

## A Model for Sustainably-Competitive Agriculture

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### Background

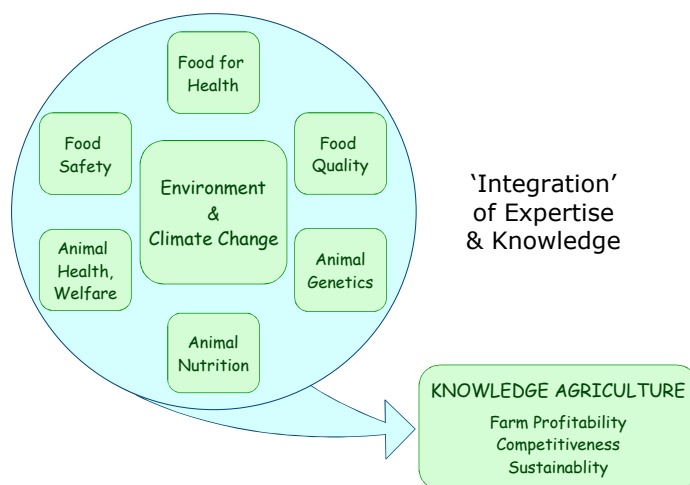
As recently stated in the journal *Nature*, “*The challenges facing agriculture today are unlike anything we have experienced before, and they require revolutionary approaches to solving food production and sustainability problems*”. The concept of Sustainably-Competitive Agriculture provides a strategic framework for addressing the issues relating to food security, environmental sustainability and the future economic viability of rural regions. Critically, it involves development of innovative, knowledge-based farming systems that confer **real marketing advantages** in terms of improved animal health, reduced environmental impacts and more consistent, high quality food products.

### Conceptual Model

With the unprecedented economic and social complexities that need to be addressed, priority needs to be given to the development of ‘*sustainably-competitive production systems*’ that meet the following design criteria:

- Profitable at farm level,
- Produce market required food products,
- Meet animal health and welfare needs,
- Are environmentally sustainable,
- Can cope with climate change,
- Are energy efficient

Based on these criteria, a conceptual model showing the generic components of a sustainably-competitive agriculture is illustrated in **Fig. 1**. The model specifically applies to livestock systems.

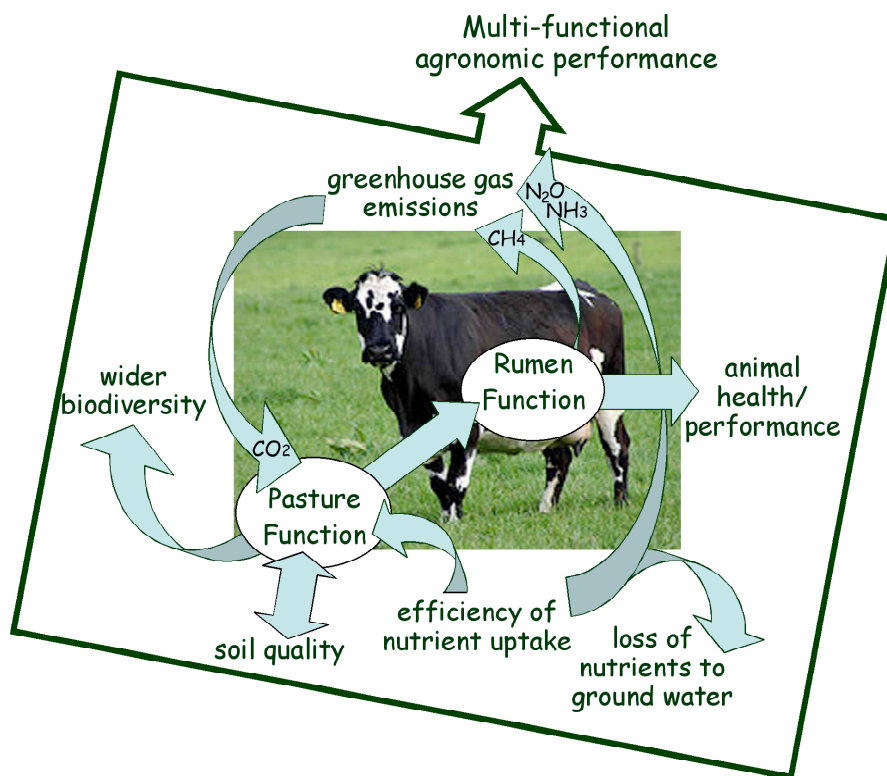


**Fig. 1:** *The architecture of a sustainably-competitive agriculture*

By positioning agriculture in the middle ground between industrialised production and the opportunities provided by organic farming, development of a sustainably-competitive agriculture would confer a clear marketing advantage on food products. Similar concepts are being developed elsewhere, including the concept of *Agriculture of the Middle*, in the US, which seeks to ensure the continued economic survival and food-producing contribution of medium-sized farmers.

### A Practical Biological Model

A model depicting sustainably-competitive grass-based dairy and beef production is presented in **Fig. 2**. This illustrates the potential multifunctional benefits of an holistic systems approach, and highlights the importance of two inter-dependent system epicentres, namely **rumen function** and **pasture function**. The agronomic and ecological efficiency of this system is ultimately dependent on optimising the functional roles of rumen microbiota and grassland plants, and their interactions with other system components, including animal performance, health and welfare, and environment and food quality.



**Fig. 2:** An agronomic model of sustainably-competitive grass-based cattle production

### Innovation-driven Research

Much of the knowledge required to begin practical development of the model depicted in **Fig. 2** already exists. However, the complex biological processes involved in optimising both rumen and pasture functions need to be elucidated. These constitute the two main pillars for an innovation-driven research programme to support system development. However, an holistic approach that also seeks to integrate and harness existing knowledge with new understanding and technologies is required. In developing such a systems approach, it is essential that a strategic framework be created such as that illustrated in **Fig. 2**, to guide an integrated **systems-based** strategy with support from all the relevant funding and educational agencies.

### Knowledge Utilisation

The development of innovative farm production systems designed to achieve all of the above-mentioned aims requires *firstly* an economic framework that adequately recognises the wider potential of such systems; and *secondly* a coherent integrative approach to their promotion and adoption throughout the food chain. Any innovation initiative also needs to address the key issues of knowledge communication, education and training needs, which are key to underpinning a wider appreciation of the sustainably-competitive concept.

### The Crucial Role of Education

Education for all participants in the food chain is a key requirement for the development of economically and environmentally sustainable rural economies. Increased priority needs to be given to strengthening within educational programmes, the disciplines of; *Animal genetics*, *Animal nutrition* (rumen function), *Environment* (functional biodiversity) *Food Health Science*, and *Systems Modelling* (econometric & environmental) Rapid and effective incorporation of the knowledge created by research into re-designed production systems is an imperative. Educational programmes are required at all points along the food chain, with the aim of shifting mindsets to *'think food'* by developing a *'fork to farm'* perspective. In undergraduate education, it is imperative that the farm, food and environmental dimensions of the conceptual model are fully integrated. Only when the links between **Farm** and **Food** are recognised, does the centrally important role of the **Environment** dimension become clearly apparent (**Fig. 1**). A radical revision of Continuing Professional Development (CPD), and development of taught post-graduate educational programmes will also be needed.