

# Re-designing as starting point for more sustainable dairy farming

Measures that make economic sense for a dairy farm often turn out to be less beneficial for the welfare of the cows. On the other hand, an improvement in animal welfare can turn out to be bad for the environment. 'These intractable cause and effect connections occur frequently in modern cattle farming systems, but they could be disconnected from one another by a completely new approach', argues Bram Bos from Wageningen UR. This is what the project *Cow Power*, that ran from 2007-2009 was all about.

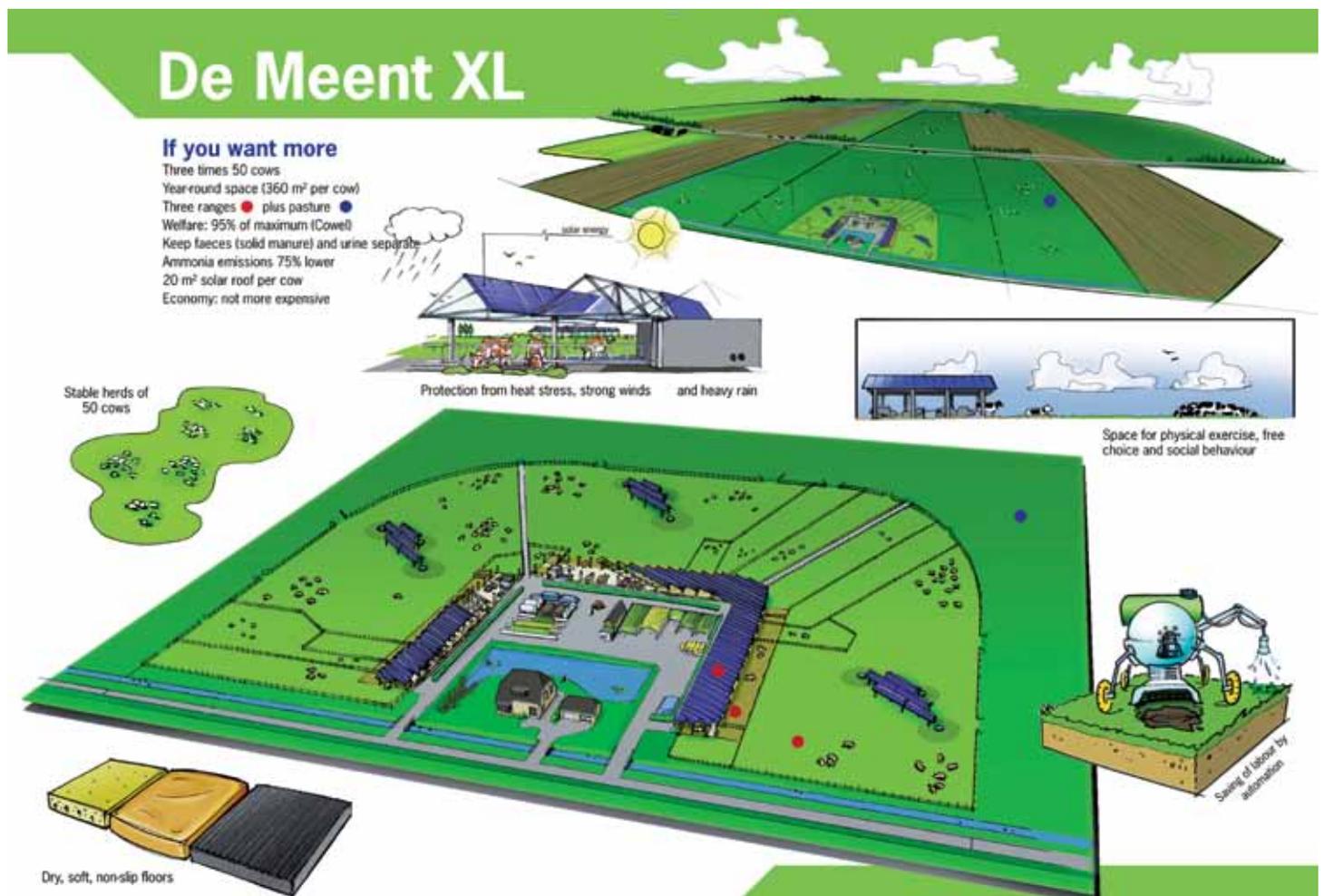
Bos talks enthusiastically about how the researchers set about achieving this. They followed a new approach to make dairy farms sustainable (Bos *et al.*, 2009a; Bos *et al.*, 2009b), based on their earlier experience in laying hen husbandry. Bos and his colleagues searched for solutions to these problems by redesigning the whole dairy farming system and not, as is usually the case, by looking for solutions to isolated problems. It is a question of zooming out and looking critically at the accepted structures within the system. This approach called *Reflexief Interactief Ontwerpen (RIO)* [Reflexive Interactive Design] has been developed by Bos and his colleagues

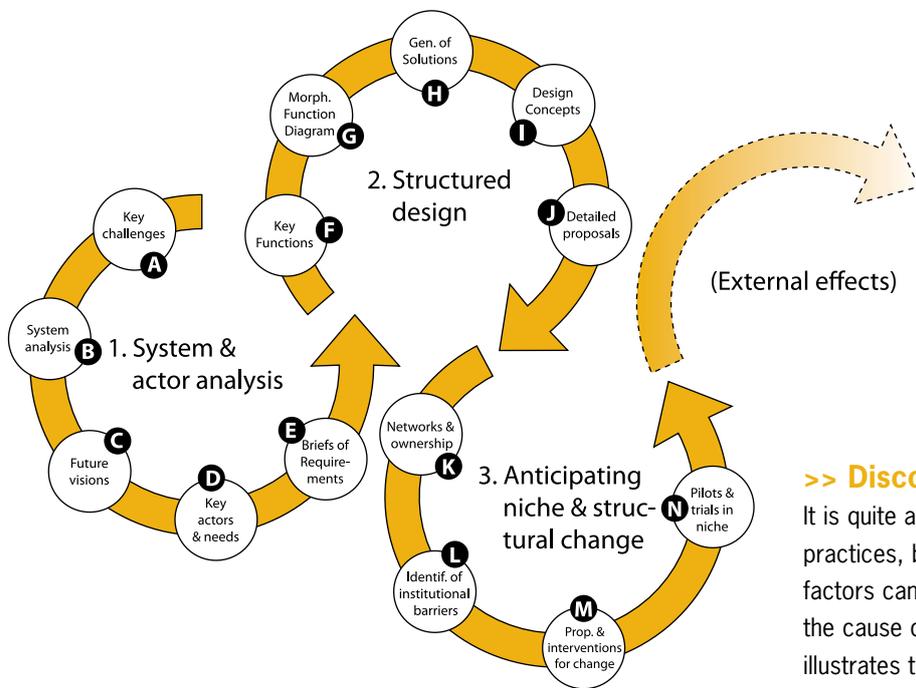
(Bos *et al.*, forthcoming; Groot Koerkamp and Bos, 2008; Bos and Grin, 2008) and has been applied in laying hen husbandry, pig husbandry, broiler production and dairy farming. This interactive and creative approach breaks through intractable cause and effect connections in modern dairy farming [see box].

## >> More than just tinkering

Dairy farmers are familiar with sustainability. Fifteen years ago the first emission reduced stalls were put into place where the ammonia emissions were greatly reduced compared to the conven-

*The Meent XL is one of the concepts that demonstrate how sustainable dairy husbandry can be realised if a completely new start is made. But making a new start is not absolutely necessary. There are surprisingly many possibilities to modify an existing farm by adopting a number of principles and solutions from these design concepts.*





The method Reflexive Interactive Design

tional stalls of the time. But sustainability achieved in this way is not what Bos means. In his eyes, sustainable dairy farming is more than just tinkering with one stall in the current system. Factors that play a part in sustainability in the Netherlands can lie, according to Bos, in the level of spatial utilization elsewhere in the world, in liberalisation and market forces. 'Dairy farming is more controversial than, say, twenty years ago. In those days the issues were manure and acid rain, which is mainly a problem locally. Now the issues are, for example, exhaustion of global phosphate supplies. This cannot be solved within the existing structures without causing problems elsewhere.'

### >> Why cows?

Whoever wants to achieve sustainability in different aspects of dairy farming has to return to basics. This is an exercise that researchers have tackled together with a group of stakeholders. It began with the question; why do we keep cows in the Netherlands? Bos: 'The most basic function of a cow in dairy husbandry is turning grass into milk. However, she uses 40 percent of her intake for her own metabolism. So you could ask if this conversion can take place without the cow. But many people see good reasons for wanting to keep dairy farming in the Netherlands. So the next question is: if dairy farming has a future here, how can we make it as sustainable as possible?'

Firstly, the Cow Power team analysed which aspects of the business were unsustainable. One example is the contribution to global warming through emissions of methane and nitrous oxide. Then the researchers categorized the causes of these unsustainable factors; like methane production in the gut and the production of cattle feed concentrates and artificial fertilizers which cost huge amounts of energy.

### >> Disconnection

It is quite a simple matter to point out the causes of unsustainable practices, but removing the cause is complex, because these factors can also produce a very desirable effect as well. Removing the cause can also mean eliminating the desirable effect. Bos illustrates this using an example taken from greenhouse cultivation: consumers want to eat capsicums all year round but this can only be achieved if the horticulturalist uses a lot of fossil fuel in the winter. Burning fossil fuel is good for capsicums but bad for the environment. This intractable linkage is 'structural' and disconnection cannot take place spontaneously. Cultivation without fossil fuel calls for a completely new frame of thinking, whereby it has to be determined how the desired effect and the undesirable effect are linked together. This analysis has led to the development of the *Greenhouse as source of energy* project for greenhouse cultivation, a new concept in which the link between fossil fuels and the greenhouse has been severed.

### >> Functional feed

Bos has the same aims in mind for different connections in dairy farming. To start with it is necessary to delve deeply into the different problems and related structures by questioning basic assumptions. In the case of cattle feed concentrates the question is: why do dairy farmers use concentrates? Answer: to maximize production. A dairy farmer makes more efficient use of his cows with concentrates. This works out to produce less greenhouse gases per kilogram of milk which in turn forms a reduced stress on the local environment. This is the positive effect of concentrates. The negative effect is among other things that there is a lot of energy required to produce the concentrates in the first place and nitrous oxide emissions increase as a result of this. The question that arises at this stage is whether it is possible to achieve the positive effect in another way. The researchers returned to the basic question: what is the basic function of concentrates exactly? They discovered that it was not so much a matter of providing extra protein as such, but more a matter of providing nutrients that are quickly absorbed in the gut. That was the beginning of the solution. Bos: 'Then you can start thinking about fabricating special feed, made of ordinary grass, for example.'

# Re-designing by breaking intractable connections

Intractable connections can be found everywhere in daily life. Creating “desirable” effects often involves “undesirable” ones as well. Sometimes they are recognisable immediately, sometimes over a period of time.

The example that improvements to animal welfare go hand in hand with extra environmental stress or the other way around is well known. Whenever cows and pigs graze outside, more ammonia is emitted. To combat this, increasing numbers of pig farmers install an air-cleaner in their sheds to reduce the emission of ammonia and smells. This is only effective if the shed is completely sealed, which is less advantageous for animal welfare. These intractable connections are also called transition points or system faults. The system is stuck at this point and a new solution is needed.

It is often thought that the one cannot exist without the other. But there are possible avenues for action that can be determined by a fundamental analysis of the system which lies at the root of the intractable linkage in order to ‘disconnect’ it. The main principle behind ‘disconnection’ is a sustainable management of the world’s resources: the utilization and exploitation of supplies must not lead to the exhaustion of those supplies. ‘Supplies’ is in this sense a broad definition. It refers not only to raw materials but also to biodiversity, the environment, employment and culture.

By linking sectors together, new win-win situations are created when waste can be

used as input in another production line.

One good example of this is the project *Zeeuwse Tong* [Zeeland’s Sole]. A system is being developed where parcels of agricultural land are being transformed into salt water ponds to raise sole, shellfish (food for sole) and algae (food for shellfish), the cultivation of saltwater vegetables and development of new conservation areas. By thinking about recycling of waste without compromising quality at the design stage, the cradle-to-cradle approach becomes sustainable. In this way new functions are added to the production system and products.

By re-designing a system – for example an animal husbandry system – system faults can be solved which have crept into it in years of one-sided focus on, for example, production efficiency. Wageningen UR’s researchers are designing this kind of new animal husbandry system according to Reflexive Interactive Design (RID). They have been commissioned by the Ministry of Economic Affairs & Agriculture and Innovation. RID defines ‘the system’ as the larger vision of what animal husbandry involves. This includes not only the stall or the business but also the supply and production chains in the area and on the other side of the world, as well as other parties such as conservation groups, government, citizens and consumers. Re-designing occurs interactively with the above-named parties. It is, therefore, not just re-designing but also co-designing. The researchers do preliminary work and

challenge the parties to come up with new solution pathways. The more concrete the choices become, the more important it is to involve the parties with a vested interest.

The result is one or more sketches of the future for the animal farming sector. In order to put the re-design into practice, the parties are involved in a way that makes them see opportunities for themselves. The objective of co-designing is so that other parties say ‘this is an objective worth pursuing, let’s all ensure that we can make this vision reality’, and then a number of those involved turn words into deeds. The researchers consider their work successful once parties or individuals indicate that they stand behind actually testing and realising the re-design or parts of it. The researchers help the parties to do this, by connecting the right people with each other; by creating a protected environment for the organisation of experiments; or by delivering technical ideas which can lead in the short term to a step in the direction of realizing the re-design.

*Cow Power* is just one of the RIO routes for change. Previous re-design routes have been implemented for laying hens (*Houden van Hennen*) [Keeping/loving Chickens] and for pigs (*ComfortClass*). Last year the project (*Varkansen*) [Pig Opportunities] was started which aims to clarify opportunities for sustainability in pig farming and RIO routes will be starting shortly for industrial egg production and for poultry farming.

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## >> Manure and urine

Another example is artificial fertilizers. The desired effect is better crop growth. Undesirable effects are exhaustion of worldwide phosphate supplies, radiation which is released from rocks during mining, a part of which leaches unused back into the soil when applied and, finally, the creation of greenhouse gases and pollution through production, transport and nitrogen emissions. Solutions to these problems are ordinarily sought in improvements to the efficiency of the animal. Dairy farmers feed the animals with measured doses so that they produce as much as possible with a minimum of excess mineral excretions. This is difficult to manage because slight malnutrition leads to problems for the animal and slight overfeeding leads to mineral excretions. In this case the question is very similar: where do you place the cut to disconnect the two so that the desirable effect of artificial fertilizer – faster crop growth – can take place without the negative effects. Bos: 'You need to get to the bottom of the structure of the system that leads to the use of artificial fertilizer. In this case it is worthwhile to step back from efficiency-thinking. Manure and urine are essentially valuable products if the concentration of minerals can be controlled and checked. If you can make manure and urine into assets then it doesn't matter how much of either comes out of the cow. In this way many turnarounds in traditional thinking have been defined in the *Cow Power* project.

## >> Drawing board

After finishing this first analytical stage the project defined pathways where solutions might be found. The next step is identifying the key functions which need to be fulfilled by the different aspects of dairy farming. This means that concrete questions have to be asked such as: how can you offer cows space to move about, in combination with separate harvests for manure and urine. After this, solutions to these key functions were sought, that were linked to integrated design concepts. Of course, there are technical components involved, such as designing a shed floor that separates manure and urine. 'But the solutions are certainly not just technological', Bos adds. The design phase also makes explicit what the consequences are at other levels, such as government, the concentrates industry or artificial fertilizer manufacturers. If manure and urine are assets, then this has implications for regulations but also, for example, for the competitive position of the farmer in relation to the artificial fertilizer manufacturer.

## >> Considerable mental capacity

Peter Schmeitz, in 2008 assigned to the project by the Ministry of Economic Affairs and Innovation is impressed by the creative think-

## Turnaround of four aspects

The design concepts are based on four radical turnarounds in thinking and acting:



1. Satisfy all the demands of the cows instead of giving them what happens to be left over



2. Consider minerals to be valuable resources instead of waste



3. Share capital and labour with others instead of dividing them over more cows



4. See the soil as a productive ecosystem instead of as a dead substrate

ing within the project. 'The *crème de la crème* of researchers and stakeholders is working on this.' He is quite confident that good pathways to solutions will come from Cow Power. 'In any event, the process is promising, interactive and transcends the partitions in the different academic disciplines. But it is also very complex. It is encouraging to know that Wageningen UR has already explored a number of transition routes using future visions. At the same time it is apparent that the process usually stagnates once the design is ready. Farmers have to buy into the idea, stall builders have to run with it, added value has to be retrieved from the market, permits are not always given. In the *ComfortClass* project for pig farming, for example, you see the whole process slowing down.' Bos is more reserved in his judgement over the process. The pathways to solutions are promising, but he does not dare say whether they can be realized 'painlessly' for farmers and for society as a whole. 'The basic assumption is that animal farming can be made sustainable without society itself having to give anything up, like eating less meat. This remains to be seen, of course.'