

## Chapter 23

# Development of an Integrated Methodology for the Management and Assessment of the Impact of Agricultural Policies at a Territorial Level

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### ABSTRACT

*In recent years, European agriculture has been subject to increased pressure due to both radical dismantling of a long-standing support regime, and to the new EU environmental policies. In order to analyse the impact of these changes at a regional level, an integrated methodology, based on Positive Mathematical Programming (PMP) techniques, and a Geographic Information System (GIS), is developed.*

*As a case study, the methodology analyses the impact of the CAP, together with water and nitrogen policies, on the agricultural system of the Lombardy irrigated lowland (Northern Italy). Results show that the introduction of the single payment makes farmers' more influenced by market trends. Environmental constraints seem to have a larger impact than changes in prices: irrigation constraints stimulate the land allocation to extensive crops, while nitrogen constraints are very sensitive to the number of livestock. The case study illustrates that the methodology proposed can provide a set of scenarios that closely account for the peculiarities of local agricultural systems within a target area. The resulting construction of a geo-referred database is also a useful tool to gather in-depth knowledge of the area.*

DOI: 10.4018/978-1-60960-621-3.ch023

## INTRODUCTION

The current agricultural sector is subjected to a complex policy framework. This complexity arises because of the changing structure that has characterised the Common Agricultural Policy (CAP), which has a double objective. First, the reduction in the level of subsidisation of the agricultural sector has led to the introduction of payments decoupling, which has exposed farmers to international market conditions and their fluctuations. Secondly, concerns of the European Union over the sustainability of current agricultural practices on the environment have imposed a set of restrictions on farmers, such as the Nitrates Directive (676/91/EEC) and Water Frame Directive (WFD, 2000/60/EC).

In this dynamic context, policymakers fundamentally need more precise indications on the impact of different policy option on the overall agricultural production, in order to timely implement *ad hoc* corrective actions whenever necessary, and most importantly to improve the efficiency of the agricultural policy management. To achieve better performances, it is essential to possess information on the impact of agricultural policies at a regional level, hence taking into account the unique territorial features that characterise each individual agricultural system. The integrated methodology developed in this paper aims to provide policymakers with a tool that allows them to gather local information and to forecast policy impacts on different localities with a good degree of detail. This objective is achieved using a novel approach that integrates two very well established methodological components:

1. An economic model to perform the analysis of the impact of policy based on *Positive Mathematical Programming* (PMP), which allows the quantification of changes in agricultural land use through scenario simulation;

2. A *Geographic Information System* (GIS) for the geo-referencing of the results obtained from the PMP model and the implementation of GIS-based analysis of the policy's impact, which has a territorial focus.

The final objective of the integrated methodology proposed in this work is dual: it first allows an understanding of the effects of pressures from agricultural policies on agricultural systems; secondly, it shows how different territorial features can influence the outcome of a policy at regional, or more generally local, level. The outcome of the economic model is used by the GIS as an input. The GIS then interprets the re-configuration of a territorial (i.e. local) agricultural system as a consequence of the agricultural policy, accounting for the different peculiarities that characterise different localities.

The first sections of this chapter present the review of the most significant works relating to modelling policy impacts on agricultural production with the PMP approach, pointing out the advantages of this method in including territorial dimension in policy analysis. Subsequently, the chapter will focus on the description of the integrated methodology, and will present its application to the Lombardy irrigated lowland, located in the North of Italy. To the authors' knowledge, this is the first time the method has been applied in this particular regional setting. The empirical analysis will focus on two different impact assessments: one based on a joint consideration of the CAP and WFD policies effect, and the other on the effects of the Nitrates Directive.

## BACKGROUND

The relevance of Mathematical Programming for the economic analysis in agriculture has been acknowledged since the mid-eighties (Hazell & Norton, 1986). Initially, many Linear Programming models were developed to reproduce the

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