Farming Systems SIMulator: First generic bio-economic farm model

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Introduction

Policymakers and farmers have an interest in making *ex-ante* assessments of the outcomes of their choices in terms of policy and farm plan (cf. Zander & Kächele, 1999; EC, 2005). A Bio-Economic Farm Model (BEFM) is defined as a model that links formulations describing farmers' resource management decisions to formulations that describe current and alternative production possibilities in terms of required inputs to achieve certain outputs and associated externalities. Janssen & Van Ittersum (2007) recently reviewed the usefulness of BEFMs for predicting the impact of policy changes and identified a lack of re-use of BEFMs, e.g., models were only used for one purpose and location for which they were initially developed and not for other purposes or locations afterwards. Instead in cropping systems models, the re-use for diverse purposes and locations is wide-spread. This lack of re-use for other purposes and locations might hinder the usefulness of BEFM for policy assessment. In SEAMLESS (System for Environmental and Agricultural Modelling: Linking European Science and Society), we choose to develop the Farming Systems SIMulator (FSSIM) as a generic bio-economic farm model. Here we define generic as being useful for a range of agri-environmental zones, different farm types, different innovations or policy questions and applications that require different level of detail in input or output data. The objective of this contribution is to introduce FSSIM as a generic BEFM model, to present its structure and how it can be applied for different purposes.

Generic features of FSSIM

FSSIM has several features that make it generic. First, it has not been built as a monolithic model, but it is the result of a combination of several components. Second, the structure of FSSIM can be adapted to the purpose for which it is being used and third, it has been coupled to different user interfaces. Each of these features will now be discussed in some more detail.

FSSIM exists out of two main modules, FSSIM-Mathematical Programming (MP) and FSSIM Agricultural Management (AM) (Figure 1). FSSIM-MP captures resources, socio-economic and policy constraints and the farmer's major objectives (Louhichi *et al*., 2007). The aim of FSSIM-AM is to describe, generate and quantify production techniques of current and alternative production enterprises which can be simulated by a cropping system model such as the Agricultural Production and Externality Simulator (APES; Donatelli *et al*., 2009) in terms of production and environmental effects. The fully quantified activities, i.e. the complete sets of agricultural inputs and outputs, are assessed in FSSIM-MP on their contribution to the farmer's and policy goals considered. As FSSIM-AM and MP are quite large entities, these have been further sub-divided into components or sub-modules that have a more specific role and a stand-alone value (Figure 1). Components exist for collecting data on current activities (either with detailed or aggregated information on agricultural management), for specifying livestock activities or livestock related constraints, for specifying policies and for calibration (Janssen *et al.*, 2008).

Conceptually, FSSIM fulfils two main purposes. The first purpose is to provide supply-response functions for so-called NUTS2-regions (corresponding to provinces in many cases) that can be upscaled to EU level, while the second purpose is to allow detailed regional impact assessment of agricultural and environmental policies and technological innovations on farming practices and sustainability of the different farming systems. The dual purpose of FSSIM resulted in applications that were more data intensive and applications that were less data intensive.

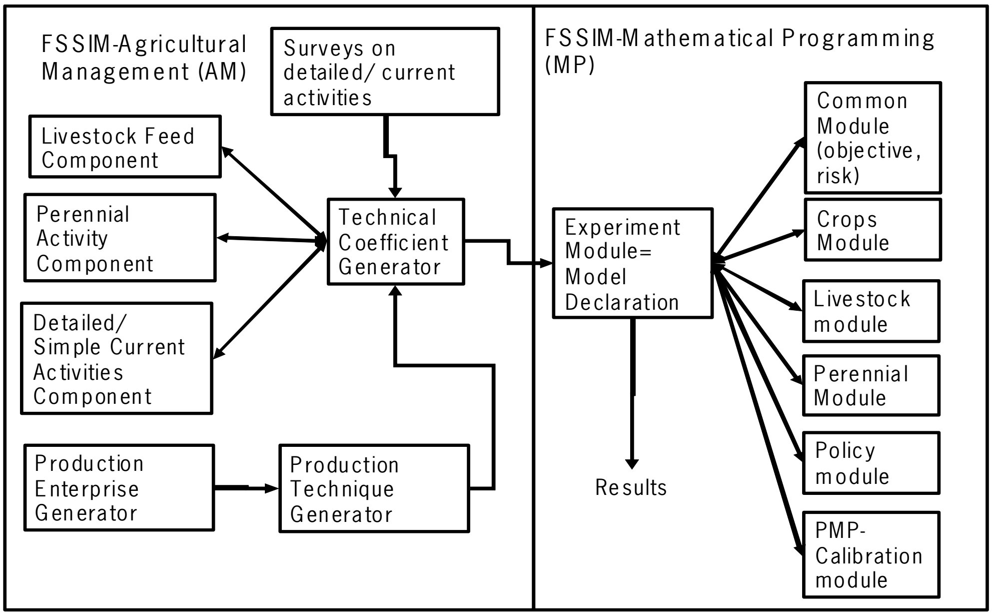

Figure1. FSSIM-MP and AM with their individual components or modules.

FSSIM has been coupled to two distinct graphical user interfaces, e.g., SEAMLESS-IF and FSSIM-GUI. In the SEAMLESS-IF, FSSIM is integrated with other models and is run as part of a model chain. The FSSIM-GUI (Meuter *et al*., 2009) allows modellers and integrative modellers to make model runs with one or more components of FSSIM. The FSSIM-GUI should, thus, help modellers and integrative modellers to evaluate components one by one and work with FSSIM across data-sets.

Concluding remarks

FSSIM has been applied to 11 regions to assess supply responses for EU, to 4 regions for a more comprehensive regional analysis, to both arable and livestock systems and to one region (Mali) outside the EU. The distinction between two different purposes, the subdivision of FSSIM in different modules and the coupling to the different user interfaces has proven to be useful for achieving an appropriate configuration of the model with respect to data availability, research question and location.

References

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