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Finding niches for whole-farm design models – contradictio in terminis?

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Abstract

Whole-farm design models quantitatively analyze the effects of a variety of potential changes at the farm system level. Science-driven technical information is confronted with value-driven objectives of farmers or other social groupings under explicit assumptions with respect to exogenous variables that are important drivers of agricultural systems (e.g., market conditions). Hence, farm design is an outcome of objective specification and the potential of a system. In recent publications, whole-farm design modelling has been proposed to enhance (farm) innovation processes. A number of operational modelling tools now offers the opportunity to assess the true potential of whole-farm design modelling to enhance innovation. In this paper, we demonstrate that it is not trivial to find niches for the application of goal-based farm models. Model outcomes appeared not to match questions of farm managers monitoring and learning from their own and other farmers' practices. However, our research indicates that whole-farm design modelling possesses the capabilities to make a valuable contribution to reframing. Reframing is the phenomenon that people feel an urge to discuss and reconsider

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current objectives and perspectives on a problem. Reframing might take place in a situation (i) of mutually felt dependency between stakeholders, (ii) in which there is sufficient pressure and urgency for stakeholders to explore new problem definitions and make progress. Furthermore, our research suggests that the way the researcher enters a likely niche to introduce a model and/or his or her position in this niche may have significant implications for the potential of models to enhance an innovation process. Therefore, we hypothesize that the chances of capitalizing on modelling expertise are likely to be higher when researchers with such expertise are a logical and more or less permanent component of ongoing trajectories than when these researchers come from outside to purposefully search for a niche.

Keywords: Whole-farm modelling; Optimisation; Arable farming; User oriented model design

1. Introduction

Traditionally, agricultural research has a firm rooting in empirical and experimental work. However, since the early 1970s this has been increasingly complemented by tools and methods from systems analysis (Maat, 2001, pp. 225–246; Ahuja et al., 2002; Matthews, 2002). Systems analysis and mathematical modelling enhanced the capabilities for testing new hypotheses through design and analysis of specific experiments and enabled explanation of results in terms of underlying processes. Following this phase of theory development and model testing, models were increasingly applied for extrapolation of location-specific knowledge and results in time and space (Van Ittersum et al., 2003). Gradually, modelling and empirical approaches have become integrated, mutually supportive research activities, as agricultural research became synthetic, rather than purely analytical. Since the 1990s, cropping system models have been successfully used in the farming context. Particularly, the APSRU group in Australia has been involved in studies to examine which biophysical ánd social factors have to be considered in making generic simulation models applicable to location-specific problems and appealing to farmers with farm-specific interests and issues (Keating and McCown, 2001; Carberry et al., 2002; McCown, 2002a). Cropping system models are particularly powerful in addressing plot scale issues, or for analysis of relatively simple cropping systems, comprising only a few crops. They are, however, less suitable for redesigning entire farming systems and complex crop rotations, in which yield-defining, yield-limiting and yield-reducing factors (Van Ittersum and Rabbinge, 1997) strongly interact and determine ultimate production options.

Economic developments, environmental degradation and maintenance of a social infrastructure are some of the reasons for (inter-)national, regional and/or local administrations/policy makers to actively pursue formulation and implementation of land use and environmental policies. As a result, at micro-scale farmers in The Netherlands and other parts of Europe are continuously provided with incentives to innovate their systems, to meet shifting economic, environmental and societal objectives (Falconer and Hodge, 2000; Lütz and Bastian, 2002; Schröder et al.,