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Barriers to the development of temperate agroforestry as an example of agroecological innovation: Mainly a matter of cognitive lock-in?

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ABSTRACT

Agroforestry (AF) is promoted as an environmentally sound farming practice to address the pressing challenges of meeting a rising global demand for agricultural commodities while conserving biodiversity. Although AF played an important role in European farming in the past, reintroducing the planting of trees in fields is a radical innovation in the modern context, and is, initially, a researcher's idea. This paper investigates stakeholders' perspectives on modern AF in two contrasting sub-regions of southern Belgium (Wallonia). Using Q methodology to identify patterns of subjectivity, we found that the conversation splits into three idealised-types of discourse that reflect different farming styles. Only one of the three discourses is in favour of AF. The results indicate that the paradigm type (holism vs. reductionism) underlying each discourse is a major factor that influences stakeholders' position on AF. The main barriers hampering mainstreaming of AF seem cognitive in nature, and are related to the level of ecological knowledge. By exploring the 'cognitive unlocking process', our Q methodological study led to the identification of two readily available strategies to scale up AF: (1) ecological education and (2) social learning within multi-actor innovation networks. Such networks could foster on-farm innovation development and research, in which the farmer is an expert at the same level as the researcher. While this study focuses on the development of AF, the findings could be extrapolated to other agroecological innovations.

1. Introduction

1.1. Temperate agroforestry: a key agroecological innovation

Trees have traditionally been important elements of European agriculture (Mosquera-Losada et al., 2012). As a temperate and industrialised European region, the southern region of Belgium (Wallonia) has a long tradition of temperate agroforestry (AF) such as hedges and grazed orchards (*pré-vergers*). However, the area under these old AF forms decreased a lot with mechanisation of farm work and concomitant enlargement of fields since the 1950s (Auclair and Dupraz, 1999; Eichhorn et al., 2006).

A few European researchers and some pioneer farmers reintroduced AF as a modern concept in the United Kingdom, southern France, and Denmark (Mosquera-Losada et al., 2008; Nair, 2011) in the late 1990s. Modern AF is compatible with highly mechanised agriculture and consists of aligning valuable hardwood or multi-purpose trees in the middle of arable fields or grassland (Dupraz and Newman, 1997; Graves et al., 2009; Nerlich et al., 2013).

The practice of growing trees and crops on the same unit of land is currently gaining interest because of an improved understanding of the environmental consequences of high-input and large-scale agriculture, such as soil erosion, water-quality deterioration, and environmental pollution (Nair, 2011). Temperate AF is thus increasingly promoted as an environmentally sound approach to land management in Europe.

Recent high-profile policy reports review and promote sustainable/agroecological-based agriculture, specifically the call for scaling-up agroecology, including AF (De Schutter, 2014; IAASTD, 2009). The soundness of AF is further argued by its potential to simultaneously meet the multiple demands for a growing world population of (i) food and fuel production, (ii) agricultural profitability (i.e., a better use of the available ecological resources), and (iii) climate change mitigation and adaptation through carbon sequestration by trees (European Commission, 2005; IAASTD, 2009; Jackson et al., 2013; Palma et al., 2007; Peloquin and Berkes, 2009; Smith et al., 2012).

Regarding the debate on biodiversity conservation strategies, Herzog and Schüepp (2013) advocate that the management model of biodiversity and food production *land sparing* (*i.e.,* strictly separating production fields and conservation areas) is not a viable solution in the case of Europe. On the other hand, the management model of *land*

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sharing (i.e., the spatial integration between nature management and food production) through high-yield wildlife-friendly farming has proven to foster synergies between the functions of conservation and production. AF is part of these shared agricultural practices and systems (Green et al., 2005; Peloquin and Berkes, 2009; Stassart et al., 2012).

Several research programs and networks of scientists and farmers across Europe were recently launched (e.g., the Farm Woodland Forum in the United Kingdom and the French Agroforestry Association). A European Agroforestry Federation was created in 2012 to coordinate national initiatives and influence European policies. In Wallonia, the Walloon Agroforestry Association timidly implemented its first actions: a training course on AF of 4.5 days and few field trips have taken place since 2014. Yet no 'mature' modern AF plantations exist in Belgium and most Walloon farmers still have no knowledge nor experience in such integrated land-use systems.

1.2. Linking agroforestry development with stakeholders' perspectives

Although AF played an important role in Walloon agriculture's recent past, introducing trees back into the middle of cropland is a radical innovation in the modern context and was initially a researcher's idea (Liagre et al., 2005). On the other hand, innovation is increasingly recognised as a socio-technical process rather than a science-and-technology product to be transferred to so-called end users (Hayati et al., 2010; Kilelu et al., 2013; Tilman, 1998). Yet, relatively little is known on farmers' perception of temperate agroforestry. Among the rare studies we can mention, Graves et al. (2009), interviewed 264 farmers across seven European countries (not in Belgium) about their interest in AF adoption. Sereke et al. (2016) interviewed 50 farmers from the Swiss Plateau to explore potential opportunities and barriers to AF maintenance or adoption.

In this study, we adopt a more systemic approach by exploring the perspectives of different types of stakeholders regarding modern AF. Based on discourse analysis, the study aims at 'drilling down' into stakeholders' worldviews in order to get the 'quintessence' (Barry and Proops, 1999) of their differences. Such description of the population of viewpoints allows new insights into the existing barriers hampering the development of AF systems (and agroecological innovation at large), as well as leverage to overcome these.

2. Material and methods

2.1. Study sites: two contrasting Walloon farming areas

Initially, the research focused on a specific Walloon province, the Botte du Hainaut (BdH). Subsequently we extended the fieldwork area to a neighbouring province, the Brabant Wallon (BW), as its agricultural context differs substantially.

Wallonia is indeed divided into two main agricultural areas located north and south of the Sambre-Meuse geological fault line. In this study, the BdH represents southern areas that are characterised by forests, grassland landscapes and a relatively extensive type of livestock farming; the BW represents areas situated north of the fault line that are characterised by homogeneous landscapes and a highly productive type of mixed farming (i.e., combining cattle breeding and commercial crops). Hence, while few trees are left in BW's landscape, woody elements are ubiquitous in BdH's landscape. Concomitantly, the socio-economic conditions of the two areas are quite different: BdH farmers face an economic crisis linked to higher production costs and lower meat and milk prices, while for the moment being the BW's more mixed farming allow farmers to better cope with market price fluctuations.

By conducting discourse analysis in these contrasting areas, we did not aim to compare how the discourses were distributed among these; rather, the objective was to embrace the whole scope of diversity in discourses regarding AF in Wallonia. This is why stakeholders from the two main types of Walloon agricultural contexts were involved.

2.2. Q methodology

We used Q methodology (referred to as Q) to learn what stakeholders 'think about' AF. Q, which was developed by psychologists in the 1930s (McKeown, 1990; Stephenson, 1953), seeks to objectively uncover and analyse (dis)similarities in the subjective viewpoints of individuals.

Q operates on the assumption of a 'finite diversity' within a particular discourse domain; it attempts to elicit this limited variety of existing discourses among small populations of respondents in a structured and statistically interpretable form (Van Exel and de Graaf, 2005). Q allows insight into stakeholders' subjectivities in a richer and more holistic way than conventional surveys, while providing clearer structure, better replicability, and a more rigorous analytical framework than purely qualitative approaches (Raadgever et al., 2008; Watts and Stenner, 2012).

For these reasons, Q methodology is attracting attention across a wide range of disciplines and research fields (e.g., nursing [Akhtar-Danesh et al., 2008], social work [Ellingsen et al., 2010], human geography [Eden et al., 2005]). According to Donner (2001), Q is particularly well-suited for topics in which it is necessary to recognise social complexity and, therefore, it has slowly gained popularity in a range of "messy" environmental issues (e.g., Addams and Proops, 2000; Barry and Proops, 1999; Cuppen et al., 2010; Curry et al., 2013; Hermans et al., 2011; Visser et al., 2007, 2011). Previte et al. (2007) advocated that Q, were it to become better known, could be successfully applied to address rural research questions in farming research.

2.2.1. How to do Q

Van Exel and de Graaf (2005), and Watts and Stenner (2012), give a detailed account of how to conduct Q research. Practically speaking, the research process entails six well-defined steps summarized below (see also Fig. 1):

(1) **Development of the concourse**: collection of opinion statements that cap-tures the range of sub-issues and worldviews at stake relative to the topic (**STEP A**).
(2) **Q sample compilation**: selection, organization, and analysis of the concourse to draw a subset of typically 20–60 opinion statements out of the list obtained in step A (**STEP B**).
(3) **P set constitution**: sub-sampling of stakeholders (usually 12–40 people) called 'Q sorters' (**STEP C**).
(4) **Q sorting**: the Q sample is submitted to the appreciation of each Q sorter, who attributes a score to each Q statement according to the extent to which (s)he agrees or disagrees with it (**STEP D**). The collection of scores attributed by one Q sorter constitutes his/her 'Q sort'; it reflects his/her viewpoint on the topic at hand.
(5) **Q Analysis of Q sorts**: correlation, factor analysis, and calculation of factor scores (Brown, 1980; Stephenson, 1953). First a data matrix is built with the Q sorts as variables (columns) and all Q statements as objects (rows). The correlation matrix is then subjected to Principal Component Analysis (**STEP E**).

Contrary to conventional factor analysis (R-type), Q factor analysis thus correlates viewpoints instead of statements. This allows clustering Q sorters according to the degree of similarity between their Q sorts (or 'sorting patterns') and of dissimilarities with others' Q sorts (Watts and Stenner, 2012). The resulting significant factors (usually between 2 and 4) are called the 'Q Factors'.

The Q sorts of respondents loading significantly on a particular Q Factor are used to calculate one idealised Q sort, as the average of the scores assigned by clustered Q sorters to one statement is calculated to produce the 'z-score' of the Q Factor. The z-scores thus represent the respective idealised scores of all Q statements within one idealised sorting pattern. As each Q Factor groups Q sorters with similar views, it can be thought of as an idealised discourse summarizing the subjective