared also by other actors who can react to it. The situation within which the social action takes place is also shaped by norms, values, means, and physical objects, which the actor considers, to the extent he/she disposes of information and knowledge (adapted from Gallino, 1993). Based on this definition, in this paper we refer to the same term "behaviour" to indicate actions enacted in order to pursue either adaptation to climate change or sustainable agriculture.

[2] The meeting of fellows was held in December 2012, organized by the International Network of Research on Coupled Human and Natural Systems (CHANS-Net).