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From the farm to the agri-food system: A multiple criteria framework to evaluate extended multi-functional value

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ABSTRACT

Multi-functionality of agriculture and rural areas has an impact on the economy, the environment, nature and also on societal and cultural development. The dimensions of multi-functionality are interpreted in literature in many different ways, but they always deal with environmental, social and economic aspects. The measurement of the multi-functionality of the agri-food system is an important issue, as it allows the value chain to be interpreted under the lens of sustainable development pillars. In this paper, we argue that multi-functionality is a value, which extends its benefits along the entire agri-food chain. We present a methodology to aggregate indicators into an evaluation framework, in order to assess the level of multi-functionality along the entire food value chain. We have called this the "extended value" of multi-functionality, since our approach is able to consider not only the farm level, but also extends to the entire food chain. To analyse multi-functionality, it was necessary to build Non-Commodity Categories (NCC) based on Non-Commodity Output (NCO), which characterised the value added function along the agri-food value chain. A set of indicators was developed to measure the level of multi-functionality in each NCC. The Multiple Criteria Decision Aiding (MCDA) methodology ELECTRE III was used to implement an evaluation process by assigning specific importance to each indicator. This process aggregated the evaluations of multiple indicators into an integrated interpretation, and aimed to support policy makers by providing a ranking of alternative ruling policies for the agri-food value chain. We finally tested our methodological approach on the value chain for the olive oil of five European countries, to analyse which value chain was able to generate more beneficial functions above and beyond the product itself.

1. Introduction

Over the last decade, the reforms of the Common Agricultural Policy have incentivised the European Union (EU) agri-food sector to improve its competitiveness by focusing on the market signals (European Commission, 2016a). During this period, the EU agri-food sector has also benefitted from the expansion of global value chains. As a result, the values of agri-food export have doubled and the EU has strengthened to become a competitive supplier at all levels of the agricultural value chain. The output of the EU agricultural sector was valued at € 410 billion in 2015. Agriculture and the food-related industries and services together provide almost 44 million jobs in the EU. The food production and processing chain accounts for 7.5% of employment and 3.7% of the total value added in the EU. The EU exports a wide range of products from all parts of the value chain, which demonstrates the versatility of the EU agri-food sector (Eurostat, 2016).

Multi-functionality is of significant importance in the EU, due to the characteristics of rural land and the production systems. The term "multi-functionality" has been used with various meanings in the agricultural policy debate, depending on the country and on the context in which it has arisen. According to the OECD (2001), multi-functionality is a characteristic of agriculture, which goes beyond its primary function of supplying food and fibre, and provides various benefits to the environment and the socio-economic fields of society.

This work argues that some of the dimensions of multi-functionality could be analysed by means of specific indicators within the entire agri-food value chain, and not exclusively at the agricultural stage, in order to implement and evaluate policies for the multi-functionality of food systems. Moreover, the multi-functional value of the primary sector may extend its importance beyond the agricultural phase, creating an extended value through the value chain. Therefore, the objective of the article is to propose a methodology to measure multi-functionality throughout the entire agri-food value chain. The indicators used to assess the agri-food value chain are regarded as evaluation criteria.

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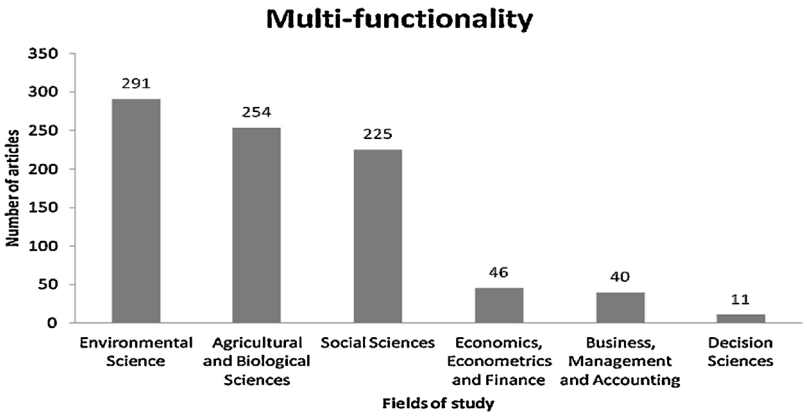

Fig. 1. Number of articles in different fields of study (search multi-functionality OR multi-functionality on Scopus database performed January 15, 2017).

Thus, the entire analysis falls into the area of multiple criteria decision aiding (MCDA) (Greco et al., 2016).

Multi-functionality has an impact not only on the economy, the environment and nature, but also on societal and cultural development (Cairol et al., 2009), and constitutes a path towards sustainable development (Caron et al., 2008). Exploring the multiple functions of the agri-food system under the lens of multi-functionality allows environmental (ecosystem services, landscape, etc.), social (recreation, new jobs, etc.) and economic (food, energy, etc.) aspects to be highlighted in the entire value chain, which integrates agricultural production with value-added functions. Thus, the measurement of the multi-functionality of the agri-food system from the farmer to the consumer is an important issue: it allows the value chain to be interpreted according to Sustainable Development pillars, and efficacy and efficiency failures to be tracked It also leads to more informed public decision-making as regards the structure of value chains. If the Decision Makers (DM) are supported by models capable of measuring multi-functionality, they would be able to implement and evaluate policies to increase the multi-functionality of the agri-food value chain within the framework of sustainable development, to define the target areas for intervention and to verify the results of existing incentive policies. Ultimately, they would be able to compare different value chains and evaluate their degree of multi-functionality compared to their degree of sustainability.

The first step to measure the multi-functionality of an agri-food value chain is to identify the functions, which is far from being an easy task. Porter (1985) uses the term “value chain” to describe a series of value-adding activities. These activities were defined as primary, related directly to manufacture, sales and distribution, and secondary, which support the primary activities, such as planning, finance, R & D and human resources.

According to Fearne et al. (2012), the existing approach – based on Value Chain Analysis (VCA) – needs to adopt a broader vision to address the analysis towards the creation of “shared value” (Porter and Kramer, 2011), in order to be relevant to the current business context.

The appropriate instrument for a multidimensional representation is a suitable set of indicators, which must be an integral part of an assessment methodology. Multiple criteria decision aiding (MCDA) plays a central role in this multidimensional evaluation process. MCDA is used to solve complex problems by assessing all the criteria (indicators), both individually and collectively, assigning specific importance to each criterion, and aggregating them in order to rank alternative policies of ruling the agri-food value chain.

This paper is arranged as follows. Section 2 presents a review of the main articles related to the research topic and an analytic dissertation about value chain and multi-functionality. Sections 3 describes our proposal, consisting of a methodology to measure multi-functionality along the entire value chain; in particular, section 3.1 describes “non-commodity categories” as an integrated framework to combine the value chain and multi-functionality of agri-food systems. Sections 3.2 and 3.3 contains not only details of the construction of the indicators (criteria) we chose to represent non-commodity categories, but also the presentation of a multiple criteria decision-aiding method, which can be used to evaluate different policies of governance of the agri-food value chain. Section 4 presents an application of the methodology to the olive oil value chain in a case study, followed by a discussion of the results in Section 5. The main conclusions end the paper.

2. The background

2.1. Multi-functionality: a brief state of the art

Academic literature on multi-functionality provides several definitions for this concept, and uses different terms to describe the same phenomenon (Van Huylenbroeck et al., 2007). An extensive review of the literature was conducted using the Scopus database, which allows researchers to consult papers, books, abstracts and articles from both academic and professional publishers. As a result of this multitude of definitions, multi-functionality has become an interdisciplinary issue. To provide a sense of its extent, Fig. 1 summarises the number of articles in different fields that consider multi-functionality.

The keyword “multi-functionality” appeared in an extensive list of articles (1364 articles). However, the number of works considered was reduced to 867, and appropriate fields of study were chosen. Whereas Environmental science appears to be the most interesting field for multi-functionality studies, our literature review showed a lack of works in the field of Decision Sciences (only 11 articles).

The literature review performed using Scopus with other predetermined keywords confirmed this trend. The researchers first employed a brainstorming technique and then, starting from the term “multi-functionality”, added keywords to the search. The final list of keyword combinations used and the number of articles found is shown in Table 1.

The analysis underlined the high interaction between “sustainability” and other keywords, in particular with “value chain”, but at the same time demonstrated how multi-functionality represents an issue

Table 1
Keywords interaction table – Performed using Scopus January 15, 2017.

Keywords	Multi-functionality	Value Chain	Agri-food	Sustainability	MCDA
Multi-functionality	–				
Value Chain	0	–			
Agri-food	1	11	–		
Sustainability	53	149	19	–	
MCDA	0	0	0	26	–