

The potentials of dairy farms for up scaling: developing a whole-farm model for tailor-made advice

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The decision environment in the dairy sector is changing. The growing demand for milk products, volatile feed and milk prices, changing policies, competition for land and growing societal concerns put the sector under pressure. Dairy farmers, who were used in the past to earn a stable income during a longer period, are recently confronted with declining margins and a volatile income. These changes incite them to change their management. Up scaling is often seen by farmers and advisers as the most obvious strategy to follow. Up scaling is possible due to technical progress, which reduces the labour requirement and is often seen as ‘necessary’ as a result of declining margins. Nevertheless, it is not straightforward to determine the optimal economic scale, as this optimum is very much farm-specific. Moreover, decisions on scale enlargement influence multiple components of the dairy farm, making a whole-farm approach necessary to tackle this problem.

In literature, numerous whole farm models (WFM) can be found. Janssen and Van Ittersum (2007) and Robertson et al. (2012) give an overview of existing WFM. They also criticize the lack of analysis of the methodological strengths and weaknesses of these WFM and their applications in literature. They propose guidelines for the development and reporting of WFM’s. These guidelines include a clear statement of the objectives of the WFM, some form of sensitivity analysis in the model, a thorough model evaluation and the aim of providing new insights in modelling.

This poster presents ongoing research on the participatory development of a normative mechanistic whole farm model to determine the optimal economic scale of individual dairy farms in Flanders. The thematic objective of this research is to determine the optimal economic scale for individual dairy farms and the factors that influence this optimum. The scientific objective is to develop a scientifically sound whole farm model that can be used in practice.

We develop a normative mixed integer nonlinear programming model in close collaboration with farmers, advisers and OR scientists. The model maximizes the cash flow one year after the expansion. The model represents the system of technical, economic, financial and social components of the dairy farm. Some components are modeled in more detail than others, because they are considered by the different stakeholders involved to be more important to answer the optimal scale question. Biophysical relations are not included in order to prevent the model to becoming too complex.

The data required to run the model are based on the technical, economic and financial results of the last five years of an individual farm. These data are completed with generic expert information. The different investment options in the model are the result of discussions between farmer and adviser. These options can include building new stables but also

remodeling and expanding existing stables. The options must also reflect the preferences of the individual farmer.

The model calculates an optimal cash flow with a corresponding optimal investment decision for the specific farm. Sensitivity analysis and shadow price analysis provide the farmer with additional information about the restrictions that prevent him to expand his farm and the price levels within which the chosen scale stays optimal. The model is currently used in practice in combination with investment plans, which are simple budgeting calculations, by advisers in discussions with farmers.

Preliminary results concerning our thematic objective indicate that the land availability and the investment costs often hamper the expansion plans of the Flemish dairy farmer. It becomes clear that some farmers must first improve their technical results before scale enlargement becomes an option. Finally, farmers often indicate that they do not want to work with hired labour, which has a large influence on the optimal scale.

Robertson et al., 2012 state that for developing a WFM a clear statement of objectives is pertinent. In our research the objective 'what is the optimal economic scale of a dairy farm' was clear before the modelling effort started. Another guideline they propose, being sensitivity analysis, is carried out for prices and production levels to demonstrate the changing results within the range of varying parameters. Finally preliminary model evaluation is carried out through comparing the model results with expert information. Other guidelines will be addressed in further research.

Janssen S, van Ittersum MK, 2007. Assessing farm innovations and responses to policies: A review of bio-economic farm models. *Agricultural Systems* 94, 622-636.

Robertson MJ, Panell DJ, Chalak M, 2012. Whole-farm models: a review of recent approaches. *AFBM Journal* 9 (2), 13-25.