

SPSD II

HOW CAN ORGANIC FARMING CONTRIBUTE TO THE SUSTAINABLE PRODUCTION AND CONSUMPTION PATTERNS?

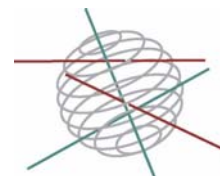
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PART 1

SUSTAINABLE PRODUCTION AND CONSUMPTION PATTERNS





Part 1:
Sustainable production and consumption patterns

FINAL REPORT



**HOW CAN ORGANIC FARMING CONTRIBUTE
TO THE SUSTAINABLE PRODUCTION
AND CONSUMPTION PATTERNS?**

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PART I

INTRODUCTION

1.1. Equipping sustainable production chains

The matter of the sustainable development of organic cattle farming

P. Stassart and D. Jamar

Argument:

A sustainable agricultural production chain ("from stable to table") is not produced ex nihilo, especially when its future hinges on demand from a supermarket distribution circuit. Many of the standards of conventional production chains effectively serve as references for intermediaries and consumers alike. The tensions between sustainability standards and market standards are thus the crucial areas in which negotiations about the chain's future take place. These inextricably intertwined technical, social, and economic tensions are the subject of this research. These tensions create a situation of uncertainty, that is to say, of choices between pathways. They are both a springboard for action and the cause of inaction, depending on how they are interpreted. This exploration is what justified an intervention-research approach that combines restating questions and changing relations to explore the possible pathways to take.

If organic farming is currently well-established and at the same time sparks great discussion, it is because this special form of agricultural production has acquired a form of recognition over the past fifteen years that has made it a recognised alternative to conventional production and consumption patterns. This recognition, which was first institutional and societal, was subsequently validated by the market. Indeed, in the wake of the food crises that marked the late 1990s, organic food emerged from the specialised networks to which it was long confined to become an increasingly broad range in supermarket shelf line-ups.

From the standpoint of sustainability, organic agriculture's recognition rests upon two issues, that of the sustainability of the (agricultural) production model, and that of this model's abilities to develop sustainably as a separate model that is sufficiently autonomous to maintain and boost the diversification of the technological avenues that it opens up. What is riding on the development of organic farming is the development of the diversity of production models or, to state it differently, the development and maintenance of the variety of socio-technical avenues capable of extending agriculture's future capacities and preventing it from becoming imprisoned in the conventional model's social actors' habitual interplay. This forces us to take account of the fact that the logic subtending a (conventional) dominant model consists not in maintaining a variety of technical options to extend future capacity but, on the contrary, in creating irreversibility around arrangements that are particularly beneficial for the options that it provides (Godard and Hubert, 2002).

The sustainability of a system and sustainability of its capacities are thus seldom connected. While there is general acceptance that organic farming, especially that of plant crops, has been able to factor in the environmental costs that conventional agriculture gradually externalised in the course of its modernisation¹ (Lampkin, 1994),

¹ Conventional agricultural, whether under the influence of government policies (the CAP sets a stock rate of 1.8 LU/ha, whereas the Organic Farming Regulation sets a stock rate of 2 LU/ha) or planned agricultural approaches, has turned

opinions diverge as to the consequences of its development. The effects of the tests to which it has been put through the expansion of organic farming's markets, especially agribusiness, mass distribution, and the processing industry's entry into the picture, remain little known. The issue of the "conventionalisation" of organic agriculture divides authors in the English-speaking world. Buck *et al.* (1997), who belong to the political economics tradition (Goodman, 1987), took up the case of California to describe its appropriation by downstream industry. Maarsden (2004) has shown in particular how the major distribution groups are taking over the profits accruing to the organic label through the classic price squeeze mechanism. Coombes and co-workers (1998) and Hall and Moggyorody (2001), on the contrary, criticise this position. They base their cases on the co-existence and possible synergies between organic "industry" and producers who identify more with the "historical movement" of organic farming.

In this report, we want to tackle the question of organic agriculture's sustainability less conventionally by focusing on its chainlike organization, on the interdependence of its different links, and the consequences of long distance work, rather than placing organic agriculture's players and their strategies at the centre of our analysis. Rather than engaging in a comprehensive analysis of the organic sector's development, of the players involved and their strategies, assuming that this were possible, we have chosen to examine the tensions that arise around a product's development. Our starting point will thus rely on the choice of a specific area, that of organic beef production.

The Belgian context and crisis situation that the conventional sector experienced these past years offered us an unprecedented situation, that of the massive influx of industry and distributors onto the organic beef market, as we shall show in the descriptive part that follows. This break with the specialised local networks (dietetic shops and direct sales) led to a direct confrontation between organic beef production and an extremely closely-knit conventional national reference frame, of which the heavily muscled Belgian Blue is the spokesman and reference model for the mass distribution circuits. This provided us with a landscape that could enable us to understand first how a strong conventional reference interacted with the content of the conversion to organic production and, subsequently, the conditions under which the conversion to organic production could deploy its full potential.

The problem is that of cattle farmers who are converting to organic operations and taking steps to increase their products' value on the Belgian market. To do this, they must effectively construct new (organic) reference points for themselves while building upon what they know, *i.e.*, the omnipresent conventional reference of the Belgian Blue. Two types of case are seen in the field: Some farmers keep what they know, whereas other farmers make the radical choice of venturing beyond the pale of existing references. The former keep the conventional equipment, which they adjust to meet organic specifications one step at a time. So it is that given the need to change breeds to avoid caesarean sections, they turn to two breeds – the Blonde d'Aquitaine and the Limousin – that are assumed to offer very similar performances to that of the Belgian Blue. We shall see, however, how tensions, cracks, appear behind the wonderful unanimity that is created by certification. The latter – the "adventurous" – convert to rustic breeds such as the Salers and Angus and/or try out

this externalisation movement around in some areas.

shorter circuits. However, after several years of unproductive groping, many of them give up, and the stock that they tried to market as offering organic meat rich in fat joins the lean-meat production chains. As a result, the latter provide outlets for a large proportion of the organic livestock, which is thus fattened for the conventional market (see the second part of the introduction). Finally, some farmers have begun a return to the conventional by crossing their Salers herds with Belgian Blue bulls to produce stock that combines the double-muscle conformation of the individual animal and the rusticity of the suckler herd. Our hypothesis is that the problem that conversion and the construction of a new sectoral reference with regard to a given set of specifications pose in this case is that of switching from an "over"-equipped production chain reference (the conventional beef market) to an "under"-equipped production chain reference (the organic beef market) and the fact that this gap makes the two references' co-existence incompatible.

To understand this problem, one must start from the existing situation and describe it through the notion of the "production chain reference frame" (*référentiel de filière*). Once this is done, we shall raise the issue of the organic reference frame's stalled development by showing that the organic reference frame grows out of this first reference frame. To conclude, we shall reincorporate the question of organic production's sustainability in our analysis. In so doing, we shall propose to go beyond the matter of the production systems' environmental contributions (Lampkin, 1994), which are recognised on the whole, to ask about the entire production-to-consumption chain's sustainability and the consequences of its various links' interdependence.

1 The chain's consistency: the reference frame concept

A partial diagnosis of the organic sector done in the first phase of our research revealed four points of tension between compliance with the organic specifications and observed practices in the breeding and fattening systems. These points of tension concern: (i) meeting the grazing obligation; (ii) the percentage of organic feed in the cattle's diets, especially for bulls confined to the barn for finishing; (iii) the type of preventive or curative allopathic treatment for parasites (lung worms and gastro-intestinal parasites), the pressure of which jumps considerably when grazing is compulsory; and (iv) the three-year gap between the organic reconversion period (two years) and time needed to change breeds (five years) that is required because of the ban on the systematic caesarean sections that go hand in hand with the original Belgian Blue breed, given its heavy frame. These four points of tension – grazing, diet, disease prevention, and breed – or sources of contradiction between practices and compliance with specifications, concern both the spirit and the letter of Belgium's organic agriculture regulation. They reveal the difficulties of transposing organic standards into first law and then practice. The exploration of these difficulties is at the heart of our research.

1.1 Interpreting the tensions linked to the organic reference frame's national transposition

We shall run quickly through two keys for interpreting these tensions that some authors might propose but we have invalidated to expand upon a third one, which makes up the central hypothesis of this paper.

The first key to interpretation is legal and administrative, that is, the observed tensions are thought to call for adjustments between rules and verification. Two outcomes are then possible: The pragmatists would suggest that the rules in the specifications should be adjusted in line with market demands and thus that the organic standards adjust to this "naturalisation" of reality, whereas the dogmatics would retort that the enforcement of the rules' implementation is too weak and must be toughened to stave off the spread of avoidance strategies, which are sources of unfair competition. We ruled out this normative interpretation because in focusing on production it does not take account of the system effects that are linked to production's interdependence with the downstream links in the chain, *i.e.*, processing and distribution, as a result of which it places a burden of responsibility on the breeders and their herds that should be shared by the sector's other players.

The second key of interpretation is more strategic and based on dominance relationships. According to this hypothesis, the downstream agrifood industry (slaughterhouses and distributors), which is a newcomer to the organic sector, reconfigures agricultural production processes to reduce them to inputs for the agrifood industry. This is what political economics terms an appropriation mechanism (Goodman, Sorj, Wilkinson, 1987; Buck, Getz and Guthman, 1997). We have effectively seen that when it comes to the definition of quality, the agrifood industry's requirements for making use of and carving the carcasses strongly influences the fattener/finisher's work. Thus, the slaughtering industry's expectations when it comes to cattle's conformation and state of fattening lead to some incompatibility with some of the organic specifications, such as the grazing requirement and feed restrictions, with which the farmers must comply and as mentioned in the four points of tension. Still, do the producers and consumers of organic meat take these intermediaries' (*i.e.*, processors and distributors) requirements lying down, powerless to change them? Can't they escape the intermediaries' appropriation logic to reframe their exchanges to be consistent with the spirit and letter of organic production? Our observations invalidated this second interpretation as well, for the same tensions appear in short-circuit situations, in the face-to-face dealings between stock farmers and consumers in on-the-farm sales, as in the long chains.

This led us therefore to advance a cognitive hypothesis, namely, that the observed points of tension are manifestations of incompatibilities between two interpretative frameworks of the world. The national frame of reference of the conventional beef sector, that of "lean and tender", which is associated with the Belgian Blue, and a more comprehensive emerging reference frame, that of organic agriculture. The incompatibilities between these two frames spawn tensions between practices and compliance with the organic terms of reference's rules. This hypothesis proposes to question the conditions under which the principles and practices that are linked to the Belgian Blue sector's reference frame can convert to the organic reference frame.

We developed the notion of the production chain reference frame by drawing upon the concepts of sectoral and global reference frames in political science (Jobert and Muller, 1987). A production chain reference frame is the shared image of a production chain that its players develop to come out with an expected product.

We shall show how it is at the same time shared, implicit, and connected to a set of standards, knowledge, and images.² We shall use the notion of the chain-specific frame to underscore first all the fact that in a sector that is composed of various links or heterogeneous groups of players (breeders, finishers, slaughterers, processors, distributors, and consumers), these groups co-ordinate their actions in line with a desirable state that enables them to share a common interpretation of the world. This does not erase the diversity of their practices, but tells us that there is a subsector (*i.e.*, chain) model that acts as an interpretative and reference frame.

1.2 The conventional "lean and tender" reference frame

1) The reference frame's shared nature is the production chain's translation (Callon, 1986) of the "desired product". It is what enables all the players to rally to a common principle of action and to keep the chain intact, despite its heterogeneity. So, a quality standard specific to the Belgian beef market became a normative frame to orient the conventional beef production chain's actions as of the early 1970s. This frame hinges on two simple criteria, namely, lean and tender. These are the two qualities of meat that Belgium's conventional beef production chain proposes, unlike other countries, with the United Kingdom espousing the opposite extreme of richly marbled, rather than lean, meat. For cattle farmers, this standard led to the selection of the heavily muscled frame (resulting from the double-muscle gene) that prevails in the Belgian Blue herd-book and, farther down the line, the so-called "anatomical butchering" taught in the National Federation of Belgian Butchers' schools³ (Stassart 2003). When it comes to what consumers have on their plates, this standard has culminated in the construction of the figure of the Belgian consumer as someone who gives priority to tenderness over taste and embarks on a fat "witch hunt" in line with dietary recommendations in favour of lean meat. In terms of the market, the shared nature of this frame is seen in the *de facto* monopoly of the Belgian Blue, which accounts for more than 98% of the beef cuts sold on the Belgian market.

2) The lean-and-tender standard is a general framework around which knowledge and performance criteria are arranged. So, when it comes to production, the alliance between the lean and the tender led at the time to new finishing options. Whereas in the past tenderness was obtained after slaughtering by letting the (fatty) carcasses ripen, the new lean-and-tender reference requires pre-slaughter tenderising, through early finishing, that could be retermed "tenderising on the hoof". This entailed the generation of new knowledge that was embodied in technical references (early Mean Daily Weight Gain curve) and practices such as limiting the period of growth (carcass volume) and having the periods of fattening (muscle development) and early finishing (intramuscular fat deposition) run concurrently. The most radical transformation, which would make the above-mentioned choices very hard to reverse, concerned selection: By isolating and reproducing the double-muscle gene, this selection strategy led to physiological and morphological changes that had crucial normative consequences for the reference frame's stability. First of

² This notion differs from that of set of technical references, which is used in agricultural science to describe a set of reference data that has come out of experimentation conducted under specified conditions and aimed at production and which is actually a translation of the standards, images, and knowledge that surround practices. (de Bonneval, 1993)

³ In addition to the dominant double-muscle conformation, there are Belgian Blue lines with a more marginal conformation forming the "mixed Belgian Blue" branch, the purpose of which is to preserve the breed's originally mixed (beef and dairy) production capacity.

all, this selection scheme resulted in the Belgian Blue's losing some of its qualities as a ruminant herbivore in exchange for a better concentrate conversion ratio, as a result of which intensive fattening with feed concentrates became the norm. Second, the combination of the cows' overly muscled pelvises and extremely stocky calves made calving naturally, via the birth canal, problematic. Formerly occasional caesareans became systematic, and this development exerted negative pressure on the breed's ability to calve naturally: The reference frame is self-referencing. We thus see how standards and knowledge interact at one link of the chain. But how does this complexity hook up between links?

3) Let's take the connections between production and processing. Practical knowledge regarding caesarean sections and fattening, on the one hand, and the butchers' knowledge of anatomical butchering, on the other hand, produced a new performance criterion through requalification of the EUROP grading system for carcasses and Belgian butchery cutting table, aimed at getting the most out of the hypermuscular carcass. This was a new carcass grade, called "S" for "super double muscle", at the top of the SEUROP grading scheme, which consequently disqualified the other breeds, which in the best of cases could do no better than grade E. However, what is known about the costs incurred behind these S performances, which maximise the carcasses' yields and cuts (Hanset, 1996)?

4) While it is shared, the lean-and-tender reference frame is also characterised by its implicitness, which is all the more powerful as it is "underground". It acts by making certain elements visible and erasing others that are too obvious or unknown. So, the C-section – a practice that cattle breeders take for granted but remains largely unknown to consumers – is open to little question. If the question is raised, albeit confidentially, it is then reduced to the animal welfare register, whereas the systematic use of C-sections raises fundamental questions about the limits of technical intervention in animal husbandry (Lips et al., 2001) and, more generally, the limits of the increasingly artificial pathway taken by stock farming. Current genome research to produce calves in which the double-muscle gene would be expressed only after birth (Georges, 2004) exemplifies this last thinking. These opaque points, which attest to the difficulty that the reference frame has in allowing for reality, show how closed to discussion this reality has become. As a result, the technological choice subtending the sector's artificialisation is less and less reversible. Still, can the strength of the lean-and-tender reference frame be explained solely by the cohesiveness of its choices and the knowledge that is developed?

5) The various links in the chain – breeding and fattening, slaughtering and butchering, distribution, and consumption – bolster each other and provide references for each other through the power of the images that the reference frame produces. These images are shortcuts that reduce each link's complexity and connect them to each other, from the breeders to the consumers: the Belgian Blues' champion "horse rumps" exhibited at every competition and highlighted ceaselessly in trade journals; the rows of carcasses hanging from meat hooks in cold rooms in even rows of identically bulging quarters and lean flanks symbolising industrial performance; the no-frills packaging of irreproachable meat, the rather pale, uniform colour of which, without spots of fat, nerves, or fasciae, meets today's dietetic standards; and finally, the current version of the steak-and-chips of yore, served up in the heat of the barbecue to make amends for the meat's minute-steak cooking performance. These images' ability to circulate makes them the anchor

points supporting the performance criteria that connect two links of the chain. So, the SEUROP carcass grading system, which crosses the boundary between production and processing, rests upon the carcasses' alignment, which the farmer keeps in mind to co-ordinate his "output" with the butcher's needs. Similarly, the butcher's chart posted at the butcher's shop's entrance relies on the irreproachable presentation of lean and tender meat that is offered to the customer. These images thus play a major role, alongside the sector's standards and performance criteria, to cement and stabilise the reference frame. But on another front, these images, given their reductive powers, help to reinforce the implicitness of the reference frame by masking the complexity and consequences of certain choices in certain links of the chain, by shielding these elements from certain observers' eyes.

How, then, can the organic reference frame take shape and fulfil all its potential in such a context?

2 The organic reference frame: model, tensions, and deficiencies

A remark must be made before we ask any questions about the existence of a shared normative frame within an organic production chain that can orient the chain's action, for organic farming (like other production patterns) rests upon a wealth of diversified but little codified knowledge. The question that we ask does not challenge this knowledge, but wonders about its ability to serve as references in entering a chain- or branch-specific way of thinking.

The lengthening of production-to-consumption chains has led to codification in the form of regulations. Beyond the general assertion of a natural production plan⁴, this shared regulatory framework took shape first of all by referring to conventional practices, as the preamble in the first European regulation on organic farming makes clear, *i.e.*, no pesticides or other chemical inputs⁵. The general principles in Regulation 1804/1999, amending the first regulation to include livestock production, specifies, through the notion of equilibrium, the naturalness of organic agriculture⁶. In banning the systematic reliance on C-sections, the Belgian regulation, for its part, prohibits some of the artificialising practices to which, as we have seen, the lean-and-tender reference frame is linked⁷. Must this regulatory ban on C-sections trigger an adjustment in the Belgian Blue frame in order to limit double muscling or, on the contrary, lead to farther-reaching changes concerning both performance criteria and knowledge? Does not breed shift challenge the standards and knowledge distributed along the chain?

⁴ "The main aims of organic agriculture are...work compatibly with natural cycles and living systems through the soil, plants, and animals in the entire production system; to recognize the wider social and ecological impact of and within production and processing systems. (IFOAM, 2004)

⁵ "Whereas organic production methods entail significant restrictions on the use of fertilizers and pesticides which (sic) may have detrimental effects on the environment or result in the presence of residues in agricultural produce;..." (Council Regulation (EEC) No 2092/91 of 24 June 1991).

⁶ "Livestock production must contribute to the equilibrium of agricultural production systems...By utilising renewable natural resources...the cropping/stockfarming system and the pasturage systems allow soil fertility to be maintained and improved in the long term and contributes (sic) to the development of sustainable agriculture...Organic stockfarming is a land-related activity...and the number of animals per unit of area must be limited to ensure integrated management of livestock and crop production..." (Council Regulation (EC) No 1804/1999 of 19 July 1999).

⁷ « The use of breeds in which calving difficulties require caesarean sections must be avoided : The caesarean section is allowed only to save an animal's life or to avoid its suffering...This rule is deemed to be observed for the beef herds of a given farm if the number of natural births five years after the start of conversion is and remains greater than 80% of the year's births..." (ministerial order (*arrêté ministériel*) of 30 October 1998).

This question was put to a score of organic cattle farmers who had banded together to deal with a distributor. We analyse their dynamics in depth in the chapter on the organic beef production chain's organization. Their coping strategy was aimed at adjusting to the key performance criterion demanded by the processor and distributor, *i.e.*, the ideal of grade S carcasses. This adjustment in the new breeds in Belgium, the Blonde d'Aquitaine and Limousin, was consistent with the producers' facilities and equipment and in line with the demands for lean and tender meat issuing from processors, distributors, and consumers alike, but proved incompatible with the natural stockfarming plans of organic meat production. These plans are reflected in particular in the organic meat production chain's specifications by the grazing obligation and three-month limit on the stable-fattening period. In actual fact, most organically raised young Limousin and Blonde d'Aquitaine bulls spend their entire second year of life in the stable. We shall see how this issue was explored in greater depth through the experiment described in Chapter 3.4 "re-conversion to organic farming".

The pasture obligation in the organic reference frame refers to the natural balance standard that favours low environmental impact resource consumption (grazing rather than feed concentrates) while allowing for the animals' need for open spaces. Cattle farmers are under-equipped to meet this demand, in contrast to their intensive fattening/finishing capacities, which respond to a concept of concentrate-based early stable finishing. The problem is one of making use of forage up to the finishing phase and managing a later finishing stage as a result. Moreover, how do they give up what they master when, as members of a production chain, they come under pressure to compete with the lean-and-tender grade S performance that is threatened by grazing, whereas processors, distributors, and consumers continue to clamour for this quality? How can they turn away from it, when it is precisely the first piece of information that the farmer looks for on the delivery slip that he gets from the slaughterhouse? It is thus very difficult for the cattle farmers to withstand the lock-in⁸ effect that the rest of the chain forces on them. That is because although the organic reference frame's principles and rules certify the entire chain, they are aimed above all at the means obligation and thus do little to stimulate thought about the chain of transformations that another concept of fattening livestock entails.

What does the grazing requirement mean for the processing and consumption links, other than redefining the products, in reference to conventional meat production, as being "free from additives and food colouring"? When it comes to processing, different ways of butchering the carcass are possible and are not without consequences for production patterns (Thrift 2003). Still, should not such questions be taken up first by consumers?

Now, opposite the conventional consumer construct, which is defined on an industrial level by two simple criteria (lean and tender), compartmentalised, and opaque as to the consequences of these choices on increasing production's artificiality, the organic consumer construct, initially built upon interpersonal relations and the delegation of responsibility, through trust, to the producer (means

⁸ Lock-in effects are mechanisms as a result of which when one embarks on a pathway, this pathway becomes easier, self-referring, because it reaches a certain degree of irreversibility. Such lock-in effects have been observed in the past in major industrial sectors, for example, around the train and coal in the 19th century; around the car, roads, and oil in the 1960s; and around nuclear power and electricity (in France) in the 1970s.

obligation), is under-equipped. Take the matter of flavour. According to very many consumers, flavour is an essential performance criterion of organic produce. As a result, overall, one can draw no conclusions as to organic meat and produce's taste advantages (Bourn and Prescott, 2002), and, to come down to specifics, while the organic carrot can make a difference, organic meat must grapple with the complex difficulties of meat product qualification, especially with regard to the quality of beef and veal (Stassart 2003b). If a flavour difference can be made, it will be fragile and first have to be strengthened by connecting it to other intangible criteria that consumers consider to be relevant (grazing and welfare). Once that is done, consumers will have to be made competent enough to be able to taste the difference.

Building the organic reference frame is not just a matter of making technical choices that connect standards and knowledge. As we have shown with regard to the conventional frame, it is fed by and feeds the chain with images that enable the players to see themselves in it and reorganize their cognitive-normative kit. Now, this is where the organic beef reference frame is poorest. While the images of green pastures and suckler herds do indeed refer back to the principle of natural balance and autonomy that subtends the stockfarming/multicropping model so dear to the organic sector, the very concept of specialised beef herds and its embodiment in principles such as fattening and finishing and expressions such as "une bête en état" ("ready" from a slaughterer's perspective) as set in the lean-and-tender reference frame is not open to translation in the organic reference frame. Beyond the horse rump that the ban on C-sections effectively places out of the organic reference frame's bounds, with what image can the Belgian Limousin or Angus farmer identify? Does this image force him to look at individual performance or does it propose management on the scale of the herd? This lack of sense-making images, these deficiencies generate a profound lack of understanding on the part of Belgian organic cattle farmers when they consider the potential of other reference frames (such as those of their French organic neighbours), which they consider to be just short of amateurism.

Can the debate about the sustainability of organic farming do without such an approach, one that exposes a series of deficiencies in the chain's reference frame and reveals how under-equipped it is compared with the dominant lean-and-tender reference frame? In symmetrical fashion, the latter can stimulate the reopening of a series of questions about the implicitness of the lean-and-tender reference frame. The first question concerns the artificialising pathway that subtends the lean-and-tender reference frame: tomorrow the C-section and/or after tomorrow genetic engineering. The second question concerns the under-equipment of some of its practices, such as parasite control – should parasites be eradicated or kept under control? –, which, instead of exploring the matter of our relationship with living things, closes it, as we could show. Finally, there is the matter of certain aspects and an under-equipment that brooks few questions, such as that of consumers' practices, the result of which is to render Belgian diners less and less able to choose from among different options. This situation of non-debate about what some people consider to be the anomalies of lean and tender meat shows how strong this reference frame has become. It has become all the more irreversible in that it is over-equipped with standards, criteria, knowledge, and images and has been reified by the players in the chain after enabling the said players to understand the chain by reducing its complexity through its simplification of reality (Muller, 1990). The

national translation of the organic reference framework is indeed ill-equipped to take on the overall over-equipped reference of lean and tender. Changing the standards alone through regulations is not enough to change the entire reference frame to which the various links in the chain remain firmly attached, being locked in as they are by their under-equippedness (Guthman, 2004). In answer to our opening question, which was that of interpreting the tensions that we see in the lengthened organic production-to-consumption chain, we thus argue that a sector reference frame must be properly equipped if it is to be sustainable.

Now, a reference frame's equipment rests upon a set of standards, knowledge, and images connected to form a system. What is more, although they are built upon the various players' interactions, these normative and cognitive matrices and their images tend to become independent from their construction process and force themselves on the players as the dominant model for interpreting the world (Muller, 2000). Their unstated unquestionability is what produces what we call "opacity effects", for example, with regard to the C-section or the "tender" performance criterion, which prevent consumers from developing their abilities to develop discriminating taste buds.

3 Conclusions

Given this stalemate and the research that it has sparked, the reader might wonder about the scope of the analyses that will be broached in the next chapters. At the end of the day, might this not be a somewhat surrealistic Belgian snafu, in which the double-muscle gene, steak and chips, and caesarean sections come together? Without letting ourselves be locked up in the routine interactions of the conventional model's agents (Godard and Hubert, 2002), we posit that the question of the equipment available for the transformation of a reference framework carries importance extending well beyond our case. Observations in the organic potato sector lead us to believe that the Bintje reference plays the same reference role for potatoes as the Belgian Blue does for meat, preventing in particular the emergence of a new reference framework based on hardier varieties. Similarly, but on an even wider scale, we can wonder about the opacity effects of the global dairy reference framework that holds sway, notably through the hegemony of the Holstein model and its implicit production dimensions (Landais, 1996; Micoud, 2003), as well as the model's other consequences, such as the possible link with the increasing prevalence of allergies to cow's milk by young children (Riedler *et al.*, 2001).

More generally, the very specific case of the Belgian meat sector shows how difficult it is to build more sustainable production-consumption chains. The cases, such as this one, in which the coping logic seems doomed to fail because of the strong hidden irreversibilities of the dominant schemes, have led us to break ground and conduct co-ordinated research involving agricultural science, technical research, and collective action. The association of actors in an experimental design entailing mutual learning, *i.e.*, intervention research, is what made this exploratory work possible. We shall describe this intervention research step by step in the second part of this report, while the third part will present the results of this research. The central question of the production-consumption chains' organization and distribution's involvement sparks a series of questions that must be treated upstream, on the production level, namely, those pertaining to fattening/finishing, parasites, the

environment, and sustainable consumption. The fourth part of this report will present briefly the direct impacts of this research in three separate areas.

The second part of this introduction presents the organic cattle farming and beef production sector's characteristics. It describes this research's empirical context.

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1.2. Characteristics of the Belgian organic beef sector

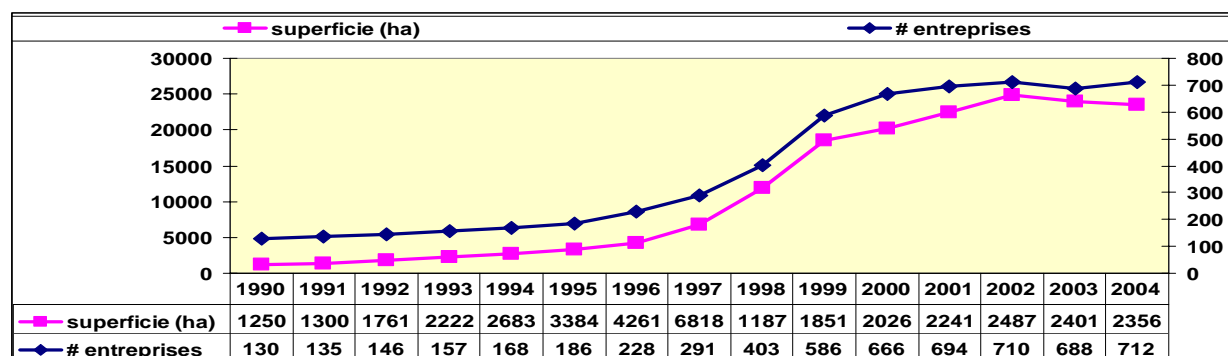
Joris Aertsens, Guido Van Huylenbroeck

1 The organic sector in general

1.1 History of the organic production in Belgium

The organic production in Belgium started in the Sixties, as a reaction on a more and more intensive production with an increasing use of artificial fertilisers and pesticides. The first producers and consumers were united in organizations like "Natur & Progrès" (Wallonia, 1967) and Velt (Flanders, 1974). Semi-official specifications were used. At the beginning of the Eighties the organic producer organizations Belbior (Flanders, 1981) and UNAB (Wallonia, 1984) were created. In 1988 Belbior and Velt introduced the Biogarantie® label and introduced formal specifications, controlled by the organizations of control Blik vzw (1987) and Ecocert Belgium bvba (1991). The European Regulation EC. 2092/91 which introduced a legislation for certification and labelling of the organic products was applied in Belgium from 1993 on. The government financially supported the organic production since 1995. Producers who engaged in organic production for a period of 5 years received subsidies. The institutionalisation of organic agriculture, together with the financial assistance and the occurrence of scares in the conventional sector, resulted in a strong development of the organic sector between 1995 and 2000 (Source: Van Huylenbroeck et al, 2005). The growth was stagnating however from the year 2000 on. Carels and Samborski (2004) indicate the lack of (good) cooperation in the the sector as one of the principal reasons for the stagnation. Thus this document which focuses amongst others on the organization and the co-operation in the various chains of organic beef can give examples for improving the functioning of other (Belgian) chains.

Figure 1: Growth of the organic production in Belgium from 1990 to 2004



source: Van Huylenbroeck et al., basé sur AM&S en NIS, 2005

In Belgium we notice also important differences between the regions. The organic area in Belgium in 2002 accounts for 1,75% of the total agricultural area. In Flanders the organic area accounts for only 0,54%, while in the Walloon region it accounted for 2,71% (Van Huylenbroeck and Al, 2005). These important differences are related to structural differences between the regions. In comparison with Flanders, in the

Walloon region the agricultural companies are more extensive and thus more suited for the conversion towards organic farming⁹. The decoupling of the subsidies from the production, made it relatively more interesting for the extensive companies to convert towards organic farming⁹. It was noted that especially producers of beef converted to the organic practices, due to the relative high subsidies per ha for meadows (Source: Van Huylenbroeck et al, 2005).

1.2 At the european and international level

The survey of FiBL, reports that in November 2005 in the EU, 5.8 mio ha are cultivated as organic land, accounting for 3,5% of the total acreage. On the level of the individual countries there are different tendencies. From 2003 to 2004 the organic area increased in e.g. Austria, the Netherlands, Portugal, Germany, Poland (+10%) and Estonia but it decreased in e.g. Italy, Denmark and the United Kingdom. On the world level the organic area remains low, but the growth continues. Between 2002 and 2003 it increased with 10%. On the world level more than 26 million ha are cultivated organically (Van Huylenbroeck et al, 2005).

2 The paradox of the seeming disequilibrium of demand for production of organic beef in Belgium

2.1 Introduction

Regarding the production and consumption of organic beef there seems to be a paradox. Our estimates indicate that the potential of the organic area and the cattle stock in Belgium is about ten times as large as the quantity of organic meat that is commercialised. The most important reason is that the subsidies for producers who convert to organic beef farming for a period of minimum five years, are largely sufficient to compensate the extra efforts, even when the meat is not sold on the organic market. Relatively very large numbers are sold to the conventional sector in Belgium or are exported. This is elaborated in this section.

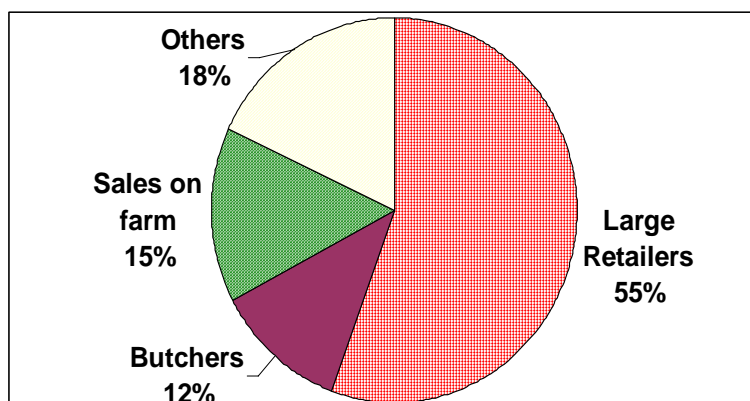
2.2 The demand for organic beef

2.2.1 The different sales channels

In Figure 2 below we present the shares of the different sales channels in 2004. Weekly about 13500 kg of organic beef is sold, of which 7500 is sold by large retailers (=55%). Among these retailers one is by far the most important 5550 kg a week (or 74% of all retailers). About 1555 kg was sold by organic butchers (=12%). We estimate that the amount of organic meat sold directly on farms in 2004 lies between 1000 and 3000 kg (=about 10 to 20%). The sales through other channels, including deliveries of colis at home, smaller shops, catering, markets and restaurants, are estimated at 2430 kg (18%) (Source: contacts with the sector).

⁹ Recently the Walloon Program for Rural Development has introduced a system of decreasing subsidies for larger farms. For areas above 20 ha, the subsidies per ha are lower.

Figure 2: Shares of sales of organic beef through the different sales channels

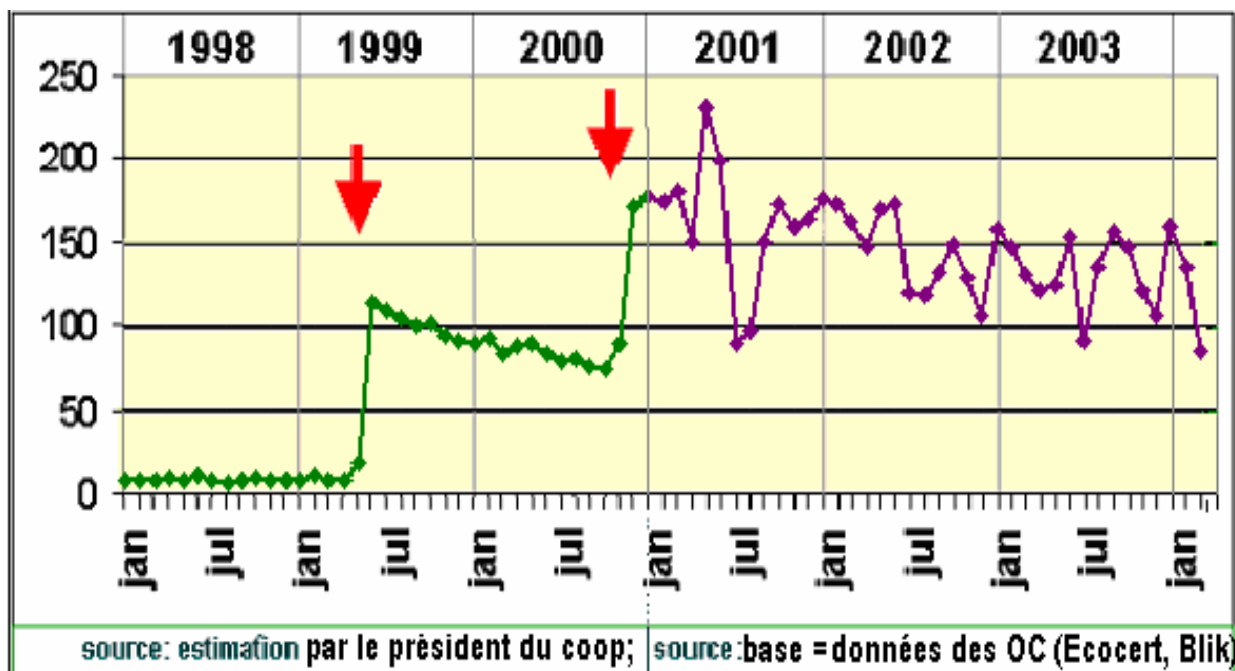


source: Estimation Ugent based on contacts with the sector.

2.2.2 The effect of scares in the meat sector on the evolution in the demand

In the figure below, the evolution of the organic cattle slaughtered monthly is presented for the period January 1998 until March 2004. One can conclude that the production and commercialisation of organic beef became important from 1999 on. There was a strong increase in demand due to the dioxin crisis. At the end of 2000, because of the BSE scare the demand increased strongly again. Between the end of 2001 and March 2004 there was a slight negative tendency in the demand for organic beef (as confidence in the conventional product was more and more restored).

Figure 3: Evolution of organic beef slaughtered monthly from 01/1998 to 03/2004



2.3 The production and commercialisation of organic beef

In this section through different approaches we indicate the disequilibrium between the organic cattle stock and the quantities of organic meat commercialised in Belgium.

2.3.1 The production of organic beef

Data from Ecocert and Blik from February 2004 learn us that the total organic cattle stock in Belgium consists of 38321 animals. These are composed by 10290 (27%) animals of breeds specialised in milk production, 16828 (44%) animals of breeds specialised in meat production and 8389 animals of breeds with a double goal (both milk and meat production). These data also learn us that there were 5586 cows older than 2 years from breeds specialised in the production of meat.

If we would assume that for each cow older than two years of a breed aimed at meat production a calf is born yearly and an animal is slaughtered yearly, there would be an organic meat production of about 5586×280 kg a year or about 30000 kg a week. Above however we have seen that only about 13500 kg (45%) of organic beef meat is commercialised weekly. This indicates that an important part of the organic animals of breeds specialised in meat production is not commercialised on the organic market.

Another comparison points in the same direction. The organic cattle stock of breeds aimed at meat production represents 0,7% of the conventional stock aimed at meat production, while the quantity of organic meat commercialised only represents 0,3% of the conventional meat commercialised.

2.3.2 The commercialisation of organic beef

We received data from Ecocert that describes changes in the statute between 1 December 2004 and 27 June 2005. In total there were 11051 changes of statute. 1582 (about 14%) of the changes refer to carcasses of organic animals that had to be destroyed (due to diseases, accidents, ...), 3111 (28%) refer to organic animals that were sold alive to the conventional sector in Belgium, 3768 (34%) refer to organic animals that were slaughtered, 2590 (23%) refer to animals that were exported (probably a large part to the conventional sector). These data indicate that a lot of animals produced organically in Belgium are not commercialised organically.

Also for the 3768 organic animals that are slaughtered it is not so that all of them are commercialised organically. This period constitutes 7 months so on average monthly 538 animals were slaughtered. On Figure 3 we can see that in the period 2002 to 2003 on average about 130 animals were slaughtered monthly for commercialisation as organic. We expect that this will not have changed a lot in 2004 and the first half of 2005. This is an indication that only about 1 on 4 organic animals slaughtered is also commercialised organically.

We can conclude that our data indicate that only about 34% of all animals present in the organic sector are slaughtered in Belgium for commercialising the meat. Even then only for about 1 out of 4 of these animals the meat is sold as organic beef.

Combining these data we find that only about 8% of all animals present in the organic sector are used to provide organic beef.

3 The assortment of organic beef products

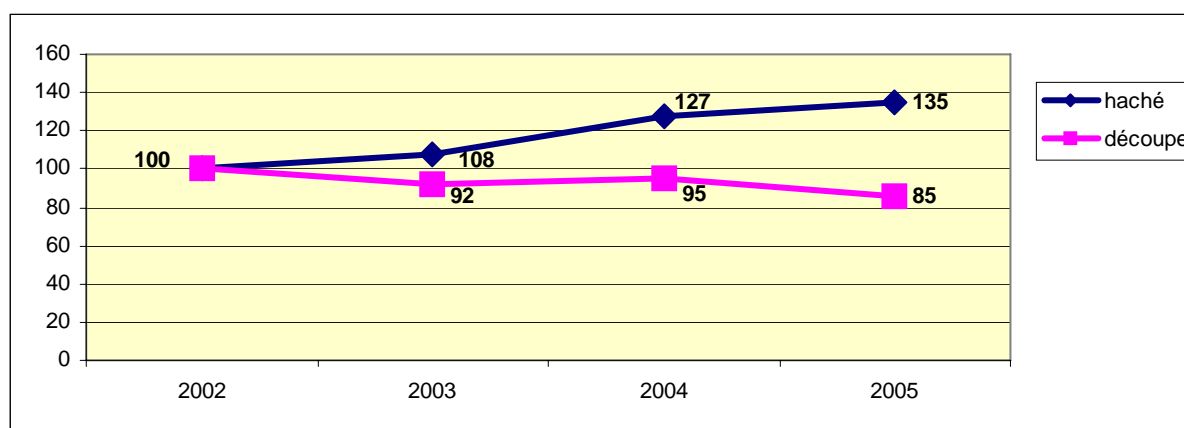
Mainly through contacts with the sector we have collected data on the different product categories.

3.1 Beef cuts and minced meat

The demand for minced meat consists about 40% of the total sales volume of organic beef products. Knowing that during the transformation of a well-formed carcass there is about 70% of meat suitable for meat cuts and about 30% for minced meat, this means that the demand for reform cows only destined at the production of minced meat is very small.

On the figure below we see that demand for organic minced meat has increased relative strongly in comparison with the demand for organic beef cuts in recent years.

Figure 4: Evolution of the demand for organic minced meat and meat cuts



source: contact with retailers, 2005

A «new» generation of consumers prefers minced meat more and more in comparison with meat cuts. The relative success of organic minced meat is partly due to the fact that the provision of minced meat is very flexible, while the organic meat cuts are provided in packages with fixed quantities of the different cuts. This means that the person who is responsible for offering the meat at the point of sales is often not inclined to order an extra package of meat cuts. A more flexible organisation may be helpful in commercialising more organic meat cuts.

3.2 Transformed products

Our data indicate that only about 5% of the total organic beef meat is commercialised in a transformed way. In this case it is mainly used in sauces and lasagnas, a very small part as "charcuterie". If we compare these with the conventional sector there seems to be a potential. However it takes some time and costs to organise this. Only recently there has been the development of a "salami" with good quality without making use of nitrites (as is specified in the organic reference in Belgium).

4 Conclusions

The main tendencies we have noticed are the following:

The demand for organic beef did increase strongly immediately after the dioxin and BSE scares in 1999 and 2001. Between 2001 and 2004 demand decreased slightly, probably because consumers regained confidence in the conventional product.

The main part of the sales takes place at the large retailers (55%). Among these large retailers one is by far the most important selling about 74% of all organic meat sold by large retailers.

An important aspect of the sector is that the total amount of cattle on organic farms could provide a quantity of organic meat that exceeds about ten times the quantity that is actually sold. For a lot of producers, the subsidies for producing organically are economically justifying the activity even if the meat itself is not sold on the organic market.

A tendency we also noticed is that as in the conventional sector the share of organic minced meat is growing relative to the share of organic meat cuts.

5 Acknowledgement

We liked to thank Philippe Ghesquiere and Blaise Hommelen (Ecocert) and Bert De Caluwé and Hilde Van Duffel (Integra/Blik) for providing important data, used in the analysis.

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PART II

METHODOLOGY

2.1 Sustainable Development and Intervention Research

Research Methodology

P. Stassart and D. Jamar

The name of our project "How can organic agriculture contribute to sustainable production and consumption patterns?" is an ambivalent proposition. Some people have interpreted it as an invitation to normative assessment based on objectives, criteria, and indicators of organic agriculture. This evaluative approach, although complementary, is not the one that we applied. Our approach differs because it is a dynamic approach that tries to understand what simultaneous changes in the direction of sustainability should or could occur. The approach is therefore more one of social learning of sustainability. This approach rests upon a method, intervention research, that links the natural sciences, engineering, and collective action in order to analyse the complex situations in which various types of knowledge can be developed and applied. This is because sustainable development includes the long term, the complexity of systems, processes of social and technical change, and transformations on variable scales of time and space.

Organic agriculture – especially here, in the case of beef cattle farming – has at first glance some serious advantages when it comes to sustainability, because it bans certain practices that are generally considered to be negative (pesticides and chemical fertilisers, etc.) and encourages others (its link with the soil, etc.). However, the development of organic stock farming to produce beef and veal has become a complex process. This production sector, which is subjected to economic and commercial pressures that orient its development, has developed recently through its entry into mass distribution, *i.e.*, the supermarkets. The support given to converting to organic methods under the CAP has also attracted new producers. Cattle farming now occupies 90 percent of the 22,000 hectares of Belgian agricultural area that has converted to organic farming. This economic and commercial dynamics has led to the development of new agrifood chains in which this project took an interest.

The matter of organic agriculture's contribution to sustainable development was included in the Support Programme for Sustainable Development that financed this research. This supposed that certain political players had imposed its relevancy. And indeed, we find this in Belgium's Federal Sustainable Development Plan, which reflected at the time concerns that were global (European Union) but also national. In the aftermath of the dioxin crisis, the "Greens" won the national elections in Belgium and imposed an ambitious objective when it came to organic agriculture. The Federal Sustainable Development Plan set an objective of having organic farming occupy 10 percent of the country's agricultural area by 2010. Beyond the goal set by the federal administration and politicians, researchers then asked on whose shoulders these stakes were riding and subject to what conditions.

1 Research design

To start off, we first had to clarify the matter of who all the partners with whom we were going to cover this question were. Besides the commissioners of the study, we had two other categories of partners: the institutions and field operators on the one hand and the beneficiaries of the research on the other hand. However, to be symmetrical, we must say a word about the researchers as well.

1.1 The institutional setting

The *commissioner* of the study was the Belgian Science Policy. Its connections with the research were formalised in a four-year contract that included the submission of all interim reports and the detailed final written report. These reports were not limited to the research's findings. They also included a large section describing the methodology that was used. The contract required the research teams to meet two times a year with a committee of users, to which they had to report on the progress that they had made. The members of the Users Committee were representatives of the beneficiaries, *intermediary* institutions, and field operators, *i.e.*, representatives of the organic sector such as trade organisations, certifiers, consumers' associations and environmental advocacy groups, supervisory staff, and the public authorities. The *beneficiaries* formed the third category of partners. This was the group on behalf of which the research programme was developed. It included a heterogeneous set of players who did not always identify with the institutions and operators that had been set up, namely, some 200 organic cattle farmers and consumers representing about two percent of the beef consumption market. Following the example set by Grin (1997), we shall say that the first category consisted of "involved" beneficiaries because they participated actively in organising the production chains. The second category of beneficiaries was that of the "affected" beneficiaries, because their involvement was indirect; it came about through their reactions to the choices made by the first category of beneficiaries, of which they would be the beneficiaries or the victims.

The *researchers* who steered the intervention research were a sociologist and an agricultural engineer, whose institutional affiliations (university department of science and environmental management, Regional Agricultural Research Centre) and initial expertise regarding the beef production chain and organic agriculture were known. Their work could be distinguished even more by their status and form of collaboration. As contractual researchers, the time frame of the research contract imposed a certain degree of urgency on them. Against these very strong time constraints, they could draw upon the professional complementarities of an agricultural engineer who had moved on to sociology and an organic producer who became a researcher, as well as a certain penchant for incompleteness. This complicity was also fuelled as the intervention research proceeded by the abilities of one of the pair to mobilise uncodified knowledge and the abilities of the other researcher to build the intervention research protocol one step at the time, yet strategically.

1.2 Heterogeneous players

The contractual institutional arrangements, including the study's commissioners, the researchers, and the Users Committee, were designed to open the world of research to that of its users. But this was to be done using conventional research models, in which the researchers remained outside the reality that they studied. The beneficiaries were the subjects of the research, their representatives, recipients whose role was to validate the research's progress annually.

Unlike this binary relationship between the researchers and the order (or demand in the case of action research), or ternary relationship amongst researchers, commissioners, and players who were at the same time the subjects of the research, most of the time we dealt with very heterogeneous sets of players characterised by variable degrees of organisation. Moreover, the form that the collective action that bound them would take was necessarily at the heart of the research. We thus did not have simple relations with the players and it was highly unlikely that our relations with the players could be expressed transparently. In the case at hand, we had to separate the described institutional setting and that which the subject of our research, organic agriculture, and more specifically organic cattle farming, drew into the picture or into conflict, that is, stock farmers, a co-operative, a slaughterhouse, a processor, a distribution company, and finally the two ends of the chain, namely, the cows and consumers. All of these players (and even more) co-operated with each other, but they were also involved in conflicts with each other. There were areas of interaction, but also very porous borders between them, points of view that they shared more or less, but also divergences. The partnership to build was itself part of the research, because it conditioned the productivity of a research project that took on the risk of transforming the relationships and knowledge that are components of the Belgian organic beef agrifood system.

2 The research set-up

The research set-up was not a given and could not be prefabricated. It had to be built gradually and consisted in making a series of translations entailing provisional theorisations.

2.1 Translation 1: Sustainability and chain

The researchers' first point of support was that of legitimacy. First, they had a sort of order from the Belgian Science Policy within the context of a programme on sustainable production and consumption patterns. Second, the Federal Sustainable Development Programme embodied a political will to support the development of organic agriculture, the latter being given a sort of social preference, including upon the European level, due to its contribution to sustainable development, since it receives special bonuses for this. Now, these political guidelines, which legitimised the research (called "How can organic agriculture contribute to sustainable development?" - a question which suspends the political *a priori*, we might point out), also had powerful effects on the sector: Indeed, the reconversion grants encouraged new producers to enter the sector, and this met a demand from the

distributors' camp. One distributor set about organising a chain¹⁰ by establishing a sort of commercial contract with a co-operative of stock farmers. These "conversions" to organic agriculture were of various types and this organisation of the sector as a chain created problems: The newcomers were necessarily different from the "incumbent" organic farmers and the chain was out of phase with the highly decentralised, short circuit organisation of traditional organic commodity chains. The first "translation" would come about "in the name of sustainable development", a label that none of the partners could refuse, even if the link was actually a very weak one, but enabled the researchers to establish "exploratory" relations with the players.

2.2 Translation 2: Diagnosis of the chain: the challenged reference frame

The heterogeneity of the players who were involved required a sociological reading of the situation. This mobilised the theoretical resource of the reference frame. Where economists speak about conventions or transaction costs to analyse the organisation of the chain, we mobilised mainly the concept of the reference frame (Jobert and Muller, 1989) to understand the organising link. The concept of reference frame has two characteristics: It stresses the internal consistency of the sector, a consistency that rests upon shared beliefs, knowledge, and standards, but it also stresses each partner's interpretive ability, which leads to the question of what is not shared (and is potentially a source of conflict). It links the sectoral and general, and thus the process of translating an overall imperative for use in a specific sector. Now, the entry of new farmers into organic farming forced them to go from one reference frame to the other. It forced them not only to engage in economic reconversion but also a sort of conversion of beliefs. Earlier studies (Stassart, 2003) showed the great consistency and rigidity of Belgium's beef cattle production system. This consistency was achieved by the power of the sociotechnical reference frame and instrumentation that was very strong on techniques and standards and, *in fine*, a definition of the product's quality to which consumers adhered massively. In contrast, the construction of an industrial type agrifood chain (division of labour amongst farmers, processor, and distributor) entered into opposition with the conventional reference frame of the organic sector, which was founded on a short circuit and face-to-face producer-consumer relations.

2.2.1 Identification of concerns, inconsistencies, and tensions

The first phase was a diagnostic phase. It consisted of putting questions to a series of players in the chain: the stock farmers via public debate, the companies involved, but also consumers' groups (via focus groups). This phase of the research rested upon justifiable choices: On the one hand we questioned separately the different sets of players who were effectively remote from each other due to distant relationships (producers-consumers) or to conflictual relationships (stock farmers-distributor) so as to suspend the strategic relations between players. On the other hand we did not want to limit ourselves to the organised players. So it was that we brought together all the stock farmers, not just the collection co-operative that was run by a small group of stock farmers and negotiated with the distributor. Moreover, this phase would lead to several types of outcome. This open questioning enabled us to pinpoint the concerns and points of view that were not represented in the

¹⁰ By "chain" we mean not a production-distribution sector, but an organised *chain* that goes from the producer to the distributor and connects the various *links* by contracts and other ways of stabilising market relations.

chain's organisation for lack of direct spokespeople.¹¹

Finally the intermediary bodies of research were constituted. On the one hand, according to the wishes of the commissioning body, the Users Committee was created. This committee consisted of various official representatives of the country's stock farmers, companies, consumers, and researchers. It functioned less like a research and decision-making body than as a place for validating the choices made in the course of the research. On the other hand, the researchers created a Competency Group, composed of players whom the researchers felt would be able to divorce themselves from the various strategic positions to envision the relevancy of the research questions, given their knowledge of the sector.

The exploratory diagnosis first of all revealed a series of concerns. These concerns were not constructed problems but rather the expression of questioning in the form of dissatisfaction, difficulties, and wishes. These concerns and their connections were identified before we constructed the research questions. They were the expression of questioning that made sense for one or more groups of players. So, some sceptical stock farmers wondered about the following question: "Should an 'organic beef' product be produced that would differ from the consumption of conventional beef products?" (Concern 1 **(C1)**). This concern, which was one of product differentiation (which was different from that of the production system), referred to a second concern according to the researchers, that is, "What is the desirable development model for organic agriculture?" (**C2**) And this also referred to another one of the researchers' questions, that is, "What are the environmental impacts of a production pattern that is perhaps as intensive as the conventional pattern?" (**C5**) Indeed, in their view, the tensions that had been identified between the specifications and the farmers' practices stemmed from a clash of development models. Without espousing this statement, some stock farmers then asked the question in terms of the agrifood chain and the consistency of the choices that were at stake: the cattle's diet, breed, carcass maturation, etc. These suggestions moreover struck a chord later on with the distributor who was present in the Chain Competency Group. Other stock farmers proposed setting up something independently from the chain choices that they felt to be most problematic, whether it concerned packaging and labelling or the allowed caesarean section rate. The issue of the product also led the stock farmers to send the ball into the researchers' camp by asking us, "Who are the organic consumers?" (**C3**)

This issue was covered upstream from the competency group and in the consumers' focus groups. Within the former, two points of view clashed, *i.e.*, that of the figure of the worried consumer, which was held by the distribution sector, and that of an ignorant but learning consumer, which was held by an association of general consumers. The question was first reformulated within the beef consumers focus group in the following terms: "What, for you, as consumers, would be the reference points on which the differentiation of the final product might rest?" Exploration of this question revealed that the change of breed was a potential landmark for differentiating the product in advance. However, for a change to be possible, it had to be adopted by the distributors, who at the time were a driving force in the organic agrifood chain's development.

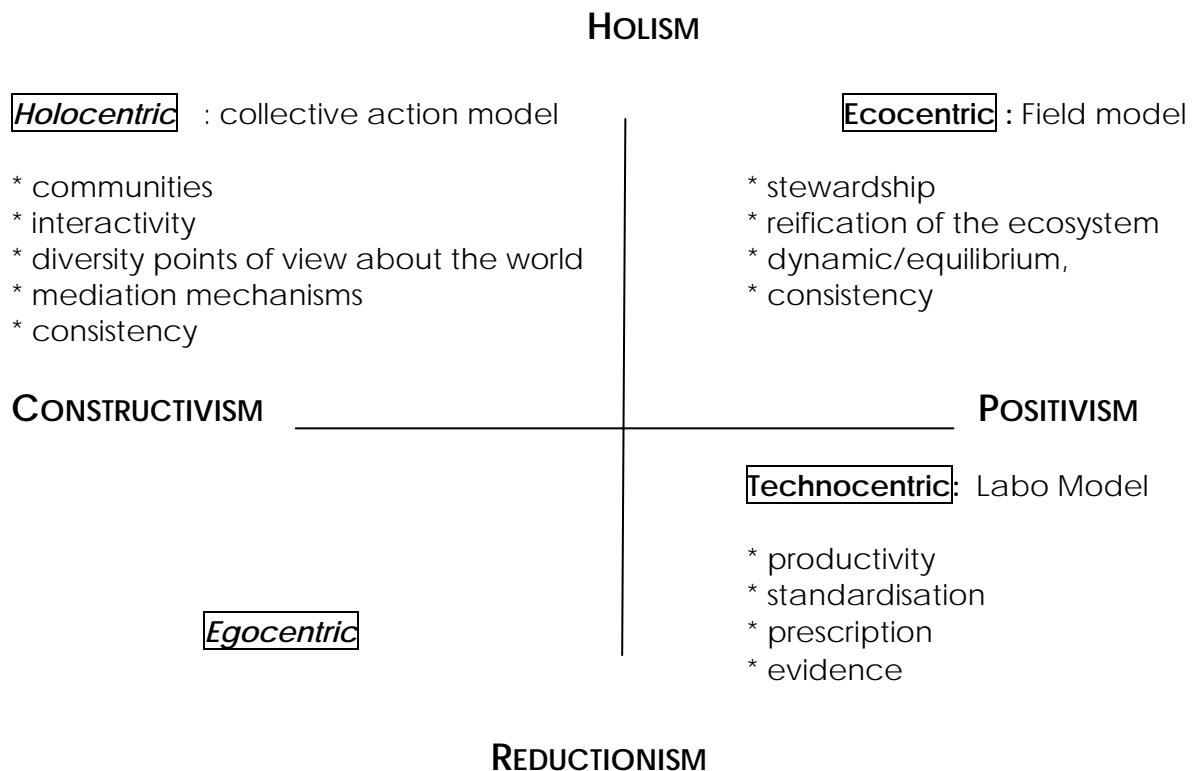
This then referred back to the question of the distributors' legitimacy, a question that

¹¹ These players – for example, consumers – are effectively well represented by technical standards, market studies, and so on, but have no direct say in things because several competing parties claim to represent them.

was stated as follows in dealing with the stock farmers, "Can farmers hope to build a lasting relationship with mass distribution?" (C4) This question, which was asked by the researchers, supposed a highly questionable possibility. For the farmers, it referred to various dimensions that concerned the concept of mass distribution (capitalistic thinking, quality policy, claim to represent consumers) and the consistency of its commitments (working with intermediaries with shady reputations, pressure to lower prices, etc.) alike. Some of these concerns revealed inconsistencies, but some of them were also sources of tension between the players. By inconsistencies we mean the gaps that may exist between the components in a system or a chain, for example, inconsistencies with regard to standards (some organic standards are not observed, for example in the grazing obligation) or social inconsistencies (the will to distinguish the organic product in terms of "quality" perceived by the consumer). By tensions we mean, on the contrary, the disagreements that are put forward by the players. Three tensions thus emerged, namely, tensions about the definition of the product's quality (tensions amongst farmers), tensions about the definition of the consumer and his/her expectations (tensions between the researchers and consumers on the one hand and the distributor on the other hand), and tensions about mutual trust between farmers and the distributor. This distinction between tensions and inconsistencies, as well as the characteristics of the points of view that were expressed, had important consequences on the choice of and connections between the research models that were adopted.

2.2.2 Translation into different research models for different working propositions

The five concerns that were expressed by our groups reflected different points of view. A difference in a point of view can be expressed with regard to a common reality, but a difference in point of view can also concern the complexity and/or level of elaboration of the problem. The distinction of this "double distance" thus refers to the need to clarify the levels of opposition to points of view. Depending on the point of view, the diagnosis and the actions to take will differ. How should this diversity of points of view be analysed? Bawden's (1997) analytical grid enables one to situate a problem on two orthogonal axes, *i.e.*, the vertical axis that pits reductionist visions of the world (towards the bottom) against holistic visions of the world (towards the top), and a horizontal axis that distinguishes an object of this vision (towards the right) from a constructivist vision (towards the left). If we discount the lower left-hand quadrant (egocentric quadrant) as not being relevant to sustainable development, we then have three quadrants that correspond to three different research models, *i.e.*, technocentric, ecocentric, and holocentric.



In the technocentric quadrant, reality is truth, it can be measured objectively. The research model is that of the laboratory. The researcher isolates entities that s/he can manipulate. Experimentation produces knowledge, the value of which depends on its degree of generality. However, the researcher who comes up against the world's technical and social complexity is forced to develop observation tools. Complexity calls for the search for consistency more than for truth. This research model is the field research model or that of ecology. In the second quadrant, the ecocentric quadrant, observation enables one to allow for the consistency, that's to say the relevancy, of the interactions between identified elements. Knowledge is more or less complete and thus leaves the door open to uncertainty. However the description of the complex world depends on the knowledge that is available to describe it. What counts is the transformation of explicit and implicit knowledge of this world. In the third quadrant, the holocentric quadrant, the researcher is a stakeholder in the diversity of the worlds that s/he describes. The research model is that of collective action, where it is no longer the field but the ways in which the players combine and interact to define a problem that are examined; there is a methodology but no pre-programmed solution.

The aim of this approach is not to assert the primacy of one point of view, but to clarify and to recognise these different points of view and thus forms of knowledge and types of stake that are linked to them. The idea is to determine where each one is situated to be able to go from a short-term to a long-term vision. So, the knowledge that is produced according to the laboratory model in the technocentric quadrant is not directly compatible with the ecocentric quadrant, if only because it produces temporal reductions that are likely to miss poorly identified yet crucial ecological interactions. Similarly, tackling questions from the third, holistic, quadrant can be done only if one commits oneself as a researcher to collective action (Hubert, 2002). Intervention research is a way of linking these three research models

in order to situate the research questions according to the expressed viewpoints and to develop appropriate research protocols accordingly. Intervention research offers the possibility of handling different levels of complexity simultaneously: handling complex questions in situations of interaction, that's to say situations of tensions where the concerns are held by different players/points of view while simultaneously fuelling it through ecocentric or technocentric treatment, but also allowing the disciplines to contribute to it by fuelling it through eco-or technocentric research.

Three of the five concerns (C1: product differentiation, C3: consumers' expectations, and C5: farmers-distributor relations) were treated in the holistic quadrant, as they were the subjects of tensions between the players expressing different points of view. To be handled through collective action, these tensions first of all had to be "reframed" in the "viewing field" to reach a certain degree of convergence. This work consisted of suspending certain points of uncertainty. This was where the researchers performed a transaction. The principle of a transaction rests upon the fact that one can construct a supposed consensus from interests that are not convergent prior to the operation but that a common object can develop in partially complementary but also partially opposing ways (Rémy, 1978). The transaction around the issues of differentiation and relations between farmers and mass distribution drew upon the idea of the change of breed. The change of breed interested the distributor in line with his differentiation strategy. It interested the collection co-operative because it enabled the co-operative to organise its exclusivity. It interested the researchers because they saw in it an object that could mediate the inconsistencies with the specifications that were ascertained, for the change of breed re-opened the issues of grazing, the ban on caesarean sections, and the use of feed concentrates that the organic specifications raised.

The transaction was translated into a limited co-operation convention that, in engaging three actors, transformed their relations as follows:

1. The distributor accepted and was given responsibility for the (middleman) slaughterhouse's behaviour. This neutralised uncertainty about the latter's behaviour.
2. The collection co-operative, which was composed of a few farmers, accepted that the farmers as a group constituted an autonomous entity with regard to its commercial structure. The farmers thus become stakeholders in the co-operation convention.
3. The researchers implicitly renounced having the consumers and players involved in this co-operation convention interact. C3 thus became an issue distinct from C1 and C5.

If we take C1 and C5 as our starting points, the first research question (**Q1**) becomes, "What are the conditions of economically sustainable and socially equitable collaborative relations between organic cattle farmers and the distributor?"¹² The three terms of the question were held by the distributor, farmers, and researchers, respectively. This question was organised around three subjects of research. The

¹² This question is reformulated in the co-operation convention as follows: "How does one go from having one foot in the organic sector to two feet in the organic sector? How does one go about having a Belgian organic sector in five years' time that can be set apart from organic produce of all origins and be sustainable?"

central subject was the definition of the limited co-operation between farmers and distributor around product differentiation criteria (research subject **S1a**). This subject was covered in a "Chain Working Group" steered by the researchers that involved the four parties to the convention. This working group was fed by two complementary subjects of research: An economist treated the subject called "the supermarkets' strategies vis-à-vis organic beef and veal" (**S1b**) through a conventional field survey, while a sociologist stoked the thinking of the Chain Working Group through upstream work which made it possible to tackle the question of "introducing thought about the specificity of the potential consumer of organic meat sold in supermarkets" (**S2**) through the consumers' focus groups, which strove to flesh out this issue. These connected studies were located in the ecocentric quadrant. They fed into the central question, the outcomes of which would in turn lead to new eco-and technocentric questions.

Unlike the central question, the questions that did not concern tensions but the inconsistencies that were detected by the researchers and validated by their bodies were handled separately using the field research model. The organic agriculture development model was examined directly through the question of *parasite management in cattle* (**Q3**). This entailed identifying the objects concerned by the action of managing parasitic infestations and characterising their interactions (**S3**). The chain's environmental impacts were covered through the question of the *environmental consequences of the chain's transformation into an industrial chain and the entry of new stock farmers* (**Q4**). This question concerned two subjects: the development of a stock farmer typology based on their organic conversion pathways and the matter of farm nitrogen balances (**S4**). These subjects were treated using research model II, that is, the field model. An agricultural scientist monitored the farms of some fifteen stock farmers for two years. This collection of dynamic data and personal observations then served as a starting point for covering these two questions by making use of systems analysis (parasites) and modelling (environmental impact).

The research was thus designed to allow for two levels of complexity or opposition of different viewpoints. The first one was located in the holocentric quadrant and concerned the future of the organic beef cattle chain and the possibilities of changing the pathway in which differentiation and equity were stakes shared by the players. What emerged once again was not determined ahead of time because we could not know ahead of time the state of knowledge in this area. It was only at the end of the research that we could demonstrate that something new had been produced, reciprocal learning had changed points of view, and new research questions had emerged. The second level concerned the impact of the ongoing transformations on the environment and on the organic agriculture development model. Here we assumed that the researchers had the ability to define the transformations under way on the systems' boundaries because the scopes of the questions were sufficiently limited. Their questions thus concerned new consistencies to propose in dealing with these pathways of transformation.

The intervention research thus also offered the possibility of treating simultaneously and interdependently different levels of complexity. It constructed a holocentric statement of the problems in open systems, that's to say, systems whose incompleteness was a resource for action. In this way, the researchers could no longer set the boundaries of the chain system in advance if they wanted to produce

knowledge that was relevant for action. However, they treated ecocentric and technocentric problems simultaneously and complementarily in systems for which the researchers could (given their academic expertise) draw relevant boundaries for the generation of knowledge for action.

2.3 Translation 3 of the working propositions into research subjects

The levels of opposition of points of view defined various research models in which the researchers would translate their questions into relevant subjects of research.

2.3.1 Holocentric research: collective action around the conditions of the chain's transformation

The problem facing the Chain Working Group was that of the transformation of a form of organisation in the face of an objective that, when seen from the standpoint of sustainable development, was judged to be legitimate by the three groups of players connected by the co-operation convention. While the proposal to change the breed was judged to be relevant even before starting for the players involved, it remained without effect for five years for lack of a procedure to get them to work together on implementing the project. What is more, each of these three groups also had good reason not to opt for this change. These were the risks inherent in redistributing the costs and benefits of the change for the stock farmers and additional constraints on organising the livestock's pick-up and sale for the collection co-operative and distributor. The division of the costs and benefits of this change related back to the construction of reciprocal commitments between groups of players and thus to the transformation of their relations, whereas the issue of managing the new constraints related back to the development of knowledge about ways to produce flexibility in the chain's organisation. These two dimensions referred to the axiomatic theory of intervention research that asserts the inseparability of relations and knowledge (Hatchuel, 2001). Simply put, the transformation of collective action oscillates between two poles, to wit, making knowledge compatible with a change in relations and making relations compatible with modified knowledge.

In their exploratory discussions with the three groups of players, the researchers thus identified three mobilising proposals that, once connected, would make it possible to specify the groups' reciprocal commitments (modified relations). They were as follows:

1. The farmers reformulated the question of the chain's economically sustainable development in light of their concern for fairness. They suggested setting up a system of (market) **access vouchers**, which had already been explored in another quality chain. This system proposed guaranteeing those who chose to change breeds priority access to the organic market. This guarantee did not exist in the context of a mercantile multibreed market rationale. This proposal, which was put forward by the farmers, committed the collection company and distributor. However the quota concept forced the farmers, in an unforeseen twist, to define their identities more, that's to say, to define who would or would not be eligible for access vouchers.
2. This redefinition involved a second criterion of differentiation, that of the role of "breeder-fattener". The organic farmers involved in the chain were long-standing conventional cow-calf operators. Having become "organic breeder-fatteners",

i.e., organic beef farmers involved in the entire stock cycle, from breeding to finishing¹³, they wanted to strengthen their control over a "finished product" right up to the slaughterhouse door. This about-face from the industrial logic of the division of labour and specialisation interested the distributor, because it reassured him by reducing the number of middlemen in the chain, but it also enabled the researchers to take a more integrated, more organic, approach to the knowledge linked to the animals' diets (grazing vs concentrates) and health (Q2). The originality of the collection co-operative lay in proposing to validate this "breeder-fattener" identity by mobilising a technical and administrative system run by the Federal Food Chain Safety Agency to manage the herds' traceability. This system can effectively issue farmers a detailed inventory consultation slip (CID in French) certifying the composition and origin of a herd or flock.¹⁴ This proposal committed the farmers to supply the documents and the distributor to have exclusive relations with the breeder-fatteners.

3. In exchange for the farmers' commitments concerning the CIDs and the collection co-operatives' commitment concerning the access vouchers, the distributor undertook, upon a proposal made by the researchers, to create a triple indication of "breed:..." - "breeder:..." - "fattener:..." on the labels of its organic beef packages and to accompany this change with an information and promotional campaign in conjunction with the other players in the chain. Arguments in favour of this proposal were then produced by the survey that the sociologist conducted. The sociologist effectively hypothesised that potential supermarket organic beef consumers (S2) would make their choices on the basis of other landmarks besides certification. Among these landmarks, the breed was a powerful advance signal of differentiation. The distinction and link made between the indication of "farmer" or "breeder" and "fattener" constituted an organising principle that also committed the distributor to the exclusivity that he granted to those who were "breeders and fatteners".

Access vouchers, dated inventory consultations slips, and labels are sociotechnical objects that incorporate the heterogeneous knowledge of the players in the course of action. The actions of these objects and their interactions and intermediate objects (Vinck, 1992) are what make it possible to build bridges between different points of view. Their implementation constitutes tests that reveal the players' positions and free some of them from their knowledge, thus making them more interdependent. Through the researchers' involvement in the holistic quadrant these objects can be identified and qualified according to the roles that are given to them. In this process of interactions this role can change and some characteristics can be studied from a more discipline-specific angle in order to fuel the interaction process. So, if the connections between these objects propose transforming antagonistic points of view about the relations between farmers and distributor, this transformation will be fuelled by the (ecocentric) field study of the distributors' strategies (S1b).

¹³ In Belgium, according to the conventional model, unlike other countries such as France, the activities of cattle raising and fattening-finishing are not associated. The consequence of this is that the fatteners (who are in addition slaughterhouse managers) and store cattle merchants (exports of the surplus supply) are the ones who must cope with the uncertainty that is linked to mismatches between a seasonal supply and a relatively constant demand. Recombining the activities of calf rearing and fattening-finishing thus requires the stock farmers to take on this uncertainty as well. Managing this uncertainty is all the more complex in that the organic beef and veal market is narrow and confined to the national territory.

¹⁴ These data are credible, available, and accessible in a standard format but exclusively for each herd or flock owner, who may obtain them by simply ringing up the agency.

This triangular co-operation framework revealed a new stake: The setting of a threshold percent conversion to the Limousin breed as of which the distributor undertook to communicate the three pieces of information "breed-breeder-fattener" to consumers led the chain to set a deadline that was supposed to enable the chain to cross this threshold and see the three commitments of the distributor (regarding labelling), the collection company (regarding the hierarchy of access vouchers), and the farmers (concerning the issuance of their CIDs) met. This new stake showed that knowledge of the chain's dynamics, from the herd's composition and performance to sales off the supermarket shelves, was fragmented. The farmer's knowledge was limited to his livestock; it contributed to sustainability but was not shared. The collection co-operative did indeed have an overall view of the twenty farmers' fattening herds, but its knowledge concerned mainly the few months of fattening that preceded their slaughter. The distributor, for his part, was shown to have good knowledge of the volume of the demand and its seasonal trends, as well as the more general dynamics of the organic and conventional beef markets, but his knowledge of the supermarket organic beef consumer was limited to the tonnages of meat and purchasing behaviour in the broader sectors (meat, organic produce, etc.). How then could one plan the production of a living product? This question came up against the difficulty of integrating the different time and space variables of the chain.

The work in the holocentric quadrant was then organised along three interdependent axes. First, to devise all these changes of the scale, the researchers together with the farmers constructed a chain management tool that would enable them to model the margin of the farmers' grouping's progress in changing breeds and to map what was going on. The administrative "data" provided by the CIDs thus changed status. They unexpectedly became a collective resource. Indexed by the farmer according to the breed, combined on the scale of the chain, they would be integrated into the diagram in the form of a plot of 24 month calving forecasts by breed. This was the theoretical curve of the grouping's combined herd's "output". In the same vein, consumer demand was expressed in the form of the second curve representing the numbers of animals slaughtered and sold, *i.e.*, information provided by the distributor. Next, the researchers, farmers' delegates, and collection co-operative's representative explored ways to set up the access vouchers system, trying to generate the vouchers from their chain management model, into which they included the triple indication of breed, breeder, and fattener. At the same time, the distributor and researchers organised the traceability of the breed and breeder-fattener status from the slaughterhouse's door to the consumer's plate, with the supermarket shelves in between.

2.3.2 Ecocentric research subjects

In this research model, the way the problem is stated is what defines how the researcher will take account of the borders of his field of observation. The researcher's work is one of translation, one that tries to identify the relevant interactions amongst the various elements that make up systems and define the boundaries of a problematisation area. This translation work involves the work of alliance building and shifting around the problem as it is defined in order to make the problem observable.

To handle their concerns about the organic agriculture development model (C2), the agricultural scientists focused on one of the three inconsistencies ascertained between the standards (organic specifications) and practices of the organic

farmers, mainly, parasite management. This was problematic given not only the ban on the preventive use of allopathic medicines but also the grazing obligation, which means that organic stock is more in contact with sources of parasitic infestations. Although this has an impact on the herd's health, and especially on the animals' weight gains, parasite management nevertheless creates few problems for the farmers, because the boundary between preventive and curative treatment remains blurry and the economic cost of allopathic treatments is insignificant. Yet this question does indeed refer to health management models. So, a cow that coughs (lung worms) may appear to be either ill or in good health.

For the researchers, stating the problem of parasite management amounted to identifying new interactions and trying to characterise them by "profit-sharing", that is, getting the parties interested in their outcomes (Callon, 1986).

1. Starting with the farmers' interest in on-the-farm weighings, which traditionally enable one to measure the bulls' performances in the fattening phase, the agricultural scientists convinced the farmers to use the scales and weighing not just as an indicator of the bull's efficiency as a meat-producing machine, but also as an indicator of the animal's state of health. To this end, weighing was coupled with taking blood and faecal samples for laboratory testing so as to measure infestation rates.
2. In exchange for the "farm weighing service" that the agricultural research station offered, the farmers agreed to have heifers intended for reproduction weighed in the pasture. In going from the fattening pen scale to that of the herd (of cows) in the pasture, this shift changed the "step" of the temporal "screw" and the entities that were observed: the animal's reproductive career (5-6 calves), the switch from the stable to the pasture, and the switch from feed lot health to herd health.
3. Finally, the animals' weights and laboratory tests were coupled with the agricultural scientists' observations of the different pasture management models and six-month collective monitoring to which all of the organic farmers were invited in the company of a homeopathic veterinary surgeon whose contribution consisted in changing the relationships in the farmer-veterinarian-parasite triad.

Starting with conventional monitoring of on-the-farm weighing, the agricultural scientists thus constructed an observation area characterised by having modified the relations between humans (farmer/extension worker/veterinary surgeon) and nonhumans (parasites/cattle/pastures) to get access to the information that would enable them to characterise their interactions. This was the area in which a series of data would be collected simultaneously to cover the issue of environmental impact (Q4), namely, the development of a typology based on observations crossed with National Statistics Institute data and the collection of farm nitrogen balance data (S4).

3 Outcomes

The area of collective action should be considered an area of the simultaneous reconstruction of both the players' and researchers' knowledge as well as of player-researcher relations. This area is located along the pathway of transitions that strove

to explore a particular orientation toward forms of organisation of products and skills that were not there and would open onto more sustainability. Its results must be assessed from two complementary angles, namely, the research partners' point of view and the point of view of science.

3.1 Outcomes in terms of forks in the road

From the partners' point of view, the question was how the intervention research enabled the players to revise their categories and rules for acting. How did their points of view adjust to a different perception of reality? It was not a matter of knowing whether the partners satisfied or dissatisfied with the answers given to their initial questions, but to analyse how the interactions modified their points of view (Hubert, 2000). Each time these changes in points of view took a new dimension of sustainability on board, they were flagged by possible bifurcations in their pathways. We identified four such forks in the road in terms of the outcomes for the research partners.

The access voucher project made it possible to explore three statuses for the organic stock farmers belonging to the chain, statuses that ranked the guarantee of market access according to three types of quota corresponding to the three indications created by the distributor. This clear signal from the chain to the farmers prompted a scurry to convert to the organic Limousin breed. As a result, the supermarket's retailing objectives were met by the deadline that it had set and the chain achieved 100% conversion to the Limousin breed one year later. This transformation of the market access rules legitimised a scheme in which the distributor and collection co-operative were accountable to the farmers. In return, the farmers acquired the competency to address the distributor, whose monolithic façade masked a set of interlocutors with different responsibilities and powers, *i.e.*, retail management, project management, and strategic management, meaning decision-making powers covering different time scales ranging from a week to 5-10 years. So, the acquisition of this competency by certain farmers – a competency that was ordinarily controlled more by mass distribution as an institution – created a first "point of bifurcation" in the path towards more sustainable systems ("Bifurcation 1" or **Bi1**), because it made it possible to connect actions to specific time frames.

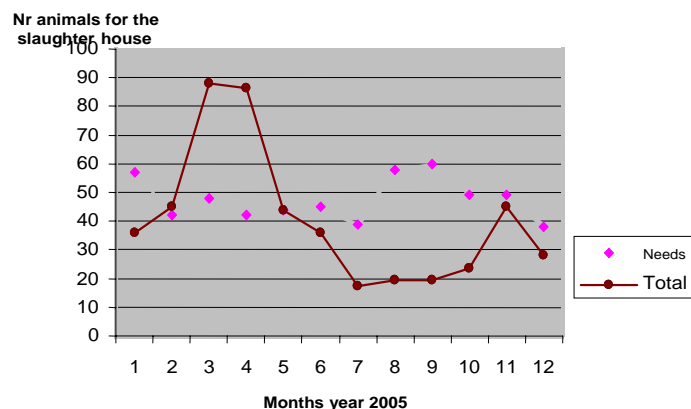
To guarantee the credibility of the exclusivity granted by the distributor, the collection company demanded that entrance and exit inspections be conducted at the slaughterhouse. Ruling out the principal of an audit conducted by an outside expert, the researchers propose to design an inspection procedure with the players of the chain. With the principles of reciprocity and simultaneously, this entailed connecting up the fragmented knowledge all along the production chain by organising the pooling of knowledge. This was done by the researchers. The obligation to report on this to the collective that the chain formed, especially for the players who had positions of strengths (distributor and slaughterhouse), induced a transformation in the players' relations with each other. This then made it possible to include a series of uncertainties that only the players' experience and knowledge could identify and which, in the absence of a procedure, were generally utilised by the various parties according to their strategic interests.

This procedure's operationalisation revealed two of the conditions governing a limited form of co-operation amongst the chain's players, namely, the recognition of their interdependence and the slaughterhouse's uncircumventable role. The

slaughterhouse could effectively play an integrating role by releasing information from its database. It thus became, in an unforeseeable way, a new *de facto* partner in the co-operation. Recognition of the parties' interdependence and the slaughterhouse's inclusion created the conditions for the emergence of a second bifurcation in the chain's development, to wit, one of the key performance criteria of the conventional industrial reference frame was challenged in turn. This was the SEUROP standard for ranking carcass grades, which was challenged and redefined (**Bi2**). This deconstruction then triggered questions about the production practices that it tied together and held firmly in its hierarchy, especially the choice of breed and grazing.

Perfecting the forecasting model, making it possible to produce dynamic forecasts of the chain's organic Limousin herd several years in advance, turned the chain into a representable entity. This action involved supplying confidential data about the farmers' specific identities. Diagramming the supply and demand trends based on a 24 month calving projection (time of delivery to the slaughterhouse) revealed large gaps between supply and demand. This created a shock that prompted the farmers to band together: the chain dynamics became a sociotechnical object of learning (Mougenot and Stassart, 2006). The loss that each individual might have felt in divesting her/his data of their confidentiality was offset by the promise of collective action that would transform their collective status. The shift was made from the concept of a collection network with unstable boundaries managed by the cattle merchants' registry to that of the grouping of breeder-fatteners that opened the debate about its boundaries and entrance and exit procedures, the debate in which the stock farmers had until then been without a voice. Moreover, the model's legitimacy and accuracy had to be re-examined in light of the farmers' strategies.

Table: 24 month post-calving projections – 2005 forecasts



So, the accuracy of the official registration of calves' birth dates could be moved forward or back two months with respect to actual calving dates. And finally, through the gap that it revealed between reality (a regular flow) and its representation (periods in which supply and demand theoretically did not match), the diagramming refined the questions of how the chain produced flexibility and how it was compatible with the planned transformations. Subjecting the forecasting model, including its development, to discussion thus created the third fork (**Bi3**) in the path towards a more sustainable chain, namely, a representation of the collective of

heterogeneous players that integrated, transformed, and redistributed fragmented knowledge (Mougenot and Stassart, 2006).

Taking the problem of the gap between supply and demand that was now raised at the chain's scale as their starting point, the Chain Working Group identified along with the researchers the strategies that would allow the production of flexibility. A minority of the stock farmers worked on a medium-term shift in calving in order to spread the calving peak over the spring. This raised the question of a new efficacy criterion, that is, the "deseasonalisation" that could refine the ranking of priorities that the access voucher plan implemented. However, the strategy that the majority of the grouping's farmers applied in order to "plug the gap" was rather that of stepped-up fattening, which was termed "fast" or "intensive" fattening. This consisted in shortening the fattening phase, which was reduced from the 24 months set in the model and the distributor's specifications to an average of 20-22 months (Delfosse, 2005), and keeping stock that was "in condition", that is, "finished" and ready for shipment to the slaughterhouse, on the farm longer. Unlike slow fattening, fast or intensive fattening relies on early and intensive use of feed concentrates and stabling in the second year of life (like conventional "feeding-finishing"). These two points are inconsistent with the grazing obligation and limitations on the use of concentrates stipulated in the organic specifications. They show how two points of view, one organic, the other that of the fattening scheme that produces flexibility in the organic chain, become incompatible because they belong to two different world views. Submitting their categories and rules to debate was the fourth fork in the chain's pathway (**Bi4**).

3.2 Outcomes for the scientists

We shall present below briefly the outcomes that are described in greater detail in the following chapters.

The conditions governing the transformation of the players' expertise and powers (**Bi1**) were the subject of lengthy debate between the economists and sociologists as to which theoretical framework could provide a more general interpretation of this problem. The points of view that were expressed belonged to the holocentric quadrant for the sociologist and ecocentric quadrant for the economists. This led us to present them separately, given that the latter nourished the former.

On the holocentric level, their participation in the process of transforming the players' relations generated a series of data during the experiment that was composed of the different stages in the chain project that the sociologist proposed to interpret from the socio-economic standpoint in terms of convention economics (**Chapter 3.2**, "Missing protocols and legitimacy systems"). The stalemates that developed in the transformation of the qualification convention were analysed from a second angle. The notion of reference frame proposed a sectoral interpretation that the collective action enabled the scientists to validate afterwards. This interpretation showed in particular that these stalemates affected short and long circuits indifferently, thereby challenging the relevancy of using these categories in thinking about the chain's transformation (**Chapter 1.1**, "Equipping sustainable production chains").

The economists, for their part, drew upon their observations of the major Belgian supermarket chains' strategies in dealing with the emerging organic market to validate the hypothesis of the qualification convention from an ecocentric perspective. They effectively described how the Belgian distributor within this mass distribution group who was involved in the collective action of differentiation redefined his relations with the organic beef farmers in a way that dovetailed with his broader brand reputation strategy (**Chapter 3.1**, "Comparison of marketing strategies of retailers of organic beef").

While the choice of including the supermarket's entry into the organic market in the intervention research was fully justified, it nevertheless carried a major cost in terms of the research's design, for mass distribution's presence delegitimised the researchers' plan to treat the question of consumers in interaction with the other players in the chain. In covering the question separately at first, the sociologist introduced the notion of type or figure of consumer to identify competing representations of consumers in the chain and contradictions with the differentiation project. This broader statement of the problem then created an area in which it became possible to construct a new figure, that of the negotiating consumer, and to explore the consequences of this on the chain's transformation (**Chapter 3.3**, "Figure of the consumer and construction of a sustainable chain").

For the consumers, the notion of breed was subtended by criticism of the "forced animal husbandry" category. By this they meant the artificialising practices that had consequences for the animals (welfare), product (taste), and stock farmers alike. This category in turn raised questions about the fattening concept, a challenge that for the stock farmers was subtended by the notion of fast or "intensive" fattening (feeding-finishing). So it was that the notion of animal production was gradually deconstructed in light of questions pertaining to consumption (**Q2'**), differentiation (**Q1'**), and the organic development model (**Q3'**). However, the fact that this issue became legitimate and more elaborate did not mean that it could be handled risk free. It effectively challenged the privileged instrument of flexibility within the organic chain. If we wanted to cover it, we then had to create the conditions for "suspending" the sociotechnical interactions within the chain. That is why, using the laboratory model, the animal husbandry specialists set up a technocentric trial at a research station to study two parameters of intensified fattening, namely, meal sequences and the percentage of concentrates in the diet (**Chapter 3.4**, "Conversion to organic farming").

Finally, two questions were treated exclusively from the ecocentric standpoint because they carried no stakes for the field players, although they were clearly expressed concerns of the research bodies. The question of the environmental impact of the organic beef chain's industrial organisation and the advent of new organic beef farmers was ultimately seen to have few negative effects on the farm's various balances (**Chapter 3.6**, "Link between market access and environmental pressure of organic beef production systems"). As for the parasites issue, the observations and fine measurements made by the agricultural scientists led to a remodelling of the complex relationships amongst parasites, herd, and type of grazing that culminated in a revamping of the parasite management system.

3.3 Outcomes in the form of impacts

When it comes to the research's impact (**Part IV: Impact**), we can mention the chain's reorganisation around new rules worked out through negotiation by the chain's partners, the drafting of a working programme for the sector (organic beef chain's development plan within the Bio Forum), the emergence of a local development project inspired by the chain development scenarios, and the importance of covering the issues of animal welfare, which led us to explore various ways of having farmers, consumers, and scientists discuss this issue in another framework (*Fondation Roi Bauduin* (King Baldwin Foundation) project).

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PART III

RESULTS

3.1. Comparison of marketing strategies of retailers of organic beef

Joris Aertsens, Guido Van Huylenbroeck

1 Introduction and structure of the chapter

In Belgium there are a handful of retailers that are offering a selection of organic products in their supermarkets. Three of these retailers offer a relative broad selection and can thus be considered to be important for the sector. There can be observed a large difference in their attitude and strategy towards organic produce. As these strategies may impact on the relations with producers, we compare in this chapter the strategies of these retailers in marketing organic products in general and organic beef in particular. Both the marketing mix and the organisation of the supply chain are considered. Important differences are noticed and explained.

In order to be able to compare and understand the important differences between the three retailers, we start with the analysis of the general retailers strategy by comparing their marketing mix in section 2. Differences in strategies concerning product quality, price setting, efforts for promotion and placement in the shop of the organic products are presented and discussed. Next, in section 3 we look at the strategies of the retailers when marketing organic products in general; while in section 4 the way the supply of organic beef is organised by the retailers is analysed. Hereby the following questions are addressed: (1) how important is the impact of the retailer in the organisation of the supply chain; (2) how important is the effort and how large are the costs spent by the retailer in organising the chain. The answers to the above questions indicate the importance that retailers attach to "organic beef" as a strategic product. In section 5 we discuss the findings and conclude.

2 Main characteristics and strategy of the retailers

In this chapter we refer to the three main retailers of organic food as D1, D2, and D3. We remark that the third retailer group has also three supermarkets where only organic products are sold: we refer to these as D3-bio.

2.1 General characteristics of the retailers

Table 1 presents the main characteristics of the retailer groups. In general these characteristics are similar. The total number of super- and hypermarkets they operate in Belgium varies between 125 and 170. One noteworthy difference is that group D2 has also an important number of hypermarkets (>2500 m²), where D1 and D3 only have supermarkets (< 2500 m²). Another distinction for group D2 is the more important section of non-food articles it has, where these products are offered only to a limited extent by D1 and D3.

Table 1: General characteristics of the retailers - F1+F2 (*), overview

<u>GENERAL CHARACTERISTICS</u>	D1	D2	D3	D3-bio
hyper (F1) and/or super (F2)	F2	F1+F2	F2	F2
specialisation	Food	Food+Non Food	Food	Food
# points of sales (F1+F2) 2004, in B	125	56+78	170	3
average surface (m2)	1400	4000 + 1700	1400	700
turnover 2003 (billion EUR)	3,7	4,6	3,6	
% of total sales volume F1+F2	20%	31%	20%	

sources: interviews, press, yearly reports of the firm. (*) F1: >2500 m2; F2: 650-2500 m2;

In Table 2, we summarise some characteristics of how the different groups position themselves in the market. This is of course a generalisation of more diversified strategies.

The strategy of D1 can be described as providing a large selection of high quality food products in a very pleasant shopping environment. Special attention is given to offering a selection of several "emerging" markets. "Organic products" are one of them, "fair trade" and "convenience food" are others. D1 tries to be market leader in this niche market by being the first in offering such products. The prices of D1s products are however on average 20% higher than the ones offered by its main competitors.

The strategy of Group D2 is to offer food and non food in both super- and hypermarkets, providing a large selection of food products at a relatively low price (in comparison with D1). The shopping environment can be called pleasant. The number of servants available for assisting clients however is smaller when compared to D1 (especially expressed per m²). Although D2 is claiming to offer the lowest price for some products, on average the prices are intermediate between D1 and D3 (+9% with respect to D3).

Group D3, has a strategy of offering products of good quality and this always at the lowest price in the region. The accommodation in D3 points of sales can be called "efficient and basic".

Table 2: Strategy of the retailers F1+F2 (*), overview

<u>MARKETING MIX</u>	D1	D2	D3	D3-bio
food prices (strategy)	high: 119 (=>+19%)	lower: 109 (=>+9%)	lowest: 100	low
assortment of food	very large	large	large	large
quality (**)	+++	++	+++	+++
shopping atmosphere (**)	very pleasant	very pleasant	basic / ok	pleasant
service, # servants in shop	++	+	++	++

sources: own observations

3 Retailers characteristics supplying organic products

In this section we compare the supply of organic products by the three retailer groups. This is summarised in Table 3 below.

Richter and Hempfling (2002) have been studying strategies of different retailers concerning the marketing of organic products in some European countries. From this study they identified three different strategies: First a "maximum strategy" involving (1) a range of more than 400 organic products, (2) making their commitment to organic products a significant part of their advertising and promotional campaigns, (3) the quality of the assortment is as important as the quantity, (4) a pleasant/relaxed atmosphere attracting a bigger consumer group with an interest in organic/premium products; second a "basic strategy" involving (1) a range of 50 to 250 organic products, (2) low levels of staff involvement; third a "minimum strategy" involving a range of no more than 50 primarily dry organic products.

Richter and Hempfling (2002) list following factors that determine a successful marketing of organic products:

- (a) a clear definition and control of the vision, strategy and objectives concerning the marketing of organic products;
- (b) active networking within the organic sector;
- (c) an independent team that develops the organic assortment;
- (d) staff education concerning organic products;
- (e) market research concerning organic products;
- (f) a broad assortment of organic products;
- (g) good quality of these products;
- (h) an outstanding role of the organic assortment within the companies communication;
- (i) a clear pointing out of organic products at the point of sales;
- (j) moderate price premiums.

D1 was the first to offer organic products. It started already in 1985 with offering organic bread and some other basic products. Today, we can observe that Group D1 is offering a very large selection of organic products in comparison with D2 and D3. D1 is placing the organic products on visible places, attracting even more attention towards them by using signalling flags in a systematic way. Also in their weekly "flash"-magazine the offer of organic products is promoted. An "organic products" week has been organised. Due to this combination of instruments D1 has succeeded to increase its share in the total sales of organic products in super- and hypermarkets in Belgium to 50%, while the share of overall sales for D1 in the total sales by super- and hypermarkets is much lower (20 %). D1 has realised this relatively very high market share, even while the average price of organic products at D1s is respectively 17 and 6% higher than D3 and D2. We have seen above that D1s prices for conventional products are on average 19 and 9% higher than for D3 and D2 respectively. So one could say that D1 is also trying to promote organic products by taking a comparative lower margin.

The strategy of group D2 can be summarised as "offering a basic selection of organic products, in order not to loose clients who really want to buy some of these". However little effort is done to stimulate the sales of organic products. Organic products are not placed on more visible spots. Sometimes flags indicate the

placement of organic products but as D2 is using about 5 different types of flags for different types of products, we can not speak of a real promotion preference for organic products. Certainly not, because in practice organic products are not signalled systematically. Promotional effort for organic products is very limited.

Group D3 is offering an important amount and variety of different organic products. For group D3 organic is seen as part of its "green line" products. The "green line" products of D3 emphasize its willingness to promote an environmentally friendly production and distribution. Starting from the basic concept that no "superfluous" costs may be done, the green line policy can be translated as "investments in environmental friendliness take place if they pay back". Group D3 however is creative in finding such solutions (logistics of transport limiting miles per product, recycling, use of wind energy, and so on). The organic products are given well visible places. Like other green-line products they are recognisable by a green price sticker on the shelves. Most products have white stickers. Red price stickers are attributed for the cheapest products. An effort is made for promoting the organic products. Where D3 has a history of offering on one hand basic products and on the other higher quality products, in the last ten years a lot of the higher quality products were replaced by an organic quality product.

It is important to note that D3 is not offering organic fresh meat, in contrast to D1 and D2. This is explained by different factors: First, D3 has a very well organised high quality conventional butchery in all of its points of sales. These butcheries are strategically used as an asset to attract clients. According to the "organic reference" it is necessary to strictly separate between conventional and organic. Therefore offering organic meat in this butchery is not allowed. Secondly, offering pre-packed organic meat would not fit well in this concept. When one argues that the conventional meat supplied is already of very high quality it may have an antagonistic effect to offer a more expensive organic meat. "Why would one pay more if the quality of the conventional is already very high?" Third, D3 has established also three supermarkets selling only organic products. In these exclusive organic supermarkets, organic fresh meat is offered. D3 argues that it would not make sense to open "only organic" supermarkets if all the organic products can also be found in the normal supermarkets. They refer to this as avoiding "cannibalism".

Table 3: Strategy of the retailers, when supplying organic products in general

	D1	D2	D3	D3-bio
assortment, or # org. products	650	350	200	3500-7500
org. fresh meat, cheese	available	available	not available	available
org. vegetables, fruit,	available	available	available	available
org. dairy, bread, juice, coffee, wine, dried products	available	available	available	available
retailers own org. mark and label	yes	yes	yes	yes
omzet (mio EUR)	78,6 (2,1%)			
placement of org. Products (**)	good not best	moderate	good	only organic
flags / signaling (**)	very visible flags	less visible	visible	only organic
prices of organic products (**)	117 (=>+17%)	110 (=>+10%)	100	112 (=>+12%)
% of total sales organic by supermarket	50%			
year of introduction of org. products	1985		1991	2001: open

sources: interviews; press: De Standaard (24/03/2004); internet; (**) = own/personal observations

4 Organising the supply chain of organic beef

In table 4 below, different aspects of the supply of organic meat for the different retailer groups are presented.

Table 4: Characteristics of retailers when supplying organic beef

	D1	D2	D3	D3-bio
sales volume (kg per week), 2004	5800	1300	0	245
% of total sales in F1 +F2, 2004	72%	16%		3%
start of supply of organic beef	1997	1997		2001
role in chain organisation	important role	outsourced to transformator		low
effort in chain organisation	high	low		low
agreement on future producer price	fixed	market dependent		
price paid to producers	very high (120 = +20%)	moderate (100)		
consumer prices	105 => (+5%)	100		
risk in case of low demand	for producers	for producers		
country of origin	Belgium	Belgium		

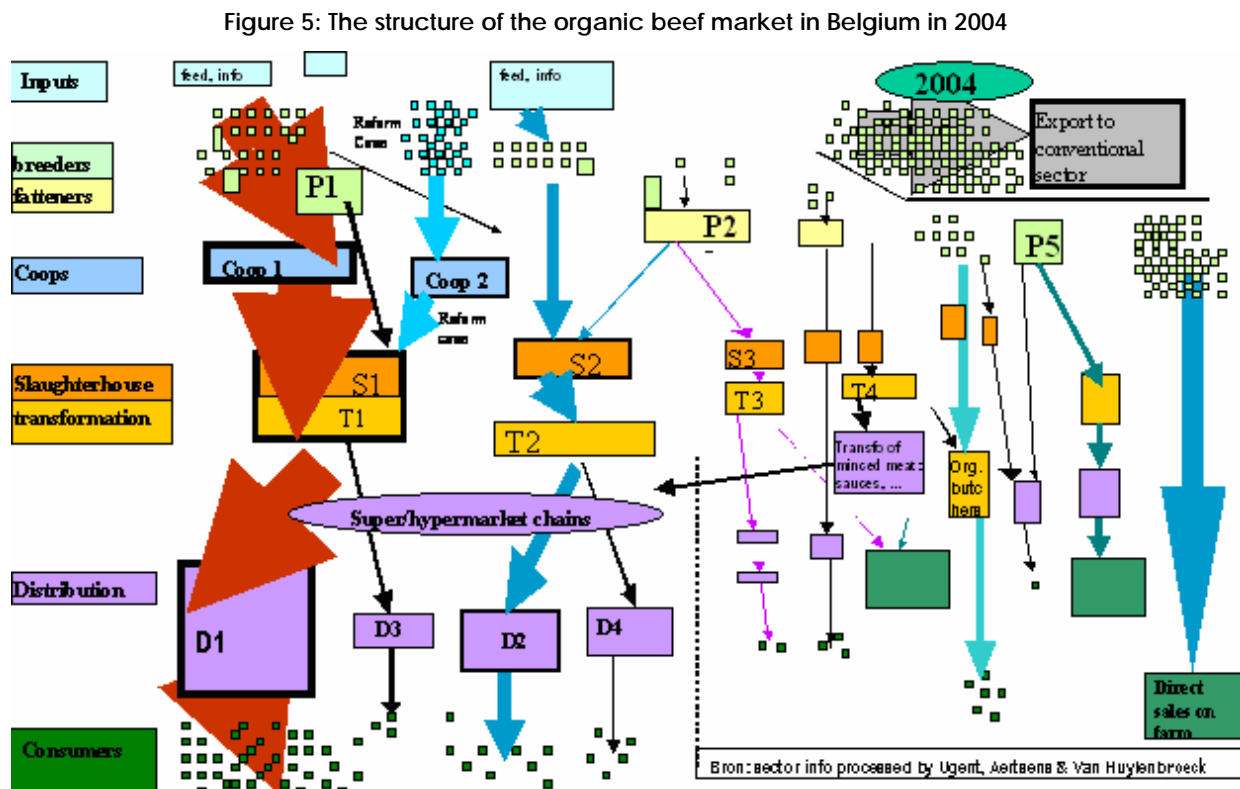
source: own research; interviews;

Group D1 is by far the most important supplier of organic beef with its 72% of the total volume of organic fresh meat provided by the supermarkets and hypermarkets in Belgium. This percentage is even higher than the 50% of the overall organic products mentioned before. The reason however is similar. D1 is doing an important effort not only in promoting organic beef, but also in organising the supply chain. In 1997 it has started to cooperate with a farmers' cooperative for the provision of high quality organic beef, with standards that go beyond the organic reference. The farms may only fatten animals that are born on the farm, this to secure the chain. Animals introduced from unfamiliar farms otherwise incorporate a risk. In the near future, only animals from two specific breeds will be allowed. In order to motivate the farmers to do the effort and to take an important quasi-irreversible step (change of breed), a price premium is offered to the farmers (for more details about the cooperation in this chain we refer to the next chapter), while at the other end the price asked from consumers is relatively low. The consumer price for organic meat is indeed only 5% higher than the consumer price asked by D2, while, as discussed before the price difference for organic products in general is about 6% higher than D2 and the price for conventional products is about 9% higher than D2.

D2 is investing little effort and less money in organising the supply. In practice it has outsourced the organisation of the supply to a processor who is also collecting the animals from the organic farmers, with whom a contractual arrangement has been made. The price paid to the producers of D2 is about 20% lower than the price that is received by the producers of D1.

As said before D3 does not supply fresh organic meat in its normal supermarkets, however it does so in its three exclusive organic supermarkets. Therefore the total offered volume remains small. The supply chain used is the same as the one that supplies D1s organic beef.

In Figure 5 below, the quantities of organic beef meat commercialised by the different sales channels in Belgium in 2004 are represented. The thickness of the arrows are representative for the volumes.



5 Discussion

Market-chains that are most important in providing organic products in Belgium have a very different strategy concerning the marketing of organic products in general and organic beef in specific. But still these strategies make sense in the overall strategy of the retailers. In this conclusion we summarise the differences in strategies and explain them.

Our study reveals an important difference in the strategic importance attributed by retailers D1 and D2 with respect to the commercialisation of organic beef. This results in important differences in effort and time spent in the organisation of the supply chain as well as in the implementation of the marketing mix (product quality, placement, promotion, price). This results in large differences in volumes of organic beef that are sold by these chains.

Using the terminology of Richter and Hempfling (2002) D1 can be indicated as the "leading retailer" while D2 and D3 are "Adapting" retailers" concerning the marketing of organic products.

5.1 Strategy and organisation of the leading distributor - D1

Elements from the study of Richter and Hempfling (2002) by which we may recognise D1 as the "Leader" are the following:

- (i) D1 has the regional market leadership in selling organic products and
- (ii) D1 promotes the organic product line in the company communication;
- (iii) D1 has also been the pioneer in marketing organic products in the region;
- (iv) D1 is also engaged and creative in developing the organic assortment.

Retailer D1 attaches high importance to the commercialisation of high quality products. According to Sans (20003), this strategy could be called a differentiation strategy. In a personal interview, a representative of D1 confirms that this is indeed the case. The nice shopping environment and the large selection of high quality and differentiated products is attracting consumers willing to pay more for a better quality.

In line with this, for retailer D1 organic products are seen as a strategic market. Organic food is one of the important differentiated high quality food products. Therefore investments are done to promote these products and time is spent to organise the supply. This also explains why D1 searches exclusive relations with the producers.

The retailer in this chain attributes a huge importance to the commercialisation of organic beef, which is considered a strategic product. The way its supply is organised (a) enforces the retailers image as a distributor of high quality products and (b) attracts new clients. This was especially relevant in the past four years, when consumers were looking for "safer" beef after the dioxin and BSE scares in the meat sector in respectively 1999 and 2000/2001. As the consumer confidence in conventional meat has been restored, promoting organic as safe food is less relevant, however positioning it as a high quality differentiated product remains very relevant for the distributor.

Therefore a lot of effort, time and money has been invested in developing an own supply chain of high quality organic beef. Already in 1997, before the increase in demand for organic beef, the retailer made an agreement with a cooperative of producers of organic beef. By paying a good price to the producers of the cooperative and cooperating for about 10 years an important degree of trust is created with the producers of the cooperative. This is an important aspect for the farmers when taking otherwise too risky decisions in the process of developing high quality organic beef and in applying higher quality standards than prescribed by the (inter)national reference on organic production. For example the trust built up helped the farmers of the cooperative to change to a breed with more potential in the organic market, but making a return to conventional farming very expensive and thus in practice sometimes impossible. From the theory of institutional economic we know that such idiosyncratic investments will only taken place under strong contractual relations (Williamson, 2000)

The strategy of the retailer also makes a lot of sense in the frame of Mickwitz (1959). According to Mickwitz during the introduction phase of the Product Life Cycle, the most important element is to provide a high quality. This is exactly what the retailer has been doing. This retailer was the first among Belgian retailers to market organic

beef. In the past 10 years the retailer put most importance on providing a high quality by specifying process and product criteria to its suppliers (homogenous breed, age, ...). The extra price given to producers is not totally charged to the consumers. From own calculations of prices and costs throughout the chain we can derive that retailer D1 is taking a rather low margin (and in certain periods even accepts losses). Its price strategy can thus be defined as a market penetration strategy (and certainly not a skimming strategy). In the second or growth phase also promotion becomes important. The retailer followed this logic. As the growth of organic beef consumption was stagnating (after 2001), the retailer started to invest more in promoting organic beef, inter alia by communicating the story of the organic beef supply chain in the monthly edition info brochure which is spread among the regular clients. The investments of this retailer in marketing organic beef certainly pay off in terms of market share. D1 has a market share of 72% of the total sales volume of organic beef sold by hypermarkets (F1) and supermarkets (F2). Although D1's investments in developing the supply of organic beef may not be entirely covered by the consumer price of organic beef in the short run, they probably will be covered in the long run. Mickwitz argumentation concerning shifts in the use of the marketing mix throughout the different phases of the Product Life Cycle, with relatively more investments in the early (introduction, growth, maturity) phases and more gains in the later phases (saturation, decline) supports this. When one considers positive side effects on other (organic products) the investments may also pay back in the short run. In other words seen the large selection of about 650 organic products in D1's points of sales, investing in the overall quality of the supply of organic beef will radiate to other organic products and beyond. Because D1 has such a large selection of products, it is enforced to do extra efforts in securing each organic product, as a problem with one of them may negatively affect all the other (organic) products.

As D1 attaches relatively high importance to the commercialisation of new differentiated products it can be expected that the share of "innovators" and early adopters" as defined by Rogers (1983) would be comparatively larger among D1's clients than under D2s. It may be interesting for further research to investigate this.

5.2 Strategy and organisation of the adapting distributor – D2

According to Richter and Hempfling (2002), "Adapting retailers" orientate their offer of organic products towards current trends in demand or just as a reaction to the strategy of main competitors. In fact they sell organic products, but without strong active engagement or effort. The organic assortment is no important part of the communication and organic products often are not clearly indicated at the point of sales. They are more passive with respect to the development of the organic market and adapt their marketing strategy to the market environment. These characteristics do hold for retailer D2. For retailer D2 organic products have no special significance. They are just a product category in the very wide range of products they offer. Organic products are offered in order not to lose consumers who really want to buy it, but no special efforts are taken to promote them.

D2 in general provides a broad range of products at low competitive prices and is trying to compete the real discounters. This second retailer therefore is also applying a different strategy when supplying organic beef, investing much less time in developing the supply itself. In practice, this second retailer is outsourcing the

organisation of the supply of organic beef to a large cattle dealer and processor who works together with a feed supplier. The strategy of D2 seems to be "provide organic beef in order not to lose clients, who would go elsewhere if no organic beef is provided". The second retailer is therefore not interested in strong promotion of organic beef. For the organic products this second retailer has on average prices that are 6% lower than the first retailer. For organic beef prices are 5% lower. As the prices that this second retailer is paying to the producers are 20% lower than what the first retailer is paying the margin is higher for this second retailer (about 10%). Due to the fact that less effort is paid in attracting producers and of course also due to the more moderate prices paid, this distributor is providing much less organic beef. This is okay for the distributor, as the targeted segment of consumers from the overall population is different. One may say that the second retailer is aiming at a "broader public than the first" and less targeting at consumers that are willing to pay more for high quality, therefore making much less efforts in promoting these products or placing them on the more visible places. The market share of the second retailer is only 17% of the organic beef sold in F1+F2. According to the theory of Rogers (1983) one would guess that D2's clients constitute a relatively larger share of "late majority" and "laggards" when it concerns the adoption of new innovative products.

5.3 Strategy and organisation of distributor D3

Though retailer D3 is quite important in the commercialisation of organic products in general, with a selection of 350 different organic products, D3 does not provide organic beef in its conventional supermarkets. The reason is to avoid cannibalism with respect to its conventional butcheries and exclusive organic supermarkets. D3 argues that as it has butcheries in the supermarkets that provide high quality conventional meat and besides 3 points of sales where only organic products are provided and thus also organic meat. Supply of organic meat in the conventional supermarkets would have an antagonistic effect. As the total volume of organic meat sold in the 3 organic supermarkets is rather small with a market share of only ... percent, the effort in organising the supply for organic meat is relatively small.

6 Conclusion

The analysis presented in this chapter shows that the way large retailers engage in organic markets and organise their supply chain is related to their overall marketing strategy. The importance of the organic produce in this strategy explains the importance attached to product criteria and extra quality criteria by the retailers. This impacts on the contractual relations the retailers want to build and may explain a lot of the tensions in the supply chain.

7 Literature

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3.2. Missing PROTOCOLS & LEGITIMACY Systems

Qualification and effort conventions in the transformation of relations between distributors and breeders

P. Stassart and D. Jamar

The systemic approach put forward explores the cohesion of the existing production chains and examines the options within them for constructing co-ordination systems developing capacities for taking account of sustainable development. Starting from the theoretical framework of the economics of conventions, we show how the quality convention acts on two separate levels, which it connects through a chain qualification convention and effort conventions from professional organisations. An effort convention can clarify a qualification convention by transforming its rules defining what good work is, and in return can open up the transformation process imposed by qualification. Transformations of the quality convention make it possible to observe the role that procedures and legitimacy play in allowing for equity and the environmental dimension.

As regards the sustainability of animal production, the complexification of production chains and multiplication of intermediaries and professions, together with vertical integration and co-ordination phenomena, render production-based approaches to these matters highly ineffectual. Faced with this complexity, Hinrich and Welsh (2003) put forward a systematic approach that can explore the cohesion of existing chains and, within these chains, can examine the options for constructing alternative co-ordination systems. This makes it possible to develop a more comprehensive approach to these systems while still recognising the weight of historical contingencies (Vissac, 2002).

Developing such a comprehensive approach to agrifood systems and identifying the conditions for their transformation means taking the role of mass distribution and the increasing differentiation of markets into account. Mass distribution is acknowledged, to the detriment of agro-industry, as having a key role in reconfiguring agrifood processing chains. While many believe that their oligopolistic and supranational position gives them the capacity to rival agro-industry's brands, we may now be witnessing the emergence of a new phase in development, which sees these big chains playing a more and more active role, in satisfying and redefining consumer demand, on the one hand, and, in its translation with respect to the production chains, on the other hand. The question then arises of the redistribution of the profits that are generated by such dynamics. The introductory chapter (Part I, 1.1 "Equipping sustainable production **chains**") emphasises how far this question, as applied to the field of organic production, divides authors; the debate in English-speaking countries on the "Conventionalisation of organic agriculture" bears witness to this.

The beef production chain, which has been particularly shaken up all over Europe by the various food crises, is seeing the emergence, in the initial phase at least, of tripartite contracts in which distributors co-operate with associations of producers to counterbalance the power of the slaughtering industry. In contrast to the traditional power relationship, in which the distributors impose their standards because they can

threaten unilateral action to terminate contracts, these new arrangements are aimed rather at making adjustments reached through dialogue with the producers' associations and defusing situations before they create tensions. The result of this, according to Mazé (2002), is a mutual learning process involving the distributors and the breeders' associations that hinges on the adaptation and codification of quality. So behind these reconfigurations, the question arises of the nature of chain qualification processes and the redefinition of competences that this implies.

We can then analyse the emergence of a new form of production chain organisation, starting from the connection between the two types of qualification convention, *i.e.*, the chain qualification convention, which defines the division of competences between those active within a chain, and the effort convention, which specifies the commitments within the various professional groupings (breeders, butchers, distributors, etc.). The commitments express loyalty to a grouping. The professional qualification conventions lay down the professional person's responsibility in relation to the professional groupings of which (s)he is a member, and in relation to the users/clients, within the chain qualification convention. So effort conventions have specific positions in a certain context with regard to the haggling and negotiations that accompany a contract and to the obstacles encountered by entrepreneurship and co-operation

The conventionalist approach that we are adopting is "functionalist" in the sense that our argument is based on a case study which *a posteriori* has led us to establish a theoretical framework, that of the Economics of Conventions (Eymard Duvernay, 1989; Orleans, 1989). This framework allows us to go beyond the static or sequential vision developed by the neo-classical information economics approaches (Akerlof, Stiglitz) or contract approaches. Its explanatory power resides in its capacity to grasp the dynamic dimension of the processes that guide the transformation of a chain, as observed in the course of intervention-research (see Part II , Methodology).

The conventionalist approach also allows us to highlight the fact that there are many orders of justification (Boltanski, Thévenot, 1989) (we shall refer to them in the third section of our argument). This, in conclusion, will allow us to apply this approach to the field of sustainable development in order to examine how the question of the "missing protocols and legitimacy systems" relates to that of sustainable development (Godard, 2004)

Our argument has four key points

- A convention is a co-ordination structure that makes it possible to handle root uncertainty, *i.e.*, a situation in which the uncertainty refers to the behaviour of the players and no longer affects the product alone. This convention operates on two levels using different mechanisms.
- The qualification convention affects the production chain. It serves to distribute competences among the various players in the chain. Complexification and suspicion define the dynamics of and obstacles to the convention.
- The professional effort convention applies to organisation on the level of the professional group and takes account of the incompleteness of the contract. Its transformation can remove obstacles to the chain qualification process.
- This change in the relationship between the chain qualification convention and the effort convention spawns new questions regarding knowledge.

The transformation of conventions makes it possible to observe the role that procedures and legitimacy play in the way in which equity and the environmental dimension are taken into account.

Case study: Belgian organic beef production chain

The case studied is that of a Belgian distributor who is attempting to establish an organic beef production chain in collaboration with a group of about twenty Belgian breeders. Like other national European brands, it occupies a leading position in the national market (see chapter on distributors). The choice of beef and its production chain is motivated by the perception of tension between the historical role of beef as a range "leader" in the supermarket shelf line-ups and its redefinition as an "at risk" product following a spate of crises. This tension generates differentiation and reconfiguration dynamics in the beef production chains.

1 Chain qualification convention

1.1 Foreword: the problem of root uncertainty

The agricultural food processing chains that interest us are often characterised by situations in which uncertainty cannot be reduced by market, State, or the organisation's own intervention. The expansion of production chains turns this qualitative uncertainty regarding the product (Orléans, 1991) into root uncertainty. In effect, the multiplication of the players and the complexification introduced into the chains draw them into a systemic logic of closure. The more players are brought in through the production chain, the more specialised they are and the more they close up. In consequence, from the point of view of any of the links in the chain, it becomes harder and harder to forecast the behaviour of the other links.

Because of its narrow limits and sizeable variations in demand, the organic beef market is a fragile market, and nobody can define the expected quality of the product beforehand. The regulatory framework provides the players in the production chain with information, the interpretation of which remains problematic, for the organic regulations and the European SEUROP regulations on the grading of carcasses contradict each other. Finally, the collective conventional organisation has no powers to qualify the product. In these conditions of uncertainty regarding the product's description, the distributor does not know which *new form of organisation* he should be wishing for. The organic breeder, for her/his part, sees her/his choice regarding fattening being subjected to individual choices, which are unpredictable. In effect, the breeder's individual calculation depends on the collective choice of the breeders. Finally, the organic premium means that the fattening choice can easily be reversed, as the profitability of the premium very quickly compensates for the commercial risk involved in fattening. So, in addition to uncertainty about the product, uncertainty about the players' behaviour leads to problems and dominates the transaction.

There is a root uncertainty in a choice situation when the question being asked concerns uncertainty about not only the subject of the choice but also the rules or procedures that permit such a choice. In a situation of tension, this root uncertainty is obvious, because among the players it leads to highly diverging interpretations of each other's behaviour. Thus, for example, a breeder who sees the carcass of one of her/his cattle downgraded due to lack of tenderness may think either that this is the

result of a genuine lack of quality in the carcass or, on the contrary, unfair behaviour on the part of the slaughterhouse. The distributor, for her/his part, may find it difficult to make a judgment, if we exclude the relationship of trust that the distributor may have established with the slaughterhouse. Now this situation springs, above all, from the lack of any procedure which would make it possible to define the way in which a carcass is downgraded, the measuring instruments used, the downgrading notification systems, the possibility of an appeal, etc. There is an absence of what we shall define as a qualification convention between the breeders and the slaughterhouse.

1.2 Chain qualification convention

Lewis (1969) proposes a general definition of conventions, as follows: Given an individual in a situation of uncertainty between the alternative choices of 0 and 1, (s)he will choose 1 if (s)he thinks that the general choice is 1. There is a convention when each individual knows that the general choice is 1 and not 0. A convention is not simple mimetic behaviour. For a convention to exist there must be regularity, i.e., a regular repetition of the situation in which a choice has to be made (such as, for example, driving on the right or the left). Starting from this double characteristic, Gomez (1994) proposes that the results of the general system theory should be applied (Le Moigne, 1984). He shows that a convention is a generator of information and interpretation, the interpretation being the way in which each agent treats the information that (s)he receives. This is a first crucial point in the series of arguments on the qualification of chains, because it opens up the explanation of the maintenance of an opening between the links of a chain, in spite of their systemic tendency to close up. One of the interesting properties of the notion of a convention is that it makes it possible to think of the grouping and individual freedom as acting together.

Looked at from the point of view of the production chain, our proposition involves a combination of two scales within a chain (comprising at least three groups of players). On the one hand, at the chain level, the qualification convention brings together groups of players¹⁵ who take part in the product description process, i.e., producers, processors, and distributors, but also consumers and certifiers, and on the other hand, at the organisation level specific to each group of players, the effort conventions connect the individual and her/his professional grouping *in situ* within the chain.

The qualification convention brings about a distribution of competences. The qualification convention is a structure for co-ordinating the behaviour of the agents in a market. It establishes the competence of a professional group in relation to the other professional groups involved in the chain. It provides a recurrent resolution procedure for the problem of determining quality during the exchange by providing information on the qualifying powers that are to be expected (Gomez, 1994). So the fact of being accepted as competent has as much importance as the competence itself. Qualification is the mutual recognition of competence. The notion of competence makes it possible to distinguish between the professional and the

¹⁵ To make the argument clearer, from this point onwards we shall use "player" to mean a group of players or a group of individuals belonging to the same professional grouping.

producer. The transition from the qualification of the players to that of the products then takes place through the information exchange procedure. So the convention is not a contract, or some calculations given material form by the processes of supply and demand that make it up. On the contrary, it is a procedure that makes it possible to give meaning to the players' calculations and behaviour. A qualification convention is an information system that provides players with shared knowledge about the nature of professional qualification or, to put it another way, the nature and distribution of competences.

The qualification convention is not a contract. It is not an explicit agreement between two parties. On the contrary, it is something that can be substituted for calculations about individual behaviour and allows contracts (specifications, price grids, etc.) to be made more precise by giving them a reference framework. Gomez proposes that a convention should be described through its "morphology". This is made up of its sources or "wellsprings", a statement, and the mechanisms that give it a material form: the agreements. What specific means can be used to identify the statement about the qualification of the players? A convention agreement is never an intentional construction. On the contrary, it is made up of little touches, images, anecdotes, without the imposition of any deliberate uniformity but which, in combining, form a coherent discourse, a statement that everyone recognises because it is issued by a system of legitimate sources that thus help to make the convention clearer. So, to identify this statement, this common grammar of the convention, we have to identify the sources that generate it.

1.3 The sources of convention statements and their legitimisation

A statement emanates from the institutions, organisations, and groups of people that the chain considers legitimate. These sources form part of the context in which the chain develops, but they themselves are likely to undergo changes, and so their strength can vary with time. We can distinguish between sources, depending on whether the signals making up the statement are issued by the chain, consumers, or public authorities. In our case we are dealing with the organic chain, with consumers who express their views on organic products, and with official regulations concerning organic products.

1) The organic sector, i.e., the "Bioforum" federation, made up of professional representatives, certifying bodies, and consumer associations, acknowledges that a distributor has a certain degree of credibility as a result of its past commitment to the organic cause. Having been involved for twenty years, it did not wait for the shock of the food crises before committing itself to the organic chain. The chain recognises its competence to make commitments in relation to the organic chain, although this legitimacy is still contested by certain long-standing members of the federation, who regard it as a threat to their own legitimacy.

2) The consumers (organic or not) make a much stronger link between this distributor and the organic movement than with other brands. So the distributor, supported by the great credibility that organic products enjoy, then sees this credibility extended to its own reputation and its power to take the organic route.

3) The array of European and national regulations forms a third source for the statement of qualification conventions. The production of symbols specific to animal

production (Ministerial Decree dated 30 October 1998 and European Regulation 1804/1999) coincides with the organic chain's start-up. These legal texts codify and standardise the qualification conventions that define what organic products "are": The obligation of means imposed on organic products and traceability clearly create a new distribution of competences (certifiers, etc.).

These three sources, acting together, delineate a system of legitimacies within which the statement of the convention will be made more specific while acquiring substance and content. In our case, they are what gives substance and credibility to the distributor's proposal.

1.4 Common proposal and material device

The distributor's proposal concerning the organic beef chain that it is in the process of establishing indicates a preference for a group organisation that hierarchises the distribution of competences. This proposal gives substance to the statement because, as we shall see, it translates into a practical system that organises a regularity of exchanges and by so doing consolidates this proposal. This proposal can be redrafted using the statement, "commit to a group of Belgian organic cattle breeders". It expresses a key player in the chain's wish to engage in direct collaboration with another player from the chain and create what it calls a "new form of organisation". This proposal lays down a new distribution of competences. Here we are using the term "competences" to mean the players's abilities to pass various tests in which they have to come to an agreement on the relative importance of those who find themselves involved in the situation. There are various factors involved: They are people, qualification mechanisms, and regulations that are linked to one another in sufficiently cohesive combinations for their commitment to be considered effective (Boltanski, Thévenot, 1989 : 58). *A contrario*, this proposal is explicitly opposed to the convention in place; it is what creates the dynamics for the chain's transformation. In fact, the use of the term "grouping" reinforces the statement, in that it is used in the regulations governing animal production linked to the soil. In addition, it conforms to the wider statement regarding "balanced" organic production. The term "grouping" indicates that the distributor recognises that the breeders have the competence, as a body, to define, plan, organise, and gather together the beef supply – in short, to manage. Since it is specified that we are dealing with a "breeders' grouping", the proposal contrasts with the market view, which traditionally organises supply in accordance with the principle of a collection network, the diffuse boundaries of which go against the group principle.

The joint proposal gives us an indication of the substance of the convention, its vocabulary's richness, and its statement, whilst the practical arrangements will tell us how of the information exchanges are actually structured. A convention is not just discourse. It makes possible agreements that enshrine specific statements in actual legal and practical measures and schemes. The distribution of competences that the convention establishes, based on these schemes, and the regularity that these schemes organise, make it possible to analyse the extent to which the agreement reflects the initial proposition. Agreement between different players in a chain can take various forms: specifications, classification grid, and product reference system. In taking material form, the agreement stabilises the distribution of competences among players and defines with incompleteness the expected product's quality.

The agreement between the distributor and the breeders takes the form of a "price/carcass quality" grid. This agreement generates data on the relationships between the various players (distributor, intermediaries, producers) and the expected product's quality. On the one hand, the agreement adopted by the distributor is imposed on its intermediary, the processor (slaughterhouse and cutters). It is no longer the intermediary that organises its relationships with the breeders with regard to prices, but the distributor that fixes the price at which the intermediary buys the carcasses of the cattle supplied by the breeders. This price varies in accordance with the qualification on which the distributor and the breeders have agreed. On the other hand, in exchange for this power of imposition, the distributor recognises that the intermediary has new cutting, packing, and labelling competences and offers it an agreed and stable price, together with a commitment to sell all the carcasses.

The carcass as a unit of exchange between the distributor, intermediaries, and breeders reinforces the relationship between the distributor and breeders. Irrespective of the scale and the relationships that the breeders have with the intermediaries on an individual basis, the agreement lays down a procedure, whereby the weight and grading of the carcasses are systematically communicated along with the calculation of the payment. So the "price/quality" agreement recognises the capacity of the distributor to impose equitable treatment on the different Belgian organic breeders and to protect them from fluctuations, at least in the short term, since the agreement can be renegotiated only at six-month intervals. In reality, the prices remained fixed from 1998 to 2005.

As regards the product, the agreement specifies the hierarchy for the product expected, in terms of the carcass, in accordance with the SEUROP grading scheme, for three types of livestock. The price sanctions this hierarchy by indicating the breeders' and distributor's preferences. The price level is not an optimal price¹⁶ but a satisfactory price: it is a price level "imported" from France, which is acceptable. It has the advantage of making the behaviour of the distributor and the breeders more predictable in that the price remains stable. In exchange for these guarantees, the breeders commit themselves to an exclusive relationship.

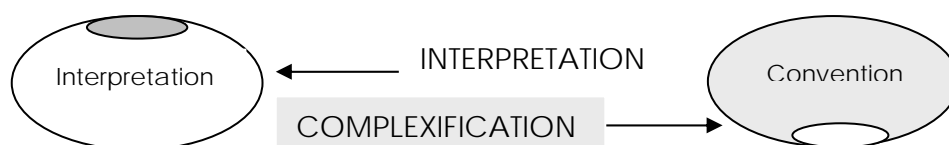
We have described the morphology of a chain qualification convention through its legitimacy system, the sources of its statement, a common proposal, and an agreement. The said morphology describes new divisions between the players' competences. Let us now see how the incomplete agreement leaves the players with an interpretative role that, depending on the individual case, generates convergence or divergence dynamics between players that reinforce or weaken the qualification convention.

¹⁶ The various players will frequently express their opinions on price levels: This price might be modified, or standard economic computations might assert that it is not optimal. But at the same time, this price is satisfactory because it makes the players' behaviour more predictable. In effect, tampering with it would mar the interpretation of behaviour, *i.e.*, the distributor's commitment and the breeders' collective capacity to parley a good price .

2 Transformation of initial qualification convention

The dynamics¹⁷ of the states of a convention can be analysed by observing the relationship between a convention's complexification and its interpretation. In effect, a balance exists between the information emanating from a convention and its interpretation by a player. The degree of complexity of a convention is defined by the amount of information about its collective procedures that it generates. The degree of interpretation of a convention is the extent to which the players are allowed to evaluate the received information's pertinence (Gomez, 1994).

Figure 6: Complexification/interpretation of the convention



2.1 Complexification

The more complex the convention becomes, the richer the statement of the convention becomes in terms of spelling out the situations, the players involved, and the penalties incurred, and the less room it leaves for individual interpretations and behaviour that strays from what has been agreed. So new situations generate new information that will either reinforce the convention or raise doubts about the collective behaviour. Complexification is the mechanism through which the convention's statement generates information of ever-greater complexity, in such a way that its possible interpretation cannot bring into question the collective procedure established by the convention. In a situation of radical uncertainty, complexification creates convergence between players. In contrast, if the information that is issued reinforces the players' individual interpretations and thus re-opens the leeway allowed for re-evaluating the convention's relevancy; there is doubt and the information produces divergence. In making the convention more precise, complexification creates convergence, but also irreversibility. This is why complexification is often gradual. It can be integrated into material schemes (revision of specifications or protocols) or remain for a moment in the discursive state, to preserve itself from the irreversibility that their material integration into such schemes risks bringing about. Complexification is revealed under the influence of trying events, both from inside the chain (the initiation of transactions, the organic conversion cycle) and outside the chain (foodstuff crises, changes in the CAP system, etc.). The beginnings of the chain that we are following illustrate this phenomenon of complexification.

The shock created by food crises highlighted the vulnerability of long chains. The distributor took the initiative to convene the organic breeders and an intermediary

¹⁷ The data on which our analysis is based are a series of agreements and protocols concluded by the distributor, the slaughterhouse, and the breeders' representatives in June 1998, August 1999, and April 2000, together with an intervention-research convention concluded in June 2003, a body of correspondence, and some semi-authoritative conversations.

(the slaughterhouse) and specified its commitments by announcing a second break with the past, *i.e.*, preference would now be given to "breeder-fatteners". Motivated by reasons of security, this choice removed from the qualification convention the industrial order that imposes specialisation by dissociating the tasks of breeding and fattening within the beef production chain. It recognised that breeders had the competence to fatten Belgian organic cattle and to reduce the risks of "accidents" occurring in the organic production chain. While the "breeder-fattener" statement was clearly backed by the distributor, it was nevertheless not integrated in any material scheme (specifications). In contrast, the agreement protocol signed by all the parties involved specifies, "The aim of the initiative is to intensify a collaboration already begun, with the objective of a beef chain concentrating on two hardy breeds, the Limousin and the Blond d'Aquitaine, reared in total compliance with the current Belgian and European specifications". The distributor recognises that these breeds are able to meet the expectations of Belgian consumers as regards both differentiation and compliance with Belgian organic specifications. Breeds and fattening by breeders are new identification points that make the convention more complex and produce convergence between players in the chain concerning product quality. This runs counter to the shock created by the crises, which put the "refuge" value of organic products to the test of diverging multiple interpretations.

Does this mean that these two new identification points are new rules of the game? The absence of enforcement and retributive procedures, although it weakens their range, produces an interval when this question remains unsettled, which is convenient for players: Some see in the absence of sanctions on breeds room for interpretation that allows them to continue to make the best use of the Belgian Blue as they convert to organic methods, while others see in the absence of breeder-fattener sanctions room for interpretation that allows them to increase the chain's flexibility by continuing to accept lean livestock bought on the farm for fattening in specialised facilities.

By structuring the generation and interpretation of information, the purpose of the convention's complexification is thus to shield the chain from competing conventions to which the possibility of divergent interpretations opens the door. It produces convergence. This dynamic is the fruit of a balance of tensions between the demand for convergence required by the situation of radical uncertainty and the need to maintain a certain degree of reversibility so that the qualification process can retain its openness. This second constraint can also explain the contingent absence of sanctions in spite of an agreement in principle.

2.2 Diverging interpretation of the qualification convention

The qualification convention is not effective unless, when it is put to the test, the interpretation that it generates is convergent with it. We observe two mechanisms for weakening the protocol that create divergence. The first concerns the testing of competences and relates to the convention's "under-equippedness", *i.e.*, its lack of references to deal with all the issues, while the second concerns the testing of legitimacy of competences and relates to a challenging of the convention.

2.2.1 Insufficiencies of qualification convention

The texts are confronted with reality tests, the purity of which is called into question by the players involved. Confused situations, in which a composite arrangement of components makes available to people entities from the various worlds that are likely to be involved in the test, are particularly open to criticism. The co-existence of entities of different natures means that several combinations are equally possible and creates uncertainty about the nature of the test that the players face. Divergence in the players' interpretations ensues (Boltanski, Thévenot, 1989: 278). Let us illustrate this case with the matter of the grouping, for while the word "grouping" refers back to a superior principle of equity to which organic breeders and consumers can aspire, in spite of the legitimacy that it draws from the convention, its referential mainstays ("equippedness") remain problematic.

The grouping initially took the legal form of a non-profit association of about thirty members. When commercial transactions began, a co-operative limited company (*Société Coopérative à Responsabilité Limitée* = SCRL) was founded by four of the breeders in the grouping and the exclusive contract signed with the grouping was transferred to it. This contract recognised the new SCRL's power to organise the grouping. The competences expected of it were those that should contribute to the implementation of this "*new mode of organisation*". A 4% margin was allocated to it for this purpose. The publicness of this margin and the way in which it is calculated show that the form and orientation of the competences are expected to be beyond the specific competences of a collection company.

While commercial law requires the incorporation of a commercial company, one form of which is an SCRL, those founding the SCRL were motivated, above all, by the fear of an assembly without any liability, which is what the non-profit association could become. In this way, they revealed that they were incapable of passing the group test: Yesterday's general meeting, is today reduced to four breeders. Moreover, the breeders would meet only twice in five years, and this at the initiative of and/or in the presence of the distributor. More than their "co-operative" competences, the SCRL expresses collectors' market competences and those of a good small or medium-sized company manager. Thus, no reports on how well the 4% attributed to the group was used were ever given.

Paradoxically, this did not extinguish the references to the grouping which, publicly put on stage, maintained the illusion: As the standard-bearer of a new horizon for the organic breeders and organic chain, relayed and amplified by the distributor, the term "grouping" transfigured the chain in the eyes of civil servants and researchers who took their dreams for reality. But a few isolated voices are sufficient to stir up trouble regarding the purity of the test: "*He's been using hormones,... it's plain to see that his interests take precedence*". Because it reveals the confusion, this type of denunciation circulates and persists...

A second source of the situation's composite organisation is external to the chain and derived from the "nature" of organic conversion. We have argued this case in detail in the introductory part of this report using the concept of the reference frame: organic conversion in beef cattle production is small-scale and has few and poor referential underpinnings in Belgium. These consist of the concept of fattening, which is imported from the conventional reference frame, a widely-ignored

pasturing obligation, insufficiently "equipped" conversion techniques, and poor qualification of the end product as regards taste.

In addition to these factors weakening the qualification convention's powers of persuasion, the convention was called into question more seriously, this time with regard to the legitimacy of the distribution of competences among the various players in the chain and no longer solely with regard to the nature of their own competences. In our case, this situation culminated in the qualification process's stalling due to convention suspicion.

2.2.2 Convention suspicion

If new data indicate that generalised behaviour is the opposite of what was expected, there is what Gomez calls "convention suspicion" because the data that it generates call it into question. The question of the interpretation of these data is central here: Do they pull the players in the direction intended or in the opposite direction to the convention? Is the general behaviour actually what was expected?

There is convention suspicion when doubt is expressed regarding the convention's validity. Two diagrams illustrate this suspicion mechanism. They refer to the conflictual relations between the collection company and the intermediary and ask about the true nature of the intermediary.

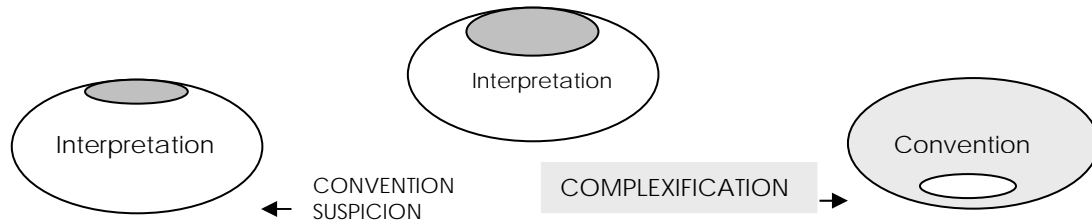
The intermediary was historically a professional livestock fattener. Moreover, the distributor initially turned to him as a fattener and not as a processor. The profession of processor (slaughtering and cutting) followed on. As an intermediary, he was therefore initially a fattener and subsequently became a slaughterer. As a fattener, the intermediary himself as clearly being excluded from the breeder-fattener convention. But as nothing in the practical system backed up this position, the doubt regarding the origin of the fattened cattle (born on a farm or collected in the markets) still remained. This doubt regarding the true nature of the intermediary proliferated all the more because, depending on the seasonal variations in supply, he plugged the gaps, while at other times he is obviously getting round the breeder-fatteners' exclusivity agreement.

Whether stopgap, fattener, or slaughterer, the intermediary was a representative whose legitimacy was trouble. Moreover, a number of incidents led to decertify the intermediary as organic a fattener: a (transient) mixture of conventional and organic livestock, non-compliant practices as regards the feeding of cattle certified by the collection company, etc. This ended in the intermediary's decertification as an organic breeder, coupled with an attempt by the latter to take the certifying body to court in order to test the strength of its procedures. For the collection company, there was "... real anxiety in connection with a genuine desire to bring this project to a conclusion, even if only on the level of profitability and credibility (...)". The intermediary went from trouble legitimacy to illegitimacy as a decertified breeder, and the breeders have begun/began to doubt the distributor's capacity to impose to the intermediary the project of the grouping of organic breeder-fatteners.

If one player is enough to sow suspicion, suspicion rapidly falls on other players and their capacity to impose the distribution of competence that is laid down by the convention. In the absence of procedures for taking certain points of agreement into account (breed and breeder-fattener) and sanctions, the relationships between

the players involved in generating the data, and whose interpretations thereof diverge in line with their positions in space and time, deteriorate. There is convention suspicion.

Figure 7: Qualification convention between complexification and suspicion



Suspicion causes the players to slip into an area of strategic behaviour that redefines the chain as a world of winners and losers in which the client, i.e., the distributor, is king. In this game, the product qualification process is stalled because it becomes secondary: Uncertainty about the product is shrugged off because uncertainty about behaviour proliferates, depending on the players' strategic logics. A complexified convention makes way for a simplified quality standard. The collective interest is reduced to the sum of individual interests, which are expressed or activated in an area of divergent interpretations, resulting in winners and losers at every stage in the game.

So it is the impossibility of predicting the behaviour of the other party within a qualification convention that blocks the qualification in progress, i.e., the generation, circulation, and convergent interpretation of information. Now it is precisely this systemic logic, involving the closing of the links within the chain in relation to each other, that the qualification convention is trying to re-open. A convention can be characterised by a "degree of openness" as reflected in the generation and circulation of information. So, openness is of a conventional order. The argument runs as follows: In contrast to closure, openness is not spontaneously maintained. It must therefore be maintained by an institutional device that ensures the circulation of emerging knowledge. This theoretical system is known as the "effort convention". Co-operation, like transparency, is not absolute. The convention in knowledge systems, as in co-operation systems (which are essentially of the same nature), straddle/divide the private and public domains (Allaire, 2004). In the next section, we wish to show that part of the uncertainty about the players' behaviour (regarding the qualification of competences) can be dealt with by an internal effort exerted on one of the links (in the present case, the breeders' group). So we shall change scale, going from the chain to the organisation of one of its links.

3 Co-operation effort convention

The concept of an effort convention was developed in connection with the analysis of employees' contracts within a company. It makes it possible to explain how to respond to the incompleteness of a job contract that recognises a qualification but does not describe any detailed tasks. The effort convention, set up in the employees' collective space, is what establishes a vertical relationship within the

company (Leibenstein, H., 1982). This analytical framework was subsequently taken up again in order to explain how the quality of service in relation to a user is established within a company (Gomez, 1994). Beuret (1998), starting from the conventions that shape a profession, then defines two types of convention: those that define the professional field and those that define the co-operation effort.

There are conventions that define the content of the profession and conventions that establish a hierarchy for this content by specifying the level of effort that it requires. It is in this frame that "good practice" can be understood. So, effort conventions are established in professional groupings. They are self-qualifying for the groupings and are deployed in various justification registers, as is emphasised by the concept of a quality convention (Eymard Duvernay, 1993).

"One effort convention is of particular importance: it is the *effort convention relating to co-operation*¹⁸. This convention implies an evaluation of the professional grouping and a certain degree of commitment at the same time. This convention is a constituent part of professional ethics and calls responsibilities into play. In any local group of farmers, the question arises of the boundary between individual initiative and responsibility, and collective competences. What is problematic is the complementary relationship between the economic efficiency of the collective, from the point of view of its members (comparative advantage), and the nature of the distribution of professional competences versus individual competences. An effort convention relating to co-operation is effective if it allows an action or an exchange in a new situation that in some fashion goes beyond what the relations would be between an individual and a finite grouping of persons or situations (without uncertainty)"¹⁹ (Allaire, 2004). In the problem that concerns us, inclusion in the chain is the action that concerns the new situation. As this chain's specific purpose is to put products "that come from organic agriculture", onto the market, we are interested in the organisation of organic agriculture, i.e., how the producers are organised.

3.1 Morphology of initial effort convention: the collection network

The effort convention tries to overcome its incompleteness regarding the definition of competences to be acquired not by restoring the definition with hindsight, but, on the contrary, by foreseeing its necessary incompleteness. A complete contract would, in effect, require the contracting parties to have infinite foresight. In a similar manner to the qualification convention, the effort convention can be described through its morphology, i.e., its common principles statements' sources, and implementation.

¹⁸ Co-operation conventions can be seen as knowledge systems: A knowledge system is "a network of agents and structures that provides for specific functions within the processes of generating, converting, transmitting, and storing knowledge (Foray, 1998)".

¹⁹ Changing the productive model (in the direction of market differentiation) touches the heart of co-operation conventions. In a stable environment, the development of groupings forms part of the trajectories of specialisation and standardisation. The innovative competences to be introduced are reserved at farm operational level for the strategic conduct of strategic itineraries and for delegating economic competences to intermediaries. A changing environment leads to the reservation of economic competences to allow accelerated co-operation at production level.

3.1.1 Statement

The common principle indicates the problem that the convention resolves in a procedural manner. It designates what is considered a good thing (positive) through a group procedure and highlights the reasons for which the convention is being adopted (Gomez, 1994). This principle also organises distinctions within the organisation. The case of the breeders is a good illustration of this principle, for the breeders share a strong principle of autonomy, which their hierarchy (the collection company), translates as, "We can stop tomorrow or carry on for another ten years; we have no subsidies, no big loans, and the premiums do not compel us to fatten, but our distributor has never lacked livestock". This principle is translated into rules that will simultaneously set up barriers to the other links in the chain and ensure the regularity of procurement. These rules take their strength from three statement sources: the beef sector, the organisation of organic breeders supplying the organic beef chain, and the members of this organisation.

3.1.2 Sources of the effort convention's statements

- 1) The profession constitutes a first source of the effort convention. As we have already emphasised, it is a powerful brake on the chain's conversion process because it is not directly affected by the proposed chain qualification convention. Direct collaboration with a distributor and, even more, the organic project are anomalies that the beef sector has difficulty interpreting.
- 2) In this context of anomy, the organisation, i.e., the collection company and its network of breeder members, is the central source of discourse regarding the quality of the organisation's members' work. This organisation is shaped by two divides. The first one distinguishes between the managers, i.e., the collection company (the SCRL), and the network of members. The second one distinguishes between the good and bad breeders within this network of colleagues. Unlike the codified relations that an organisation has with its employees, the discourse of the breeders' organisation is implicit, and is not governed by any internal rules of procedure. It is often more diffuse, but has just as great an effect on structure through the forms that it can take: backroom discussions, telephone calls to place orders, the management of tensions and sanctions, and dispute settlement. The effort convention is directed, above all, at the chain and the need for regularity that it imposes. The individual efforts made by the organisation's members concern the regularity of the finished product, the fattened livestock. As for the collective effort, this is exerted on the organisation, which makes it possible to ensure a regular flow, in spite of stock farming's cyclical nature. And then, the principle of autonomy imposes a walling off from an intangible outside world. Opportunities for advancement come more from the mistakes made by the other players rather than from the farmers' opportunities for co-operation.
- 3) The members' ability to form groups within or outside the organisation is the third source of statements. Without necessarily taking the form of collective agreements or trade union representation, it can have a more underground form that just breaks the surface. Thus, although the breeders may never seem to take the floor as a group, the collective expression of their views remains legitimate in the context of the chain qualification convention. It materialises around the request for fairness that the breeders address to the distributor, but it is ground

down by the market relations between the intermediary and the collection company.

3.1.3 The device : the rules of effort

The device is the support on which the transfer of information about the effort convention rest. In the industrial world, it is materialised as technical rules and procedures. In the domestic world, it takes the form of interpersonal relationships and, by the same token, is more abstract and more difficult to grasp. But two questions can help us describe these systems. The first concerns the forms of negotiation concerning the flexibility of the effort within the conventional framework: Is there a common rule or is negotiation carried out on a case-by-case basis? The second concerns the evaluation of the organisation's members' performances: How are the members' individual performances evaluated? Effort is translated both internally – an effort that organises the relationships between the members' individual efforts and the organisation's collective effort – and externally – an "opening" convention that organises and maintains the organisation's systemic openness to the outside world.

The breeders' organisation works on the principle of compartmentalisation, or resistance to opening, which entails forming a block in dealing with the outside world in general and the intermediary in particular. The boundaries between players are defined in a stable and well-established manner. The collection company in particular does not engage in any form of participation downstream in the chain. In a strong position, thanks to the exclusivity granted by the distributor, it attempts to maintain the boundaries' intangibility, in spite of the distributor's proposals. Thus, while the June 1998 protocol insists on the conversion of boundaries by proposing "... that the person in charge of the collection company continues to grade organic livestock in the slaughterhouse and this grading system acts as a basis for invoicing", the collection company prefers to withdraw from this the first time difficulties arise, to take up its collection work again. This resistance to opening up the link (Rule 1) culminates in the exclusion of uncertainties and of any form of co-operation that might include uncertainty.

Internally, the strategy of resistance obliges all the breeders to present a "united front", so as not to let other players "find fertile ground for the imposition of their ideas, whereas when dealing with the hierarchy their ideas fall on stony ground...". This form of resistance is not that of trade union resistance organised on civic grounds. The organisation is ill-equipped (both quantitatively and qualitatively) for collective work. It develops on the domestic level of interpersonal relations, with its members, supporting and revealing the hierarchical relationships involved. In this context, the mean effort expected by the hierarchy is negotiated on an individual case-by-case basis, in accordance with a hierarchy defined by loyalty to the organisation. The executives' discourse distinguishes between two levels of effort, namely, good breeders (those "who understand"), and the others (those "who don't understand"). Trustworthy close associates act as reinforcements for the block formed by the four directors of the collection company. They form its praetorian guard. The evaluation of the members' performances, i.e., their level of commitment, is thus defined in terms of their interpersonal relationships with the hierarchy (Rule 2).

Different types of individual effort intended to stop the gaps can then be evidenced (Delfosse, 2005:84-85). A high proportion of the "good" breeders practise rapid

fattening (over twenty instead of twenty-four months), and which we call "stepped-up" fattening. A minority stagger their work in the medium term: they move the births in their herd forward some months into the "fallow" periods that the natural reproductive cycle induces. Finally, in the rarest cases, these two types of effort are combined. These ways of regulating the fattening herd form part of a wider rule, which is that of creating room for manoeuvre within the frameworks imposed from outside (rule 3). Rather than re-negotiating the 24-month ceiling or questioning its legitimacy (which, incidentally, is strongly contested outside market circles), the collection company prefers to accelerate the fattening rate.

In an interpersonal information system, the breeders' effort convention is based on a common principle of autonomy for the collection network. The sources of its statements are the profession and the organisation. A third source, that of the members, remains "dormant". The effort convention provides a procedure that can be used repeatedly for resolving the problems of determining the quality of work by issuing information on the rules establishing the member breeder's involvement in the collection network in connection with regularity: the intensity of effort is negotiated individually and in accordance with one's place in the hierarchy, while the regulation effort is exercised through the framework imposed by the context; finally, changes are detected in accordance with a logic of resistance to opening up to the outside. This implies the exclusion of uncertainties and of any form of co-operation that might lead to uncertainties. Chain qualification convention suspicion can thus be seen to be reinforced by an effort convention of resistance to opening up.

3.2 Changing existing effort conventions

In this second part, we attempt to show how the initial effort convention and its resistance to opening up to the outside can be converted into a limited co-operation convention.

3.2.1 Conditions for change

The chain qualification process stalled because of the closed and compartmentalised relationship between the intermediary and the breeders: market attitudes, on the one hand, and the convention of resistance to opening up to others, on the other hand, replaced the qualification convention. Using the method of intervention-research, we have partially neutralised this double mechanism. As the distributor was gradually forced to accept/take on the intermediary's behaviours in situations of uncertainty, the intermediary's market attitudes were suspended to some extent. Lastly, the collection company's resistance to opening was then questioned by re-legitimising the third wellspring of statements, the source that allows the breeders to express themselves as citizens in the name of equity. The result was the creation of a third entity, an entity made up of breeders, independent of the collection company.

Thus, for the first time, the breeders found themselves "among breeders". This possibility, which was implicit in the distributor's initial proposal, was this time "outfitted" by the "procedural competences" offered by the researchers. The breeders then went from the status of being members of a collection network to having the status of a grouping, in which rules of membership and operation were to be negotiated. The first statement produced by the group was the description of its

representatives, which it called "*delegates*". The new type of relationships organised by the delegates led to some emancipation from the interpersonal dependence imposed by the of the collection company's hierarchy, as the collective, and not the individual, dimension of the problems emerged. Thus the regulation of the supply of cattle is no longer done individually, case by case, but according to a quota system that makes it possible to attain the objectives of the chain, in accordance with priority criteria negotiated collectively, *i.e.*, the breed and breeder-fattener status become exclusion criteria for setting these quotas. This conversion of supply negotiations from an individual level (collection network) to a collective level (collection grouping) encounters some resistance internally in relation to the hierarchy of the organisation, the collection company. The latter symbolically draws a red line that is not to be crossed: the breeders may not give a name to their grouping. However, in contrast, the "delegates' voices can be heard outside the grouping, at the chain level: conflicts between the collection company and the intermediary are to be "laid on the table" within a collective framework that they refuse to reduce to the level of personal conflicts.

The emergence of the breeders' body changes the chain's initial polar configuration (distributor-collection company) into a triangular configuration (distributor-collection company-breeders grouping). This shift in the qualification convention creates the conditions for a modification in the morphology of the breeders' organisation's effort convention. The most powerful effect of this change is to propose a change in the regime of responsibility. What is at stake is not merely the transition from a domestic style to a citizen style. It is also the change in the regime of responsibility, which henceforward delegates to a party outside the specific link the power to say what the problem is. Even if this external party is limited to the distributor and excludes the consumers, this change still signifies that there has been a shift towards the delegation of competences. The effort convention of resistance to opening is converted into an opening convention. Starting from this finding, let's describe the morphological transformation of the effort convention that concerns the changes in the rules.

3.2.2 Change in the effort convention's existing morphology

The effort convention plays a part in the qualification convention. The resistance to opening is converted into a form of interdependence with the other players in the chain. The existence of the breeders' body reconfigures the contacts of the breeders between themselves and in relation to the outside world, *i.e.*, the collection company and the chain. They hold meetings of their own, from which, in principle, the collection company and the distributor are excluded. Their representatives, the five delegates, extract themselves from the domestic environment set up by the hierarchy of the collection company in order to come into direct contact with the distributor: They sit on the steering committee for the production chain and have direct contacts with the distributor via faxes, mobile phones, and E-mail. In return, they undertake collective commitments vis-à-vis the production chain and the breeders.

How does interdependence become acceptable when it previously was not (resistance effort to opening up to others)? This is possible only because the rules of the effort convention can be changed, and can thus make the consequences of the players' interdependence less threatening.

Rule 2, "the intensity of the effort is defined by the hierarchical position within the organisation (domestic register)" is gradually transformed into **"the intensity of the effort is defined by mutual commitments (civic register)"**. These commitments, in turn, are negotiated within the chain through the changing of Rule 3 "creating room for manoeuvre within the frameworks imposed by the outside world" into **"creating room for manoeuvre negotiated with the other players in the production chain"**.

Thus, while the collection company was organised around the need for regularity and a 24-month ceiling laid down by the distributor's specifications, the breeders' delegates, within the legitimacy framework of the intervention-research, are going to restructure this external constraint as part of their collective and individual efforts. The question of conversion from the Belgian Blue to the Limousin breed becomes a constraint negotiated with the distributor and the slaughterhouse because it organises their interdependence – a product range differentiation constraint for the distributor, a traceability constraint for the slaughterhouse, and an organic conversion constraint for the breeders – in contradistinction to the slaughtering age limit of 24 months, which remains external because it is imposed and not justified. Following the distributor's written commitment, the delegates then convinced all twenty breeders to put a procedure into place that signposted and accelerated the breed change, namely, setting up a system of individual quotas in accordance with the criteria of breed and supply volume negotiated at the grouping level

The breeders' delegates, the distributor, and the collection company then met regularly in a steering committee in which the breed change project had been negotiated and now had to be managed step by step. This means that the breeders identify their discussion partner, the distributor, as having various types of competence. In fact, with regard to the latter, the buyer has technical competences, but the procedural competences fall more within the remit of her/his manager, whom we refer to as the project head, whilst the risk decisions are assumed by her/his superior, the planning manager. This is no longer a threatening external world. We now have players with defined identities who are committed to a procedure affecting the breed change project.

Finally, this effort, which affects the procedures and sees the breeders who are members of the collection network struggling free from their domestic relationships to project themselves into civic relationships, is possible only because it takes place through the instrumentation or outfitting of these procedures (Boltanski & Thévenot, 1989 : 397). It was effectively a matter of "progressing in accordance with a schedule" to achieve "a result in terms of a cutoff percentage" that will trigger a communication campaign within the distributor's organisation concerning the breed change. To this end, the delegates had to organise themselves to collect and encode the data from the various farms, plan the medium-term supply at the group level by representing the data in graphs in collaboration with a DP centre, and issue delivery documents in accordance with production quotas, the criteria for which were negotiated within the grouping.

The transformation of the initial rules of effort into rules of mutual commitment and rules of negotiation of external requirements makes it possible to divert some effort towards co-operation between breeders and opening up to the other players in the chain. These rules belong to a civic register, the outfitting of which results from a compromise between civic interests and industry in the name of efficiency. In thus

transforming the information circulation formats of the initial domestic (collection company) and commercial (intermediary) registers, they unblock the chain's qualification process. Collective learning becomes possible because the players are more confident that they will benefit from the consequences in an equitable manner. Recognition of the players' interdependence and identities is a prerequisite for the recognition of uncertainty about the product. While the product's regularity is a central concern, the accepted interdependence makes it possible to re-open the question of the product's differentiation, because the uncertainty as to its quality can be collectively recognised. The uncertainty is distributed across the interdependence of the various links of the chain.

4 Interaction between effort convention and chain qualification convention

The change in the rules of effort does not dispel all the doubts that were revealed by the suspicion described in the second part. Whilst the majority of the member breeders adopted these new rules, certain members of the organisation – the hierarchy in particular – remained faithful to the initial rules. This tension led to the division of the qualification convention into a double dynamic.

4.1 Division around the management of uncertainty

The effort convention is split within "the organisation" between those who, faithful to the qualification convention, gradually adopt a new effort convention, which might be called the co-operation effort convention, and those who, encouraged by their suspicions, remain stuck on an effort convention of resistance to opening. These divergent dynamics outline rival areas for generating and interpreting information within the chain.

Thus, in the area of resistance to opening, the legitimate discussion partners are the collection company, the intermediary (slaughterhouse and fattener), and the distributor's buyer. In the co-operation area (effort convention 2), the discussion partners are the breeders' delegates, the distributor's project manager, and the collection company. The shift from one effort convention to the other takes place under the pressure of two opposing movements, those of the chain qualification convention and the effort convention of resistance to opening up. The qualification convention, with regard to which the distributor's proposal is based on a system of triple legitimacy (statement source, organic chain, consumers and regulation), exerts an influence in favour of a limited co-operation effort convention. The effort convention, which is based on a system of double legitimacy, (statement source, the meat chain and the collection company's organisation), exerts an influence in favour of suspicion of a convention.

So the generation and interpretation of information can take two forms. The effort convention of resistance to opening structures information around traditional forms of commercial transaction. The boundaries between players are stable; they define the compartmentalisation between the different links of the chain and the production/conversion interaction that takes place as a head-on contact, block against block. The co-operation effort convention creates a systemic opening between the different players. The links at the ends of the chain are also brought into a relationship. Once extracted from the head-on contact, the intermediary can

acquire a better-defined identity. He becomes, on the one hand, the slaughterhouse, and, on the other hand, the breeder-fattener. For its part, the producer block defines new relationships between commercial functions and production functions: the collection company and the breeders collectively question the choices to be made in the area of production.

These two ways of generating information lead to divergent and rival forms of interpretation of the players' behaviour. This is what happens with the interpretation of the behaviour of the distributor, which divides the breeders into the collection company and the delegates. The former appeal to mistrust. They are continually emphasising the gap "between theory and reality, between the beautiful story that the distributor is selling and the real circumstances to which the intermediary subjects them". They invariably conclude that "you can't imagine what they're capable of and how far they can go". In contrast, the second group, the breeders' delegates, appeal to debate, and emphasise the extent to which they "just don't understand why more precise language is not used in the steering committee by the collection company - the next time they want specific progress from the distributor, with figures, so that they can talk about real problems". For them, the distributor is a discussion partner who can be made accountable. In this tension between resistance to opening and co-operation, the re-definition of the players' professional identities, the boundaries of their competences and the relevant areas in which they are ready to be made accountable are what is at stake. For example, what is the true nature of the intermediary that, as we have said, has been seriously challenged? Upstream of the chain (as a fattener) and downstream of it (as a slaughterhouse), what are the rules of the game by which he is willing to play? The qualification procedure for "breeder-fattener" illustrates this question.

To supply proof of their identity as breeder-fatteners, the breeders collectively decide that they are obliged to supply a document, which the authorities can issue to them. This document relates to the traceability of cattle on the farm and thus makes it possible to guarantee the "breeder-fattener". On this document, each breeder has to specify which cattle he intends to supply to the chain within the next 6 months, cattle of which the origins are attested to by the document (whether or not they were born on the farm). The provision of this document thus makes it possible to test the breeder's status as a breeder-fattener, while giving information regarding what he expects to be able to supply to the chain. In addition, the provision of this document shows that the breeder belongs to the group: anyone not submitting to the system is automatically excluded from the grouping. The question that is then raised for the breeders is to know whether the intermediary, in the shape of the livestock company that he owns, can submit to the system on the same basis as the other members of the grouping. For the collection company (effort convention of resistance to opening), it is not desirable to set the fox to mind the geese. For the breeders' delegates, in contrast, the livestock company has to submit to the same system. This difference of interpretation follows the fracture line that distinguishes the two effort conventions: whether the intermediary should be included in, or excluded from, the collective procedures.

What is at stake here is the transformation of the third rule of the resistance effort convention: the inviolability of boundaries and exclusion of social uncertainty on the one hand or, in contrast, the inclusion of social uncertainty and re-definition of boundaries between players on the other hand. The procedure instigated by the

breeders' delegates creates a way of going more deeply into what the identity of the intermediary is. In symmetrical fashion, it defines a new professional identity in dealing with the breeders. As regards the intermediary, it attempts to distinguish the breeder element from the processor element. Under the impetus of the chain qualification convention, the procedure structures the relationships between the breeders and the intermediary. This "opening up" to the intermediary is thus possible because of the change in the third rule of the initial effort convention: social uncertainty is included in the conventional dynamic. The intermediary can become a member of the breeders' grouping and consequently be dissociated from his processing role.

The propositional force of the overall conventional system is thus made stronger, and it is able to handle more information while integrating the uncertainty due to suspicion. The population of players involved in the convention is increased, the intermediary as a livestock company and the intermediary as a slaughterhouse are (partially) recognised as legitimate discussion partners. The convention is shifted (as opposed to adapting), and it demonstrates that it has the capacity for change (as opposed to the capacity for resistance). This change of configuration, which now integrates the slaughterhouse and the livestock company, can be used as a basis for opening up new questions of knowledge. The uncertainty about the product's quality can be dealt with in an interdependent manner.

4.2 Exploration of questions of knowledge

Relationships and knowledge are connected. Because it makes it possible to handle questions relating to product uncertainty on a civic and industrial level, the convention allows us to open up the complexity of issues of product qualification rather than reduce them to a matter of commercial power balance. A question of prices, which previously would simply have been handled in the form of a decision imposed by the big boys on the small trader (intermediary) is seen to be reframed and complexified through the co-ordination structure formed by the convention. The deconstruction of the carcass standard hierarchy illustrates how the convention can deconstruct and re-examine this question in the light of the co-ordination framework that it proposes.

The difference between the conventional price (fixed in accordance with the price/quality grid) and the market price (variable) leads the slaughterhouse to question once again the principle of the guaranteed price from a commercial standpoint (rarity). However, once taken on by the convention, this question then circulates between the distributor, the breeders, and the intermediary. In particular, the question is re-examined in the light of the breed effect, for cutability ("butchering performance") and production costs are in fact linked to this. Other data are discarded: reconverted breed (Belgian Blue) or crossbreed. Since the price is the subject of a fixed agreement between the distributor and the breeder, the variable on which the players can act is the grade. The price varies, in fact, depending on the conformation classification. The SEUROP standard indicates a preference for type S or E carcasses which is translated by the hierarchy of prices fixed by the distributor. But if the slaughterhouse carries out an arbitration between its purchase prices and its selling price, the processor obtains a lower purchase price for the meat coming from type not S-E. He then questions the hierarchy imposed by

the SEUROP standard, and proposes to explore the not S-E, this time in the light of the relationship between first and second choice cuts.

The breeders resist and the ideal of the super double-muscle type carcass S is shaken. Moreover, doubt can creep in at any time once the effort convention is split. But this issue finds other allies: the slaughterhouse and the distributor try to calculate their real costs, even if it means having to question a central standard. The researchers, for their part, are convinced that the U hypothesis is worth exploring for the issues related to product qualification (marbled meat) in connection with the model of fast or slow fattening, but also with compliance with organic specifications and the environmental impact of intensive fattening practices linked to S. The need to explore class U thus brings out the question of the carcass standard and deconstructs the totalising impact of the SEUROP hierarchy. This question is central, because it structures the relationship between the slaughterhouse and the fattener within a reference frame that might no longer be that of lean and tender. It is explored in Chapter 3.4 "re-conversion to organic farming", which deals with the fattening reference frame and which it is expedient to define as chain experimentation, i.e., fattening experimentation under the qualification and effort conventions, the dynamics of which we have described.

5 Conclusions: missing protocols and legitimacy systems

The development of sustainable production chains – integrating economic, social, and environmental factors – supposes that the elements making up these chains can be co-ordinated. Our systemic approach consisted of exploring possible new types of co-ordination in the construction of an organic stock farming chain. Two variables play a central role in this exploration: the distributor who embarks on this course of action and the quality of the products that have to be differentiated in terms of quality. Our analysis is based on a conceptual approach, the originality of which is as follows: it refers to a production chain qualification process by structuring the production chain dynamic and the breeders' organisation dynamic involved in this production chain around the ideas of the chain qualification convention and the breeders' effort convention.

In fact, uncertainty does not merely affect the product; it also affects the behaviour of the other players in the chain. This double uncertainty leads to blockages, or to what might be called a lack of confidence. Our hypothesis is that such an uncertainty can be resolved only by putting into place protocols based on sources of legitimacy. We use the term "protocol" to emphasise the fact that these are procedures that define rights and rules of conduct, but also procedures that oblige players to follow the rules. When these procedures are missing (missing protocols), we observe a tendency for the various links of a production chain to close up, because each player tends to exclude uncertainty by keeping to the socio-technical trajectories on which he has already embarked. These "missing protocols" make it possible to maintain stable boundaries and thus there is no call to have their involvement in the chain's conversion processes brought into question. What are the conditions under which these protocols can be created?

The first and second parts show that the distributor's commitment to a proposal to the breeders is based on three sources of qualification statements that form a system

and legitimate his proposal. These three sources (chain, consumer and regulations) are partly based on "organic agriculture" as a reference. They are credible because organic agriculture reflects the taking into account of environmental considerations through the institutional recognition of various public regulations, and they also reflect the concern for equity, which aims to preserve the "small" farmers through their social representation, in particular in the positions of the associations brought together worldwide by IFOAM. The taking into account of these two factors within the framework of economic activity clearly refers to the "sustainable development" background mentioned by certain isolated minority players in the chain. It makes it possible to justify the importance of taking equity or local know-how into account. But it is not enough just to want to make a commitment to sustainable development. It pre-supposes the establishment of a procedure and some indicators that are sufficiently well defined and generally accepted to put a stop to any disagreements (Godard, 2004).

The third and fourth parts show that the breeders' commitment to the protocols for handling uncertainty can be made only on a civic level. In a configuration in which there is a threat that the oligopolistic position of the distributor could be abused, the breeders will not become committed unless they are convinced (presence of protocols) that the benefit of their effort and any innovations which may flow from it will be redistributed equitably. Converting the effort convention from a domestic to a civic sphere then constitutes the condition upon which the breeders base their commitment to a relationship of interdependence. This conversion is accompanied by measures to improve efficiency, i.e., providing resources on an industrial scale: accumulation of data, performance indicators, etc.

Sources of legitimacy and equipments refer to the changes in the profession and the system of responsibilities for the agricultural profession. From a structural point of view, the installation of young farmers outside the framework of agricultural successions and the involvement of a greater diversity of sources of knowledge transform the information circuits. On the level of society, we can detect a professional structural crisis in connection with the weakening of the professional co-operation conventions and, in particular, the distribution of competences between the private and collective domains. This professional crisis, emphasises Allaire (2004), is also a crisis of delegation of competences. In particular, as regards our case, it refers to a question, that is central for the breeders, that of the legitimacy of whoever is telling them what their profession will become - a legitimacy that is always uncertain about the classic picture of the distributor. The organic chain is so far refusing to debate this legitimacy, thus allowing the traditional sectoral organisation to define what an effort convention is ... as a convention of resistance to opening to the distributor.

The organic chain, as a process of change within a perspective of sustainable development, thus brings up questions relating to the construction of systems of legitimacy which, from a theoretical point of view, form part of the logic of the plurality of orders of justification. These are the "missing legitimacy systems" that block the process of change. In certain areas and, in particular, as regards the relations between breeders and distributors, intervention-research has been able to do something by activating the "legitimacy systems" and bringing in competences of a civic and industrial nature in order to negotiate the "missing protocols". In contrast, precisely because of the "missing legitimacy systems", it has not been

possible to start a debate on the question of consumers, except indirectly, outside the chain, in order to influence the qualification process (see next chapter, "Transforming the figure of the consumer to reconfigure a chain"). As for the question of environmental validity, this has scarcely been considered at all in the very extensive area that the organic chain represents. So it has been possible to deal with it only through an independent research system, involving players in the intervention-research.

Finally, it has been possible to cast light on the construction of a sustainable production chain, viz.: with regard to producers who have at one and the same time to redefine their products, their profession and their relationships, both with each other and with their economic partners, a sustainable production chain pre-supposes the setting up of agreements which themselves are based on sources of legitimacy and which should be translated into discussion protocols and provided with test and measurement systems. Therefore, an entire profession needs to redefine itself in all its aspects.

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3.3 Transforming the figure of the consumer to reconfigure a chain

P. Stassart

1 Introduction

The commodity chain and actor network theories (see Friedland, 1984, and Callon, 1989, respectively) tend to focus on physical and symbolic changes in products from production practices through to consumption. However, these theories are often developed for very specific chains or industries (Goodman, 2004) in which it is easy to characterise all the players, including consumers. Long, complex agrifood chains make allowing for the consumer more problematic. This chapter is thus devoted to the ways in which consumers are taken into account through a twofold theoretical and methodological shift.

The consumer is characterised in various ways, depending on the field of study (Pfieglar, 2003). So, economists talk of a selective consumer who is able to choose from competing offers on a market, marketing experts focus on defining an individual driven by desires and for whom price is but one of many factors, and political scientists tend to identify the driving forces of collective choices behind consumption choices. These approaches tend to be mutually exclusive, although the real consumer is multifaceted (Dubuisson, 2004, Cochoy, 2002), for s/he circulates amongst these various attitudes according to the situation.

Market sociology underlines the importance and specificity of the work between buyer and seller that culminates in the final exchange. This is the work of building, adjusting, and stabilising the relationships of the people involved in the exchange. It culminates in different consumption patterns. In this process, supply cannot be understood without demand: the figure of the seller defines that of the consumer, and vice versa. As P. Ughetto (2002) points out, "...saying what the client is means above all saying how one must behave in dealing with him and thus what the seller is (or must be). The figure of the seller is inevitably the lining of that of the consumer". Defining oneself through others only takes up the mechanism inherent in identity building (Dubet, 1994), not in opposition to the other, to the stranger, but in a scheme in which the supply agents define themselves with regard to the other in a network of identity relationships. This work of constructing one's identity in relation to others is not limited to the surface of the exchange. It effectively is part of the work that precedes and follows the exchange.

Upstream, the circulation of production information that is required by the market is accompanied by the circulation of information about demand. The later is summed up in a unique figure of the end user, the "consumer", that the entire chain learns to share. Market studies, specifications, and data exchange software all contribute both to developing these figures and to having them circulate in the markets (Dubuisson-Quellier, 2004). Downstream, consumer associations are not simply mouthpieces for a supply that has already been created. They help to package the supply according to different criteria from those of production. "Prescribers", (Hatchuel, 1995), that is, third parties, enable the consumers to acquire information and appraise its validity. The notion of the figure of the consumer thus designates the development and structuring of the demand. "It intimates that the

representations on which their behaviour is predicated are highly structured upstream by the elaboration of a representation of this reality called 'the consumer' that is deemed fundamental", says Ughetto (2002). This work of elaboration orients the representations of both supply and demand, thereby showing the paradox of consumers as defined by distributors and consumers' organisations but very little by themselves, except when they end up identifying with portraits that others paint of them. We thus suggest the hypothesis of "consumption styles" (Ohl, 2002) that results from prescription practices distributed in the social area.

From a methodological point of view, we consider the consumer to be the starting point in the construction of a production chain rather than the last link in the chain. So, what matters to us is neither the development of agricultural production (Chapter 3.4 on re-conversion) nor the matter of co-ordinating the agents in the agrifood chain (Chapter 3.2 on the chain's organisation), but the attempt gradually to construct the consumer's presence and observe the consequences of this action on the reconfiguration of the various links in the chain. This starting point is set out before the fact rather than after the fact because it must enable us to overcome the inevitable effacement operations that a chain's stabilisation entails.

To do this, we developed an intervention-research approach (chap 2, sustainable development and intervention research). The experimental work of pulling the consumer into the picture effectively requires setting up an observation scheme that can take follow the chain's construction as it occurs. This work is complicated by the fact that most of the parties involved in what are known as "long chains", *i.e.*, those involving a distributor, wear several hats: the slaughterhouses work for both the conventional and the organic markets, the butchers cut the carcasses for wholesale and retail, the meat is sold on local markets and for export, and so on. These situations entangle and blur the representations of the consumer. Intervention research enables one to test certain hypotheses in the social area in addition to giving access to data on a deeper level.

To achieve our goal, three questions are developed in this chapter, to wit:
What are the figures of the consumers involved and how do they create problems?
How to create a breach by developing a new figure of the consumer?
To what changes does this lead?

2 Inventory of the figures involved

Our descriptions of the figures of beef consumers are based on a review of the literature, an exploratory phone survey of some thirty restaurant managers, and a dozen semi-directive interviews of the distributor involved in the chain that we are studying. The various figures of beef consumers are described here through two characteristics, namely, the form of prescription and the consumption profile that describes the product's characteristics or hierarchy of preferences. Based on the conventional product range of "best buy, distributor's brand, and top-of-the-line", we hypothesised that these figures of beef as a product could be found in all major Belgian supermarket chains.

2.1 Figure of the consumer of "tender meat"

Historically, Belgian consumers' beef buying, cooking, and consumption choices are determined by delegation to market intermediaries, *i.e.*, Belgium's butchers. The latter's positions are in turn tributary to the creation of an extra-meaty breed, the double-muscled Belgian Blue, and the systematic reliance on caesarean sections (see Chapter 1.1, "Equipping sustainable production chains"). The supermarket sector's development, for its part, reinforced the visual dimension of this figure. The meat's presentation must be irreproachable: uniform, without fat, and pink to reddish-pink in colour. "Customers buy first with their eyes. They want a nice colour and not too much juice. A nice colour means red or rosy red. People don't like it if the colour is too dark. We sometimes get questions about fat, questions about pieces of meat that contain streaks of fat, even though that does not mean that the meat is not good" (phone interview of a restaurant manager, 13 November 2002). While consumers eat the meat first with their eyes, they then go on to their forks and teeth: "...it is meat that you can cut with a fork". This all leads to a "meat prescription", developed by the butchers, in which the meat's visual, culinary, and organoleptic characteristics are modelled on two simple characteristics, *i.e.*, leanness and tenderness (Stassart, 2005).

The consumer's judgement is thus built upon competence by default, that is, on the rejection of tough meat and fat. This prescription developed in the framework of the strong rise in household consumption of red meat in the 1960s and 1970s. It was maintained and transmitted, through the chain's rigid organisation, to the very heart of the supermarket chains' hierarchy. As a result, the supermarket chains resisted strongly the advent of a new reference frame such as organic meat. This is shown by the beef cattle buyer's reaction in mobilising the figure of tenderness: "The Belgian Blue is the ideal breed, but at a certain point the organic certifying body will say that it is no longer acceptable. The Belgian Blue offers much more stable quality than the other breeds. And then, I wonder how they are going to check the 20% caesarean section rate...We get complaints, by e-mail and fax, about the tenderness of organic meat. Tenderness is the crux of the matter...We work with only the extra-prime cuts from those animals because, you know, natural conditions lead to a lack of tenderness, and, uh, if you're like me, and you wear dentures, well, you are going to break a tooth on something, so, therefore, we work only with the prime cuts. That explains the price of this meat from animals that live, I suppose, completely naturally" (Distributor's Butcher's Dept. Category Manager, 13 May 2002).

Why is this figure of tenderness problematic today? First, it assumes continued high demand for prime meat, for high-quality cuts, whereas a number of indices show a decline in this demand, with a switch towards chopped meat and other processed cuts (see Chapter 1.2, Characteristic of the Belgian Organic Beef Sector). Second, there is some technical incompatibility between the organic specifications' requirements (see Chapter 1.1, "Equipping sustainable production chains") and this type of production. This figure of the consumer is thus a critical point in this chain's development.

2.2 Figure of the consumer as a "beef lover"

At the opposite end of the scale from the tenderness figure delegated to the butcher *cum* prescribing authority we have the figure of the beef aficionado. This

corresponds to consumers who are above all sensitive to differences in flavour. They are open to the new experiences that are offered by gastronomic dinners and travelling and have special appreciation for Irish and Argentinian beef, but also for the meat from French breeds considered to be more flavourful than Belgian beef. They are typically the buyers of the top-of-the-line Irish and Argentinian meat found in Belgian supermarkets.

This type of meat differs in terms of flavour but also appearance, for the meat is dark red, even maroon, and marbled with fat. The dark colour indicates the product's maturity. This preference is accompanied by a choice of cuts that entails great attention and in connection with which the consumer is less concerned about the price. Pure fillet, rib steak, sirloin, *aloyau*, and *onglet* are the cuts mentioned most often. This figure is supported by connoisseurs who express their views in specialised literature, culinary academies, broadcasts on good eating, and so on. This figure is characterised by the idea of non-delegation, whether it is the restaurant manager who personally keeps himself informed of the product and how to work with it and even insists on cutting the carcass himself, or the consumer who goes from one distribution channel to the next. So, in this case we are dealing with a consumer who is curious, mobile, appreciates fine food, and is not a stick in the mud, someone who can pass fine judgements on both the product and its culinary preparation.

Still, this consumer is usually little informed about the real production conditions. These products' exoticism creates a screen between production and consumption.

2.3 Figure of the "worried consumer"

Finally, the food and health crises of the late 1990s have given rise to the figure of the worried consumer. In this context, some distributors have made strategic choices in favour of organic products (see Chapter 3.1, "Comparison of marketing strategies of retailers of organic beef"). Nevertheless, this choice remains difficult to interpret, because it is aimed at capturing two types of consumer in one go: "There are two major groups of consumers of organic products, the obsessed who couldn't care less (and focus on the exclusivity of certification) and the 'health conscious' who say that they do indeed want organic products but that they also want quality meat, that is, tenderness and flavour. Now, organic meat is not stable" (Category Manager, September 2002). The long-standing consumers of organic products tend to be exclusively organic customers, whereas the new ones are tipping, albeit irreversibly, into organic buying under the force of the health argument formatted by the spate of crises, that is, that organic food is a reassuring safe haven. This safety-minded formatting induces a reinterpretation of the organic trend in answer to consumers' worries. So, the ban on systematic caesarean sections, which are a sign of the artificialisation of animal husbandry, is reread by the distributor through safety arguments to be a ban on the use of antibiotics: "The Belgian Blue means 95 percent caesarean births. In organic production, the aim is to stop that, because caesareans mean working with antibiotics. To perform a caesarian section you cut into the cow, there is a scar; you thus have to tend the animal by giving it medication. Now, in organic stock farming giving medication preventively is not allowed". (butchers' training course by a distributor, September 2003).

Unlike the previous figures, this figure overlooks the issues of texture, taste, and appearance. Inspection is impersonal. On the other hand, the choice of packing

the meat under a controlled atmosphere makes it impossible to check the product out by handling and smelling it. Organic meat appears sterile and unattractive.

These three figures obviously compete with each other. So, the distributor's choice to go organic (Consumer Type 3) weakens his head butcher's prescription (Consumer Type 1) in favour of tenderness. This competition is also reflected in the contrary demands of the distributor who wants organic meat (Consumer Type 3) that is tasty (Consumer Type 2) and tender (Consumer Type 1): "The beef customer wants meat that is tender; that is his first criterion. When he eats, he wants to be able to cut the meat; we say you can cut through it like butter. He doesn't make any distinction between organic and American meat. It must be tender. Next, it must have flavour, and constant quality at an acceptable price" (Senior Market Manager, June 2004). In his communication materials the distributor uses all arguments to reach as broad a range of consumers as possible, but in reality his efforts (see "effort convention" in the preceding chapter, Chapter 3.2) focus on the worried consumer, as we shall see.

2.4 Reassurance: from the product to the chain

The dioxin crisis that hit Belgium in 1999 triggered a health and political earthquake. It led to a revamping of the country's health inspection policy that quickly led to the creation of the Federal Food Chain Safety Agency or AFSCA. The shock wave that this crisis produced underlined the vulnerability of animal production chains, the lengthening of which provided more opportunities for incidents and accidents. This led our distributor to reorganise his organic beef chain. He decided to give preference to producers who were both breeders and fatteners in order to improve traceability. For, as one of the distributor's senior managers explained, "If you tell consumers that there will be two certification checks instead of one, do you truly think that they will be reassured? Or will they wonder, on the contrary, about the small number of inspections?" (Senior Vice President Procurement, stock farmers' meeting of 24 June 2003). He tried both to reduce the number of players in the chain and bring them closer in order to reduce risks. The distributor also presented this option to his agricultural partners as a way to cement them in order to face increased inspections and health requirements together: "An agency now exists...in the wake of all these problems, and the agency forces everyone to carry out self-inspections...it is going to be more difficult to produce something. Believe me, it would be better to get along with each other and talk to each other" (Senior Vice President Procurement, 24 June 2003).

To consecrate this narrowing of the gap, the distributor created a special reference on this organic beef product labels giving the name of the farm from which the slaughtered animal came. The statement was rather ambiguous in order to get the stock farmers to rally to it without sparking overt opposition from the butchers (Consumer Type 1). Indeed, while the farmers took a certain amount of pride in seeing their names on the supermarket's shelves, the name each time was only that of the last farmer in the chain, who was not always the animal's breeder. This made it possible not to issue a fundamental challenge to the tender meat figure that the butchers defended against the "breeder-fattener" project. (The former effectively rested upon the principle of uncoupling the rearing and fattening-finishing phases, thereby enabling the finishers and butchers to sort through the herds and keep only the most efficient subjects for fattening.)

This individual labelling solution remained compatible with the figure of the consumer of tender meat and targeted above all the worried consumer. It even made it possible to highlight the distributor's interest in working with a local chain composed of producers from the region. However, from the consumer's point of view, this mention had two flaws, namely, the weakness of the signal and the consumer's inability to interpret it. If the signal was to be relevant, the consumer had to be able to interpret it. Now, the rarity that it tried to organise around the farmer's name assumed a consumer who knew the farm and the host of players who are involved. What is more, the signal was weak because its grip was insignificant: six to ten letters in commonplace characters lost in a sea of information that combines the distributor's brand and compulsory information. While the "breeder-fattener" product made sense, in terms of the chain's organisation and credibility, by narrowing the gaps between the stock farmers and distributor, the information that the indication of the farmer's name on the label transmits had very little meaning for the consumer. However, it created an opportunity to raise the question of the consumer. This is where the intervention research would try to work on this figure of the consumer with the chain's players.

3 Construction of a figure of the consumer as "negotiator"

3.1 Exclusive and occasional organic customers: The figure of the intermittent consumer

The distributor saw his "organic customers" as belonging to two categories: exclusive purchasers of organic commodities who asked few questions because they trusted the label, and worried consumers who turned to organic commodities out of food safety fears. However, he also knew that many of these consumers were actually occasional organic consumers, as Zanolli (2004) has shown.

We hypothesised that the figure of the occasional consumer, whom we shall call the negotiating consumer, made it possible to see-saw between the organic beef lover's judgement on the product and worried consumer's judgement on the product and this balancing between the two is what could give rise to lasting changes in a commodity chain.

Lamine (2003) has developed the notion of the "intermittent" organic consumer. This refers to non-exclusive, sometimes regular, but in any case occasional consumption of organic products. Unlike exclusive organic consumers, intermittent organic consumers are not organic "converts"; their trust in organic foods is partial and their demand is multifaceted (taste, safety, and health), modulable, and limited. The ranking of their preferences thus varies with the situation. "The degree of certainty as to the cause-and-effect relationship between the organic specification and each register of self-concern and environmental concern is limited and variable, which contributes to the negotiability of their choices" (Lamine 2003). For example, whereas an exclusive organic consumer says that he has faith in organic beef's better flavour (interviews at Laplante market, Namur, 19 September 2003), the intermittent organic consumer will express more modest hopes concerning the difference in taste. Moreover – and this is the second characteristic that sets exclusive and intermittent consumers apart –, the latter have the ability to recombine their preferences according to the product. So, whereas the choice of organic milk

is motivated above all by the environmental impact of its production pattern, the choice of organic carrots is motivated more by their taste. Such recombination can also vary for the same product according to its uses. Finally, health and safety concerns are approached from the more comprehensive angles of balance and consistency, rather than a determination to have an exclusively organic diet. Lamine's intermittent organic consumers are thus characterised by their ability to factor in the tensions between different concerns and to situate them according to the product's use. This way of consuming creates an opportunity, for the reversibility of the consumers' choices can effectively also allow renegotiation of the terms of quality on different scales of time and space. As these consumers mobilise diverse criteria in diverse circumstances, they are more open to new signals. This argument is what led us to talk about the figure of the negotiating consumer.

The organic consumers' choices concern trustworthy commodities with regard to which judgement through learning and "groping in the dark" is impossible, due to the cognitive complexity of the task, lack of sufficient number of repeated trials, or else learning that is too long and expensive. They need prescribers. In this situation, the figures of consumers to which the prescribers and consumers contribute become references that make it possible to stabilise the prescription and, subsequently, the transactions. Rather than building stereotyped figures such the "wealthy and healthy" (Lockie, 2002) or "the environmentally insensitive self-centred consumer" for Rousseau, 2005) and given the dichotomous picture of the exclusive consumer versus the worried consumer, we proposed to test a figure of negotiating consumer, that of a "vigilant/learning" consumer, which we felt would be suitable for exploring the lasting transformation of an organic beef chain.

3.2 Construction of the figure of the negotiating consumer

To explore this figure, we convened three "deliberative focus groups" (Louviaux, 2006) to discuss organic beef consumption. Our aim was to observe what positions the openly interacting participants in these deliberations proposed should be taken into account and how they could be retranslated within the chain. Deliberative focus groups are arrangements that create the conditions for generating knowledge by placing the participants in a sort of think-tank, in a situation in which they must put their heads together and restate their preferences. The aim was not to come up with a "definition" of consumers, but, on the contrary, to observe, starting from their intersubjectivity, the relevance of the questions and answers that they proposed. It was less an attempt to observe their spontaneous representations of things than to observe their abilities to construct interactively solutions that "stay the course" when subjected to the diverse array of viewpoints involved.

To avoid self-referent talk, interest in organic production and consumption had not been mentioned in the recruitment announcements. Moreover, we included 1/3 occasional organic buyers versus 2/3 conventional consumers in our corpus. All of the participants were consumers of beef and veal bought in supermarkets.

One strong point came out of these deliberative focus groups, that of the matter of breed. For most of the consumers participating in these discussions, the cattle breed or, more precisely, change of breed was a relevant signal of quality, because it signalled both a difference in the production system and a difference in the product's quality. Belgian consumers are not well versed in cattle breeds, but they

all know of the Belgian Blue, given that it is a national breed that is widely publicised in the media. Starting with this known and recognised reference, they then refer to the other side of the coin, that of the "other breeds". These are the French breeds – mainly the Limousin and Charolais, which they come across in the pastures – and exotic or ethnic breeds, such as Irish beef and Argentinian beef, which are promoted in restaurants and supermarkets. The Belgian Blue has a good image as a national asset, although some participants felt it was promoted by excessive advertising. Our consumers agreed that this type of meat was the product of forced production methods, as testified by the animal's muscle-bound appearance. Some of them thought that this was the result of selection and crosses between efficient subjects; others thought it was the fruit of shady practices, including hormone supplements. The animals' artificial muscle development and reliance on caesarean sections then became open to criticism because they were unnatural. Those who believed that the breed was the result of breeding programmes saw nothing shocking in such artifices and their implications and could associate the breed with the meat's tenderness. They included big meat eaters who ate meat daily. The others associated this breed with hormones and pale, tasteless meat, meat that was full of water. The breed could thus be used to establish a link with the production system, which in turn would be considered forced or normal, depending on the person's viewpoint. However, the breed did not affect the production side of the equation only. It was also associated with consumption issues, especially that of taste.

Irish beef, Angus beef, Argentinian beef, and Brazilian beef: these names and breeds were mentioned extensively and appreciated for the intense flavour of their meat. They were sought after in particular by meat lovers and people who liked new taste experiences²⁰. Some people may have been disappointed by the excessive richness of these meats, which are too rich in fat and nerve tissue, which have too strong a taste. But in all cases, the breed was what made the flavour! This link between breed and flavour was often established in a specific situation, such as a trip abroad or a meal in a restaurant. It was in such situations, which departed from the routine, that the eater's interest was mobilised and the breed was stamped in his/her memory, with the daily consumption of lean and tender Belgian Blue serving as the burin or embossing tool. The breed²¹ and, more precisely, the breed's name (Limousin, for example), was thus a resource that enabled the consumers to tackle understanding of the chain holistically because it linked the product (taste) to a production pattern ("not forced"). This cognitive resource has both the ability to include different immaterial attributes (Allaire, 2004) and the effectiveness of a signal of quality that is credible and pertinent in the consumer's view (Valceschini, 1999).

The breed as an integrating principle is both plastic enough to adapt to the localised preferences of the figure of the negotiating consumer and sturdy enough to keep the product's identity stable. The borders with other breeds are visible and can be grasped by consumers: the Limousin's tawny coat is both very different from that of the Belgian Blue and close to that of wildlife, and this border exists in an organised

²⁰ **R from Mons:** You have some...there are the English beef cattle. They are delicious! **F from Arlon:** I, for my part, regularly buy Angus beef. I like it...In my opinion, it has a stronger, more pronounced taste. I don't know how to describe it... **M from Namur:** I've had the same experience. I once had a chance to eat some in England. It was fabulous! It was a ribsteak...

²¹ Some farmers have understood this quite well, as one sees when they say how children will "spontaneously and systematically" prefer the russet coats of the Limousin breed, which is so close to the tawny colouring of wildlife, to the predominantly white coats of Belgian Blue herds.

manner through the Belgian Limousin Herdbook. While the breed is pertinent from the consumers' point of view, is the switch in breed to the Limousin pertinent from the chain's point of view?

3.3 Pertinence for the chain

The focus groups' members spontaneously mentioned the cattle's diets as the first criterion of meat quality, especially in the wake of the mad cow (1996-7), dioxin (1999), and bone meal (2001-2) crises. At first glance, this might converge with the organic stock farmers who, in wishing to get a jump on the organic regulations, wanted to raise the percentage of organic components in their organic feed concentrates from 70 to 100 percent. In so doing, they could guarantee stock fed 100 percent organic rations, something that neither practices nor regulations currently impose. However, this proposal, which would offer a response to consumers' worries (Consumer Type 3), is not highly integrating (what does it say about breeding patterns and the product's flavour?) and contains too high a cost of rendering the practice visible for the distributor, for how does the distributor explain that the cattle's rations are not required to be 100% organic by law? What can he say about the other animal products that do not meet this standard?

As we have shown, through its holistic nature, the breed can be used to connect various dimensions of the chain that are linked to the product and production scheme. In addition, this integrating cognitive resource makes it possible to connect up the heterogeneous knowledge that is distributed across the chain. It can become a guiding thread that runs from the farmers to the consumers via the distributor and even the processor.

The breed is first of all a strong back-up for knowledge about stock farming. Beyond the gene pool that it constitutes, the breed is a back-up for individual and collective knowledge: It backs up individual farming and finishing practices and at the same time is a shared representation that supports an organisation that is both the memory of the breed and its management venue, *i.e.*, the Belgian Limousin herdbook. So, in addressing future breeders, the herdbook presents the breed and what it entails for the breeder as follows: "The Limousin is a herd animal, it does not react like a dairy cow...Seek out information, study the animals and the other breeders' ways of working with them before buying...Never give an injection if you can treat the animal another way. The Limousin very seldom has lice and is even less subject to mange...when the animals are used to one or two people, they are the ones who have to go out. It is useless to upset the animals by sending out 5 or 6 people...the animal's character depends on the strain, not the breed. There are calm strains and more nervous strains in every breed. Don't buy a worried animal that raises its head and leaves the herd when you approach...". The breed must be learnt. This learning is carried by the social organisation (the herdbook) but also by the herd and the individuals themselves. Consequently, changing breeds is an experience, an event, for stock farmers who are old hands at systematic cesareans and have to (re-)learn how to calve naturally.

Changing breeds was a pertinent choice for the distributor. As an institution that is constantly listening to its market and consumers, the distributor "knows" that some consumers "know" how to distinguish conventional Belgian beef from Argentinian,

Angus, and Irish beef. The distributor thus had no trouble with the idea of adding a new difference to his organic meat, even if that meant dropping the national breed.

Finally, for the researchers, switching to hardier breeds than the Belgian Blue, and to the Limousin in particular, was an even more powerful turning point than the conversion to organic farming. This conversion opened onto not an adaptation, but rather a fork in the stock farmers' path that enabled them to change their reference framework. Changing breeds, dropping the Belgian Blue, offered the possibility of giving up artificialising practices such as the caesarean, increasingly narrow genetic selection, intensive use of feed concentrates, preventive treatment for parasites, etc., and their consequences: falling herd fertility and a decreased maternal instinct.

The breed thus appears to be a resource that allows the consumers' reflexivity, as expressed in the focus groups, to be transported to the chain. However, the choice of breed as a chain reconfiguration resource depends on a more plastic figure of the consumer that breaks with the ones that exist. It is neither that of the tender meat eater, which masques certain artificialising practices (Consumer Type 1), nor that of the meat lover who cares little about the production scheme (Consumer Type 2), nor even that of the worried consumer whose only escape seems to be inspections and certification (Consumer Type 3). This break, combined with the change in breeds, introduces a figure of the consumer that is both more complex and more flexible, that of a not-exclusively organic, negotiating consumer. This leads to a broadening of the set of factors that are taken into account, which becomes more varied and differently connected. Changing breeds means changing practices, changing the messages about farming practices, and reconnecting the farmers and consumers.

4 Change within the chain.

Making specific qualities of the products visible always comprises a commercial profit, but also entails costs. While the change of breed promises to associate a renewed product with another figure of the consumer, it also entails significant changes in both the chain's organisation and the underlying knowledge.

4.1 Nothing but advantages for the distributor, who has a wonderful tale to tell...

Publicising the change of breed, *i.e.*, the introduction of a rustic breed in Belgian cattle raising, is a "wonderful story" that suits the distributor. The promotional campaign that he conducts sees a reinforcement of the holistic dimension of the change of breed from the product to the farm. This is what the distributor calls the "wonderful story"²² that he includes in the flyer that he prints up and which contains a coupon redeemable at the purchase of organic Limousin beef. "Organic beef offers incontestable gastronomic qualities in addition to all the ecological guarantees that the distributor demands for all his organic products. To accentuate this gourmet dimension, the distributor is encouraging the gradual reintroduction of the Limousin breed into Belgium's organically raised stock, for the greater pleasure of

²² Term used deliberately by the distributor's Senior Vice President in charge of procurement in order both to convert his buyers and to increase consumer trust.

connoisseurs. This breed lives on the range in summer and on forage in the winter, plus cereals and sometimes legumes. It calves naturally and suckles its young. The result is firmer, tastier meat – a true delight for beef lovers" (Meat department flyer, "*Au rayon boucherie, Toutes les Saveurs du bio*", October 2004). The wonderful story that this advertising material tells is not enough, however, to convince the stock farmers, who are more aware of the gap between "their true story as stock farmers" and the "wonderful tale told to consumers", a gap that, moreover, the distributor takes care not to mention. Stated this way, the problem of dissonance between the *wonderful story*²³ and *true story*, the content and the credibility of the information printed on the product's label, creates high stakes for the farmers.

4.2 A signal that reconfigures relations

As to the principle, the statement printed on the product proposes to combine the farmers' commitment to change breeds and the distributor's commitment to deal only with breeder-fatteners. The translation of this principle into action is allegedly "only a technical matter". The matter definitely is technical. Indeed, the problem is to provide all the information required by law (number, country of birth, country of slaughter and cutting, EEC No., traceability batch No., and conventional obligations), certification scheme (statement negotiated with the certifier and the distributor's organic brand), and commercial qualifications (cut of meat, price, weight, and use-by date) on an area limited to 20 cm², and in all three national languages to boot. New information about the breed and "breeder-fattener" must thus be added to the label. This may seem simple, but requires mobilising the slaughterhouse, which does the packaging and labelling for the distributor's products, first. The slaughterhouse must in turn mobilise a subcontractor, upon which moreover it depends to manage its traceability labelling computer programmes. Any change in the labels thus entails not only agreement between the farmer and distributor, but also renegotiation of the deals with the slaughterhouse and its subcontractor and the attendant costs. The changes in the indications on the labels must be negotiated, and each party to the negotiations can mask his defection behind a "major" technical objection.

What is more, rendering something that was not visible visible and doing so credibly entails both organisational changes (how to identify a new breed) and issues of expertise. A breed corresponds to a social organisation, its registration, judging, and selection practices. But how can one identify a breed with certainty if registering stock in the Limousin Herdbook is not required by the chain and the slaughterhouse's entrance records reveal a 10 percent margin of error in registrations based on voluntary reporting (Delfosse, 2005)? How does one identify the Limousin in a country where, given the Belgian Blue's hegemony, official traceability documents remain silent on this point? Indicating the breed correctly requires identification, a description, and validation.

Identifying the animal by the colour of its coat, which is mentioned in the farm traceability documents, is an indication of breed, but it remains subjective, because crosses between breeds create confusion. Creating stock farmer groups, in contrast, can reduce the risk of errors by targeting the identification effort on "at-risk" groups. The stock farmers effectively see themselves as belonging to one of three categories:

²³ Opposition of terms that is regularly used by the stock farmers to denounce the distributor's lack of transparency.

pure Limousin breeders (the majority), farmers in the process of switching breeds (they have Belgian Blues and other breeds), and the more hesitant farmers, who cope with the risk by keeping crossed herds. Errors of identification slip into the stock of the second and third groups. Managing the attribute "breed" is thus dependent on defining the boundary between "purebred" and "crossbred". The group considered, rather pragmatically, that second-generation crosses (3/4 purebreds) could be assimilated with purebreds. Beyond that, the breed is validated at the slaughterhouse doors, before the breed is encoded in the computer system that eventually spits out the packages' labels. This means that the cattle drover who receives the stock in the stable before they are slaughtered must have the ability to recognise the various breeds in order to validate or correct their IDs and thus undo previous mistakes, and this in a world in which formerly only the Belgian Blue had its "letters of accreditation". Including the breed in the chain's organisation thus means developing new validation skills (for the drover) and forms of collective action to identify and flag the breed (for the groups of farmers).

4.3 Increased visibility: new categories and exclusions

As we explained in Section 1.4, the generic reference to "breeder" does not indicate the difference between a breeder/producer and a fatterer. Inversely, the name of the "breeder-fatterer" that the distributor wanted mentioned on the label makes two breaks with the status quo. First, it plots a boundary that now unequivocally excludes the fatterer and the flexibility that allows purchasing underweight stock any time in the year. However, mentioning the French term for fatterer, "engraisseur", and, even more so, its Flemish equivalent, "vetmester", would spark reactions of reprobation and rejection on the part of consumers, according to the distributor's Cattle Category Manager's statements. Indeed, consumers associated these terms with the hormone scandals that swept through Belgium. Using the term "fatterer" was thus risky. The buyer, who set the prescription of the tender meat consumer (Consumer Type 1), resisted it, bolstering his position with arguments supported by the worried consumer figure (Consumer Type 3): He argued that the mention was useless because the national traceability system guaranteed the meat's origin and the "Organic" certification already played this role of reassurance. So as not to bring up the term of fatterer, with its uncertain consequences on consumers, while observing the principle of control and autonomy to which the farmers' clung, given that this principle showed their ability to combine breeding and fattening, the new indication that was adopted used the terms "*naisseur-éleveur*" ("calf producer and rearer") instead of "*naisseur-engraisseur*" ("breeder-fatterer" responsible for the complete cycle from calving to finishing). However, in reassociating in this way the function of *naisseur* (breeder or "calf producer"), the scheme opened up a new category that included the product offered on the distributor's shelves in a process going all the way back to the calf's birth. This indication marks the return of the farm to the supermarket shelf, thereby reconnecting what the industrialisation of animal production schemes tends to dissociate.

New category creation is not only the work of production systems; it also affects the grammar that deploys and stabilises the product's relevant qualities. In his public statements about the project that surrounds the launch and promotion of the two production statements, "*naisseurs-engraisseurs*" (breeder-fatterers) and "Limousin breed", the Senior Market Manager juggled with the three conventional figures of

the consumer, but inevitably reframed the figures of the tender-meat-eating and worried consumers in line with his initial references: "There are three things: The organic assortment is based on health, convenience, and fine cuisine...Health: Of course, you must know that even today people still pay attention to it and an organic product is equated with health. Convenience: In our view, it means that our product is wrapped under a controlled atmosphere because when consumers do their marketing there is no guarantee that they are going to use their purchases right away; they may keep them for a few days...And naturally fine cuisine, that is part of it, because our clientele is one with taste, with good taste, and I think that our organic meat is part of that...Now, organic must be turned into something conventional. Beef customers want tender meat, that is their first criterion when they eat, they must be able to cut the meat, and what we say is that you should be able to cut through it like butter. The customer does not make a distinction between organic and American meat, and it must be tender. Next, it must have flavour" (22 June 2004).

The hedonism of tenderness cropped up repeatedly, like an incantation, in the distributor's remarks and necessarily led to an alignment with the practices and definitions of the Belgian Blue model. This is because tenderness is a simple, industrial-type criterion, but it includes an incompressible cost in terms of animal production if one tries to maximise it. It is thus an exclusive criterion that enters the logic of "either tender or not forced". In exploring this paradox, we found (Stassart, 2003) that a small chain selling genuine beef, that is, the meat of steers (castrated bulls), invented a new category that enabled it to escape the measurement of tenderness by reconnecting tenderness, taste, and unforced rearing. So it is that it had to redesign this "technological or process" criterion by talking, on the contrary, about the meat's firmness. The creation of the firmness category increased the complexity of the technological question of tenderness by linking it to the dimensions of the product that allow the meat to be firm and tender and the sign of a slower, less forced, production pattern that yields meat that does not float in its own juice when cooked. What is more, the firmness criterion opened up an area of observable, precisely situated judgements: at the time of cutting (on the butcher's block), when cooking in the skillet (because the meat loses less of its juice), and on the plate. Finally, in trying to strike the satisfactory compromise between firmness and tenderness, the players re-opened the matter of taste that the early finishing practices required to produce tender meat had excluded by associating tenderness with leanness. The following two excerpts show how the criterion of tenderness could give way to that of firmness in the distributor's discourse, how the latter criterion regrouped around the question of flavour: June 2004: "The beef customer wants tender meat; that is his first criterion". October 2004: "The Limousin steer is a breed that the distributor wants to see making up Belgium's organic herds...it's meat is more flavourful and firmer than that to which the Belgian is accustomed, it is appreciated by connoisseurs all the more as its maturation is extended". The speaker went from an absolute criterion, that of tenderness, which taste merely follows, to a rearrangement of the links between taste and firmness that moreover recalls the attributes of the meat-lover figure, but this time completed with the animal's origin and type. So, the firmness criterion opened onto a perspective resulting from new possibilities of connections that tenderness, in the name of which the totalising practice of the caesarean had imposed the double-muscle young bull, had refused. Firmness opened up the issue of the product's flavour, but it also opened up a matter that the consumer and producer touched upon without

spontaneously bringing into the discussion, that of the interpretation of the forced nature of the husbandry system.

4.4 Challenging the fattening concept

We have mentioned how in their discussion of breed the consumers' focus groups raised the issue of the interpretation of the forced ways in which the Belgian Blue was breed and fattened. The farmers mentioned this same question indirectly. In the collective planning of the chain's conversion to the Limousin, the production highs and low linked to the seasonality of animal husbandry operations became visible. To meet them in the short term, a large proportion of the farmers in the chain (see Figure 5, Chapter 3.4, "Re-conversion to organic farming") applied a strategy of acceleration to speed up the finishing. They spoke collectively of "rapid finishing" in opposition to "slow finishing". Some of them, in solitary colloquies, went as far as to use the term "*matraquage*" ("overkill") in referring to the intensity of the final fattening phase.

The rearing and fattening model, be it slow or rapid, thus raises the issue of the definition of what natural production is or should be, the issue of the interpretation of the "forced or unforced" character of cattle raising today. Rapid finishing means that the bulls are confined to pens, after a first season of grazing, and given rich rations *ad libitum*. The rapid fattening model thus rests upon the consumption of large amounts of concentrates at an early age. The fattening reference frame aims to maximise the bull's constant weight gain. Once the bulls are "finished", some of them will then be "kept in condition". Finally, as hypothesised at the end of the next chapter, the issue of speed cannot be limited to the finishing phase; the entire rearing and fattening cycle is concerned, and that is what will or will not allow a second season out to passage. In the case of a second turn on pasture, the animals must not be "burnt" by giving them rough forage instead of concentrates and thus taking advantage of compensatory growth before going on to the finishing lot stage.

This question is relevant in the chain's context because it refers back to a turning point that is well known to consumers, that of animal welfare, which consumers evaluate through the importance of grazing and connect to the matter of forced operations. Now, the issue of animal welfare appeared to be a powerful point of convergence amongst the members of the focus groups, who, it should be added, expressed very divergent opinions otherwise. Given the strategic importance of this issue, a slow fattening experiment was set up within the chain. This is described in the next chapter. What is more, the fattening concept also refers to the environmental impacts of animal husbandry: One can understand intuitively that strong reliance on concentrates allows a farmer to keep more animals on a farm and consequently, given that the feed efficiency of ruminants is closer to 20 than to 80 percent, to lead to unfavourable farm nitrogen balances. This is covered in the last chapter of this section.

5 Conclusions

The notion of the figure of the consumer abolishes a deterministic vision of the consumer whose practices are attributed to economic or socio-cultural

characteristics. This notion opens up an area in which prescribers and intermediaries circulate information that structures and allows a shared representation of consumers. In this chapter we started with an inventory of the figures found in our chain: we compared the traditional figure of the lean-and-tender meat eater with the more recent figure of the worried consumer. Next, through deliberative focus groups we tried to explore the possibility of another figure of the beef-eating consumer. Using the notion of the intermittent organic consumer, we defined a figure, that of the negotiating consumer who is able to arbitrate amongst the various dimensions for assessing organic beef (taste, safety, etc.), provided that each of these dimensions is made to appear in the act of consuming.

The figure of the consumer's transformation rests upon a turning point, *i.e.*, the change of breed. We propose three interpretations of this: existing competence, integrative logic, and conversion. The breed as a vector of differentiation, as a relevant transformation for the Belgian consumer, shows how the transformations draw upon consumers' existing competence. The latter effectively know that meat production in Belgium relies on a "national asset", the Belgian Blue breed. Armed with this knowledge, they can then see the change through exactly what they know, that is to say, the change in breeds. Next, if the breed makes it possible to develop the figure of the negotiating consumer, it is because it is a holistic resource that combines the various dimensions of the system and its output in a single signal. The distributor then of course relies upon the holism of this resource when he stresses the "beauty" of the story. Indeed, using the "wonderful story" is not limited to consumers; this device is also useful to convince and mobilise the distributor's own buyers, to guide the performances of all the parties in the chain.

We then used intervention-research to evaluate the conditions of possibility and the implications for the chain of a change of breed and simultaneously of a new type of signal for consumers concerning a chain of "breeder-farmers". The integrative powers of the change of breed opens first onto the change in and acquisition of new competences, without excluding the known practices of the traditional figures on which the latter depend. The organisational change that accompanies the change of breed remains compatible with the figures of the tender meat-eating (Consumer Type 1) and worried (Consumer Type 3) consumers, but choosing the Limousin increases the affinities between the figures of the meat-loving (Consumer Type 2) and worried (Consumer Type 3) consumers. This is what we were striving for with the figure of the negotiating consumer, who sees in the production's origin a source of trust and compromise with the search for certain characteristics in the product, namely, taste. The change of breed relies in turn on another turning point, of which it is actually the translation, namely, the conversion to organic farming. In mobilising different dimensions simultaneously, the change of breed is well suited to a consumer who prefers to take several dimensions of quality into account.

Subtending the significance that the breed has for consumers we find the category of "forced animal husbandry", "forced" in reference to the practices that lead to artificial growth conditions. The choice was made in favour of using the term "*naisseur-éleveur*" ("calf producer/breeder and stock farmer" to encompass the breeding and rearing dimensions) rather than "breeder-fattener" precisely in opposition to this forced nature of stock farming. The forced nature of the Belgian Blue is what led the organic sector and its consumers in particular to include a ban on systematic ceasareans, which meant a change of breed, in the national organic

farming specifications. We must stress that this measure is specific to the Belgian translation of the European organic specifications and has no equivalent in the other EU Member States.

From the point of view of sustainability, we can therefore say that, through the systemic changes that it induces, the conversion to organic farming becomes a resource that opens up new questions about production practices such as fattening and finishing. This then raises the problem of outfitting the "change of breed" standard, which we shall tackle in the next chapter.

Finally, when seen from the perspective of the link between production and sustainable consumption, the figure of the negotiating organic consumer makes the figure of the organic consumer "thinkable" for organic meat producers. The figure of the exclusive organic consumer is unthinkable in the farmers' view because it is in contradiction with both the highly variable practices that they see among organic meat consumers and the little interest that historic organic consumers show in eating meat. Imprisoned in this figure of the exclusively organic, the farmers then choose to place their fates in the distributor's hands. Having become detached from the consumer, they reconnect themselves to the distributor. In reconnecting to a negotiating figure, the farmers reforge a direct link with consumers.

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3.4. The re-conversion to organic farming: between organic farming rules and agro-food chain referential. What should the organic farming fattening referential look like?

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Abstract

Within the context of Belgium, which is characterized by a strict frame of reference for lean and tender cattle meat based on factors relating to animal, breeder, veterinarian, butcher and consumer competencies, we discuss how organic principles and rules are translated into practice, and we highlight the discrepancies emerging when the re-conversion to organic frame takes place in the agro-food chain. We then discuss an experiment we conducted as part of a research-action project focusing on one organic cattle meat food chain after constituting breeders' learning groups and introducing an 'negotiating consumer concept', to explore how organic conversion may question the basic concepts of the conventional frame of reference. We look at how, without successive and mutual adaptations between conventional and organic referential towards a 'lower common denominator', an experiment could be the starting point for greater coherence in terms of fattening practices. Coherence, at the interface between the breeding system and the agro-food chain, requires seeing the breed changes and the organic rules more as opportunities in term of organic cattle meat differentiation than constraints in terms of conventional production systems.

The experiment involved 24 Limousin bulls and four feeding strategies, whereby two concentrate levels (high = 65% and low = 50%) crossed with two diet distribution strategies (non-sequenced or sequenced meals) were compared in terms of animal and economic performances. The results highlighted the absence, even at such relatively high levels, of any impact of concentrate, while diet distribution strategy played a significant role in animal performance and intake that was marginally translated into feedstuff use efficiency. An important result was the observation of the impact of animal and breeder adaptation to such unusual feeding practices. This has to be taken into consideration if we want to develop such experimental approach.

For the organic cattle meat food chain, the main output of the trial was the demonstration that it is possible to reduce bull fattening scheme intensity in order to adhere more closely to organic farming rules, while retaining control of performance. However, it is difficult to support such a production scheme because of its relatively high maintenance requirements if it is to absorb the benefits of more progressive feeding approaches. So the question remains, 'What is the advantage fattening bulls within the limited organic framework instead of pursuing more extensive alternatives such as heifers, steers or, if we want to produce lean and tender meat, suckling calves?'

1 Introduction

1.1 Tensions and possible solutions

This work was performed following the identification by the researchers of discrepancies between organic farming rules and requirements ('obligation of means') and the implicit or explicit rules in the agro-food chain in terms of product characteristics. The requirements have been formulated along the lines of conventional quality norms that, in Belgium, focus on the lean and tender meat of young Belgian Blue bulls. In this context, organic farming rules are difficult to follow and breeders' practices tend to be at the limit of them. Two of these rules are often evaded. The first relates to limits on the intensity of the fattening phase, with the requirement (1) to use more than 60% of rough fodder, on a dry-matter basis, in the daily diet and (2) to graze, even during the fattening phase, as soon as pedo-climatic conditions allow it (rule ANN.I.B.4.7.). In practice, during the fattening phase, concentrates are used at a higher rate than the accepted 40% and, based on rule ANN.I.B.8.3.3, which requires that, for security reasons, 1-year-old bulls are kept for breeding in the cowshed, most fattened bulls stay in the cowshed from weaning till slaughtering. The second rule relates to the prohibited use of allopathic medicine in a preventive way. Preventive use notion that Belgian organic rules attempt to precise. This rule is evaded as anti-helminthic treatments are systematically performed in a preventive way. However, this discrepancy between organic farming rules and farmer practices, although important from the sustainability and credibility points of view, is not a priority for those involved in the organic cattle meat agro-food chain and is not discussed in either the agro-food chain or in the organic sector. The opening section of this report provides an in-depth analysis of this problem caused by changes in the meat sector frame of reference.

To encourage discussion of these discrepancies at the breeder level, the researchers set up learning groups (see Part II, Material and Methods) involving a veterinarian from the 'Zone Verte' group and using feeding performance indicators other than the classical 'Intake' and 'Average Daily Gain' maximisation ones. He focused more on the optimisation of digestion efficiency for better animal health and welfare (Giboudeau, 2001). Thus, he proposed some feeding rules to stabilize rumen fermentation processes. The first aimed to improve saliva production in order to limit the acidification process by using fibrous forages in the first phase of the meal. Such a feeding scheme enabled the formation of a fibrous network at the surface of the rumen fluid. This network could slow down the penetration of the concentrates in the rumen fluid and hence their fermentation. The third rule related to adjusting the diet to target performance levels instead of *ad libidum* feeding scheme.

The veterinarian group proposed distributing two sequenced meals instead of one mixed meal. Each meal started with the distribution of fibrous hay; once the hay was ingested the concentrates and the silage were distributed. Such a feeding strategy accords with the philosophy and principles of organic farming rules. It re-opens such questions as, 'What is good hay?', 'What is a healthy animal?', 'What is the good performance *criterion*?' And it makes the link between animal welfare and animal performance concepts.

Following a learning group session, one of the young breeders whose fattening bulls had some diarrhoea problems, not linked to parasites, implemented this feeding

scheme. After 1 month, the breeder was very enthusiastic; all the symptoms had disappeared, the general health status was very good and the animals seemed to have maintained good performance. Nevertheless, after weighing, performance seemed lower than it had been. The breeder decided to take no further risk and returned to the initial, classical feeding scheme. So the appropriateness of such an alternative feeding scheme, in the organic farming and agro-food chain contexts, remained open.

1.2 Introduction of a negotiating consumer

Consumer focus groups stressed the importance they attached to the feeding strategy ('What have these animals eaten and therefore what am I eating through them?') and, above all, to animal welfare. Although there was no clear consensus about the intrinsic quality of a 'good product', such observations led to the introduction of different consumer representatives, notably exclusive and negotiating consumers (see Chapter 3.3). The introduction of the negotiating consumer concept, characterised mainly by non-exclusive or discontinuous product consumption, modified the experiment objectives. The exclusive consumer image, shared by breeders, had oriented the experimentation objectives towards the question of '100% organic feedstuffs' and 'the definition of a common fattening scheme for producing lean and tender meat'. In other words, the objectives were aimed more at satisfying the retailers and the exclusive consumers who were more focused on product certification than at differentiating between intrinsic product quality. After the introduction of the negotiating consumer concept as a more appropriate concept in terms of organic produce market development, there was a shift from an 'obligation of means' to an 'obligation of result' – in other words, 'How to establish clear product differentiation to ensure that the interest and loyalty of negotiating consumers is retained?' As shown in Section 3.3, consumers are drawn to labels both by the intrinsic attributes of the product and by its immaterial attributes, such as the characteristics of the production system. Therefore, negotiating consumers are more willing to do a balancing act between the 'obligation of means' and the 'obligation of result'. Since it is not easy to ensure product differentiation in beef meat, this makes it possible to develop global differentiation on the basis of several individual and yet cumulative criteria.

To establish stable and reproducible differentiation in beef meat is difficult (Coulon & Priolo, 2002; Moloney *et al.*, 2001; Melton, 1990). This applies even when Belgian organic cattle meat breeders are required, during conversion to organic principles, to change breed because the traditional Belgian Blue breed had a caesarean rate higher than the accepted 20% rate. However, the association between the breed (Raes *et al.*, 2003, Dufey and Chambaz, 2004) and organic principles in terms of beef fattening (i.e., lower concentrate level and therefore a longer fattening phase and older slaughtered bulls) would lead to a greater feeding and breeding impact on meat characteristics and therefore on product differentiation (Micol *et al.*, 1997; Bonneau *et al.*, 1996). In addition, such a fattening scheme might also reduce the gap between the characteristics of young bull meat (lean and tender) and heifer and cow meat (more marbled) (Steen and Kilpatrick, 1995). This factor is of prime importance for fluxes regulation within the organic beef meat agro-food chain which is collecting together for carving such different animals as, heifers, young cows and young - bulls -

1.3 Objectives

The general question the researchers proposed to those involved in the food-chain, question that they should investigate under controlled conditions at a research station, was as follows: In order to ensure sustainable market development, is it possible to define a different but regular cattle meat product that would appeal to negotiating consumers and respect organic rules and principles (Holloway *et al.*, 1995) ? The outcomes of the investigation would be used to define (1) the economic and (2) environmental performance of the fattening phase and the impact of these factors on (3) cattle herd management and (4) offer flexibility.

This general objective became:

(1) For those involved in the agro-food chain: 'To define a fattening mode, used by all breeders of organic beef meat in the agro-food chain, which would result in a product that differed from the conventional one (more taste, more marbled meat, etc.) produced by older and heavier bulls.'

(2) For the research team: 'Is it possible to fatten bulls in accordance with organic rules and consumers' preferred production methods (i.e., with fewer concentrates and more farm-produced forage?). Does this slower fattening mode result in a different meat?'

To answer these questions two hypotheses were tested in the experimental scheme. The first was that the maximal concentration of the diet is not the optimal one from either a zootechnical or economic point of view. The second states that the feeding scheme (i.e., in two sequenced meals or in a single 'mixed' meal) has an impact on the diet efficiency and on animal welfare during the fattening phase.

2 Material and methods

2.1 Experimental scheme

To test these hypotheses, two levels of diet energy density were compared. One was calculated to reach a concentrate level of 80% during the finishing phase (HC) to ensure an Average Daily Gain (ADG) of 1.3 kg day⁻¹ and the production of young bulls for slaughter at a final liveweight of 700 kg. The other peaked at a concentrate level of 60% during the finishing phase (LC) to ensure an ADG of 1.1 kg day⁻¹ and the production of older bulls for slaughter at a final liveweight of 800 kg. These were implemented with two feedstuff distribution schemes – two sequenced meals (S) or one mixed meal (NS). Thus, there were four combinations: S-HC, S-LC, NS-HC and NS-LC.

In the S meals, 40% of the diet, on a dry-matter basis, was provided at 8h30 and the remaining 60% at 16h30, with the remainder of the morning diet being removed at 12h. They were sequenced as follows: fibrous hay (20% of the diet) was distributed first; it was followed 45 minutes later by the concentrates, which were followed 10 minutes later by pre-wilted silage. If 80% of the fibrous hay was not ingested by the end of the 45 minutes, the concentrates and the silage were not distributed.

In the NS meal, the concentrates were distributed at 9h00 and there was permanent access to the fibrous hay and pre-wilted silage. The feedstuff characteristics are listed in Table 1.

Table 1: Characteristics of the diet components (mean values, in % or per kg of DM). ME: metabolisable energy.

	DM %	CP %	CEL %	ME UFV	PDIN g	PDIE g	Prize €
Hay	88	7.5	34	0.54	46	58	0.10
Pre-wilted silage	64	11	32	0.60	64	57	0.10
Concentrate (18%)	90	21	9	1.09	146	115	0.30
Concentrate (15%)	90	17	10	1.13	115	113	0.30

The proposed diets were adjusted weekly at a level of 1.8 kg per 100 kg of liveweight. Twenty four 15-month-old bulls of the Limousin breed, drawn from six organic breeding farms, were used. The number of bulls per farm were 8 (CH farm), 4 (LO, AN and Me farms), 3 (BU farm) and 1 (GU farm). The experiment started in November 2004, with all but the eight bulls from the CH farm spending the preceding 6 months at pasture. The 24 animals were divided into four batches of 6 bulls each, as similar as possible in terms of their age (473 ± 72 days), weight (446 ± 37 kg) and farm of origin. The bull from the GU farm took the place of the bull from the BU farm in the S-HC group.

2.2 Measurement and observations

In order to determine their performance, the animals were weighted monthly and at slaughter. Carcass characteristics (classification on the SEUROP scale, pH, chilled weight, carcass yield) were also recorded. Intake was quantified at group level through a daily quantification and a weekly qualification of the proposed diet and of the refusals. Monitoring animal welfare and health was done through (1) a weekly measurement during the first 2 months of the experiment of the pH of a fresh faecal sample, acquired at group level, to identify possible chronic acidosis and (2) a recording of the herdsmen's observations about the groups during the fattening period and at slaughter.

2.3 Data analysis

Two trial periods were established to perform data analysis. The first ran from 8 November to 15 April, corresponding to the date of slaughtering the first animal in the NS-HC group. This period of 5 months allowed the impact of the two factors of interest (i.e., the 'concentrate level' in the fattening diet and the diet 'distribution scheme' on animal performance) to be tested.

The second trial period of 8 months ran from 8 November to 12 July. It allowed a comparison to be made between the two groups receiving two S meals during this period and thus to test for the 'concentrate level' effect. This distribution scheme changed to the distribution of two NS meals after 1 May in order to improve the level of intake and hence animal performance. Unfortunately, it is impossible to compare the two methods involving a low level of concentrates because during a stormy night the animals in the NS-LC group released the fence opening, resulting in the death of two of them and a state of shock with the four others following a collision with a lorry. As intake diet differed from the proposed diet, especially in the S-HC and S-LC groups, we began our analysis by defining and comparing the real

metabolisable energy (ME) content of the diets., expressed in UFV kg⁻¹ (French system).

A two-way crossed-fixed ANOVA was used to show a possible effect of the 'concentrate level' and 'distribution scheme' factors on diet characteristics, intake levels and diet use efficiency. It is based on 4 levels of the fixed 'diet' factor and 5 to 8 levels of the fixed 'time' factor corresponding to the time intervals between two consecutive weighings. The intake level was calculated by taking the mean intake value observed 2 weeks before and 2 weeks after each weighing. The intake value was linked to the mean live weight of the corresponding bulls group.

Feed efficiency indices were calculated on the basis of the intake of the different parts of the diet and of the corresponding animal performance. Three indices were calculated for dry matter (DME = kg of DM per kg of liveweight gain), metabolisable energy (MEE = UFV per kg of liveweight gain) and protein (PE = kg per kg of liveweight gain) use efficiency. The PE was also an indicator of nitrogen balance during the fattening phase. It allowed the different fattening schemes to be compared from their environmental pressure point of view. For the intake levels and diet use efficiency there was only one value for each 'diet'*'time' combination, so we could not test for the interaction between these factors.

A two-way crossed-mixed ANOVA was used to analyse the animal ADG, with 4 levels of the fixed 'diet' factor and 5 levels of the random 'breeder' factor.

Contrasts were used to test the specific effect of 'concentrate level' and 'distribution scheme' while multiple means comparisons were performed using the Student-Newman-Keuls method (SAS 1989).

3 Results

3.1 Comparison of the metabolisable energy concentration in the different diets

The ANOVA 2 performed on the ME content during the first period revealed a highly significant impact of both 'time' ($F(4,72) = 21.6$; $p < 0.001$) and 'diet' ($F(3,72) = 12.8$; $p < 0.001$), whereas the interaction was marginally significant ($F(12,72) = 1.9$; $p = 0.056$). The multiple means comparison identified three groups in terms of ME concentration: NS-HC > S-HC = NS-LC > S-LC (Table 1). So, as expected, there was an impact of the 'concentrate level' on the ME concentration of the diet ($F(1,72) = 25.7$; $p < 0.001$). An increase of 13% and 15% of the concentrate fraction in the diets was translated by an ME content increase of 7% and 8% for the NS and S diets, respectively (Table 1). The distribution scheme had a highly significant impact on the ME of the intake diet ($F(1,72) = 12.7$; $p < 0.001$), reflecting the drop of some meals during the learning phase. Indeed, the differences between the S and NS meals (-5%) within each concentrate level was higher than the one observed between S-HC and NS-LC diets (-2%) that could not be segregated for this parameter (Table 2).

Table 2: Results of the multiple means comparison (Student-Newman-Keuls) performed on the metabolisable energy concentration of the four diets during period I, from November to April. The means quoted with different letters are significantly different at the level $\alpha = 0.05$.

Period	Diet		Metabolisable Energy	
	Diet	% Concentrates (min-max)	UFV kg ⁻¹	SNK ($\alpha = 0.05$)
Period I	NS-HC	68 (25-85)	0.950	A
	S-HC	61 (25-70)	0.904	B
	NS-LC	55 (25-65)	0.884	B
	S-LC	46 (25-50)	0.839	C
Period II	S-HC	64 (25-74)	0.927	X
	S-LC	46 (25-50)	0.830	Y

When the S-HC and S-LC were compared during period II (a reduction of 18% and 12% of the concentrate and ME content, respectively), both the 'time' ($F(7,54) = 6.6$; $p < 0.001$) and the 'diet' ($F(1,54) = 67.2$; $p < 0.001$) effects remained highly significant.

3.2 Animal performance and carcass quality analysis

As revealed by the lack of interaction, whatever the 'breeder' of origin, the 'diet' factor had a highly significant effect on bulls' ADG during period I (Table 3). Nevertheless, in contrast to the observations on ME concentration, this effect was due to the 'distribution scheme' ($F(1,12) = 35.6$; $p < 0.001$) and not to the 'concentrate level' ($F(1,12) = 1.6$; $p = 0.234$), although the concentrate level was 13% higher in the NS-HC than in the NS-LC and 15% higher in the S-HC than in the S-LC. HC meals led to a mean increase of the ADG of 8% ($= 0.185 \text{ kg day}^{-1}$): +4% in the NS distribution scheme and +13% in the S distribution scheme. The S meals led to a mean reduction of the ADG of 33% ($= 0.342 \text{ kg day}^{-1}$): -28% in the HC diet and -38% in the LC diet (Table 4).

During period II, the 'diet' impact could only be considered as marginally significant (Table 3). This confirmed the weakness of the 'concentrate level' impact compared with the importance of the 'distribution scheme' impact, even when the 18% increase of the concentrate fraction led to a mean increase of animal performance of 23% ($0.214 \text{ kg day}^{-1}$).

The 'breeder' factor also had a marginally significant impact. This was linked to the improved performance of the 'BU' bulls, with a ADG of $1.491 \text{ kg day}^{-1}$ against $1.160 \pm 0.038 \text{ kg day}^{-1}$ for the other breeders' animals.

Table 3: Impact of the diet factor (fixed - 4 levels during period I, and 2 levels during period II) and of the breeder factor (random - 5 levels) on the ADG variations observed during period I or II. Diet effect was tested against the diet*breeder interaction.

Effect	Variable: ADG (kg day ⁻¹)					
	Period I (November - April)			Period II (November - July)		
	DF	F	p	DF	F	p
Model	19	4.57	0.075	9	1.31	0.506
Diet	3	12.46	< 0.001	1	6.08	0.069
Breeder	4	6.20	0.053	4	1.29	0.481
Diet*Breeder	12	1.22	0.463	4	0.59	0.705
Residual	4			2		

Table 4: Results of the multiple means comparison (Student-Newman-Keuls) performed on the ADG observed for the four diets during period I, from November to April, and period II, from November to July. The means quoted with different letters are significantly different.

Period	Diet		ADG	
	Diet	% concentrates / DM (min-max)	Mean ADG (kg day ⁻¹)	SNK (= 0,05)
Period I	NS-HC	68 (25-85)	1.411	A
	S-HC	61 (25-70)	1.102	B
	NS-LC	55 (25-65)	1.351	A
	S-LC	46 (25-50)	0.977	B
Period II	S-HC	64 (25-74)	1.138	X
	S-LC	46 (25-50)	0.924	X

This performance led, at slaughter, to the characteristics presented in Table 5.

Table 5: Mean characteristics of the carcass obtained with the four diets.

Characteristics	unit	Diets			
		NS-HC	S-HC	NS-LC	S-LC
No. of carcasses characterized		6	5	4	6
Slaughter age	month	21.5	23.3	24.3	26.9
Growing-fattening length	day	185	257	258 ¹	339
Liveweight at slaughter	kg	719	757	813	820
ADG	kg day ⁻¹	1.47	1.20	1.39	1.04
Warm carcass weight	kg	452	470	511	496
Carcass dressing percentage ²	%	62.8	62.1	62.8	62.0
Conformation	SEUROP ³	U+	U+	E-	U+
Fattening score	SEUROP ³	2 (+0,0)	2 (+0,13)	2 (+0,0)	2 (+0,11)
Ph after 96 hours		5.72	5.71	5.73	5.69
Carcass maturation length	day	6.3	6.0	7.3	6.1
Carcass maturation losses	%	2.5	2.7	2.9	2.4

1 For the four bulls of this group, after the deduction of the number of days required to reach their 'before accident weight'.

2 On the Warm Carcass Weight basis.

3 European Carcass Classification scale, SEUROP S = very good conformation and P = very poor conformation).

Apart from their weight, carcass characteristics were very similar whatever diet was involved. None of them was downgraded on the criteria used by the food-chain, apart from the age point of view. At carving, butchers had labeled three of the six

carcasses from the S-CB group and one of the four carcasses from the NS-CB group as more 'dry' (i.e., with a lower apparent dampness following muscle cutting, and with a stronger adherence of the conjunctiva tissue to the muscles). This supports the observations made by Dufey and Chambaz (2004).

3.3 Intake comparison

The impact of the 'time' and 'diet' factors on the level of intake, expressed in terms of kg of dry matter, kg of protein and UFV per 100 kg of liveweight, was tested for period I. Variance analyses showed a highly significant impact of the 'diet' factor on the variation of these three variables (Table 6). The contrasts (Table 6) and the multiple means comparison (Table 7) performed underlined the significant and negative impact of meal sequencing on the level of intake (-13% DM base), while the increase of the concentrate fraction in the diet had no significant impact on intake (+2% DM base) (Table 7). From the energy intake point of view, with the NS meal the substitution of a forage fraction by a concentrate fraction (+13%) increased the ME content (+8%) and, not significantly, the level of DM intake (+4%), leading to a significant increase of the ME (+12%) intake. Nevertheless, with the S meals, a similar substitution had no impact on DM intake (0%) or ME intake (+7%) (Table 7).

Table 6: Impact of the diet (fixed - 4 levels during period I) and of the time (fixed - 5 levels) factors on the level of dry matter, metabolisable energy and protein intakes.

Model		Intake variables					
		Dry matter		Energy		Protein	
Effect	DF	F	p	F	p	F	p
Model	7	13.5	< 0.001	6.6	0.002	10.8	< 0.001
'Time'	4	13.4	< 0.001	1.5	0.262	10.4	< 0.001
'Diet'	3	13.6	< 0.001	13.5	< 0.001	11.4	< 0.001
Residual	12	-	-	-	-	-	-
Contrast							
'Concentrate'	1	1.2	0.291	8.6	0.012	0.74	0.406
'Distribution'	1	38.1	< 0.001	30.9	< 0.001	32.9	< 0.001

Table 7: Results of the multiple means comparison (Student-Newman-Keuls) performed on the level of intake of the different diet fraction for the four diets during period I, from November to April. The means quoted with different letters are significantly different at the level = 0,05.

Diet		Variables		
Diet	Level of CC %	Dry matter (kg *100 kg lwt ⁻¹)	Energy (UFV*100 kg lwt ⁻¹)	Protein (kg*100 kg lwt ⁻¹)
NS-HC	68 (25-85)	1.910 a	1.789 a	0.295 a
S-HC	61 (25-70)	1.652 b	1.477 bc	0.243 b
NS-LC	55 (25-65)	1.829 a	1.603 b	0.282 a
S-LC	46 (25-50)	1.656 b	1.383 c	0.242 b

3.4 Apparent feed efficiency indices

During period I, due to a high coefficient of variation (CV =26), there was no significant impact of the 'diet' factor ($0.20 < p < 0.36$) on these feed efficiency indices. This high variability is illustrated in Figure 3, while a significant to highly significant proportion of these indices variations are explained by the 'time' factor ($3.8 < F(4,12) < 5.3$; $0.01 < p < 0.03$) (Figure 1). This illustrates the role of environmental factors (temperature, etc.) on diet efficiency, through their impact on the fraction of the diet energy used for animal maintenance.

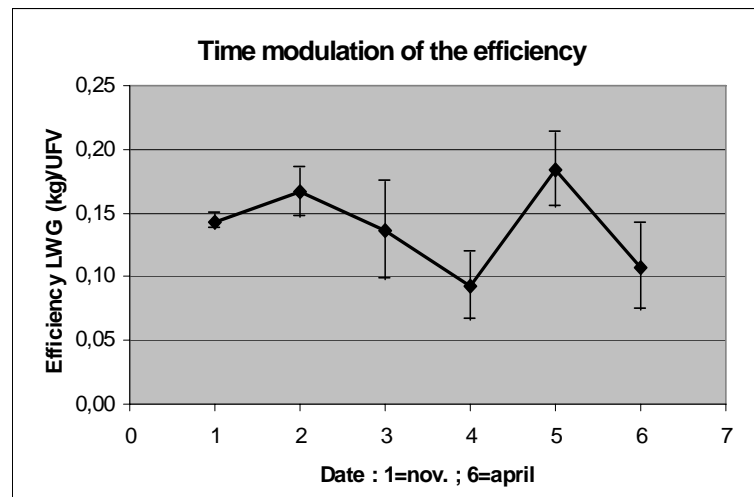


Figure 1 : Evolution of metabolisable energy apparent efficiency index during the period I

The comparison testing the 'distribution scheme' impact tended to be marginally significant ($2.8 < F(1,12) < 4.2$; $0.06 < p < 0.12$) in all cases. Taking into account this marginal effect, the S meals reduced DM, UFV and protein efficiency indices by 17%, 11% and 10%, respectively. This seemed to be more effective with LC diets, with reductions of 29%, 21% and 20%, respectively, than with HC diets, with reductions of 8%, 3% and 2%, respectively. An increase in the concentrate proportion did not affect the efficiency indices of NS diets but allowed the S diets to enhance their efficiency indices from 18%, 8% and 15% for DM, UFV and protein use efficiency, respectively. During period II, with the comparison of the S-HC and S-LC methods and the 'level of concentrate' effect, from November to July, there was also no significant impact of the 'diet' factor ($0.16 < p < 0.51$) on these feed efficiency indices. Nevertheless, the 18% increase in the concentrate fraction in the S meals enhanced diet efficiency in the same proportions as those observed during period I: 20%, 7% and 13% for DM, UFV and protein efficiency, respectively (Table 8). Such a positive, although not significant, 'concentrate' effect intensified the 'sequencing' effect as the S meals were systematically poorer in concentrate (-7%, -9%) and ME (-5%) than the corresponding NS meals.

Table 8: Means observed for the different feed efficiency indices according to the different diets, during periods I and II. Lwg: liveweight gain

	Diet		Variables		
	Diet	Concentrates % DM	Dry matter (kg lwg*kg ⁻¹)	Energy (kg lwg*UFV ⁻¹)	Protein (kg lwg*kg ⁻¹)
Period I	NS-HC	68 (25-85)	0.134	0.140	8.66
	S-HC	61 (25-70)	0.124	0.136	8.50
	NS-LC	55 (25-65)	0.135	0.152	8.91
	S-LC	46 (25-50)	0.105	0.126	7.40
Period II	S-HC	64 (25-74)	0.127	0.127	8.17
	S-LC	46 (25-50)	0.098	0.119	7.23

3.5 Feeding cost and economical efficiency

The cost and feedstuffs characteristics are given in Table 1. The focus is on feeding cost per kg of liveweight gain (Table 9).

Table 9: Mean feeding costs, in euro per kg of liveweight gain, according to the different diets during period I and throughout the fattening period

Diet	Period I				Throughout the fattening period ¹			
	Concentrates (% DM)	Live-weight	€/kg LWG	%	Concentrates (% DM)	Live-weight	€/kg LWG	%
NS-HC	68	678	1.97	108	70	719	1.97	119
S-HC	61	641	2.05	112	67	757	2.00	121
NS-LC	55	699	1.82	100	57	813	1.66	100
S-LC	46	615	1.99	109	50	820	2.00	120

¹ After the deduction, for the 4 bulls of the 'NS-LC' group, of the number of days necessary to reach their 'before accident weight'

At the end of period I, the NS-LC diet was the more interesting one from an economic point of view as it was the cheapest way to produce 1 kg of organic bull liveweight. The other diets were all 10 to 20% more expensive when taking into account period I or the entire fattening phase, respectively.

3.6 Animal welfare and health

Faecal pH evolution during the two first months of the trial was fairly similar in the different groups, with an evolution of 7.3 to 7.1. Nevertheless, although the NS-HC had, on average, the same faecal pH as the other groups, it was subjected to stronger variations (Figure 3).

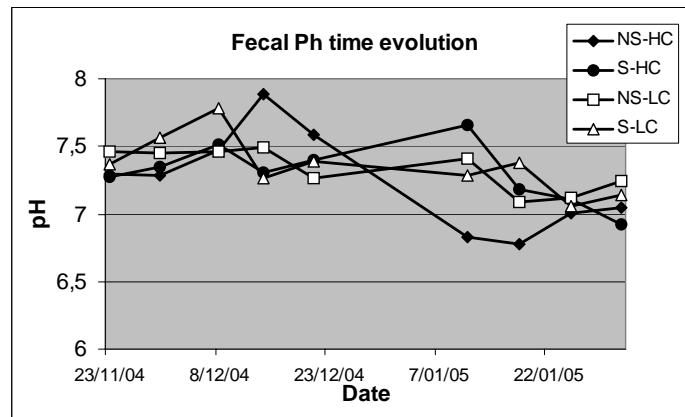


Figure 2 : Fecal pH evolution (mean sample per group) during the two first months of the experimentation.

From the animal health point of view, the herdsmen had noted a lower susceptibility of the bulls from the S-LC group to the development of scab infestation that had started in the NS-LC group and contaminated all the other groups at the beginning of the trial. No other health problems were observed, whatever the diet. From a behavioral point of view, the bulls from the S-LC group were quieter and more docile at weighing than the other groups that were more nervous and aggressive at the end of the fattening phase. This observation was confirmed, independently, by the stockmen responsible for animal reception at the slaughterhouse.

4 Discussion

4.1 Effect of the distribution scheme

The hypothesis was that, through ruminal fermentation stabilisation, a sequenced distribution of the different components of the diet, beginning with fibrous forage, would have allowed a better efficiency of the diets. Such a strategy would be adapt to organic rules (i.e., to have a concentrate fraction lower than 40% in the diet even during the fattening phase, if the breeder accepts having lower animal performance and the slaughter of older animals). The strategy did not seek to maximise animal performance but to improve diet efficiency. In contrast to the expected results (Giboudeau, 2001; Sauvant and Mertens, 1998; Dulphy *et al.*, 1995), such a sequenced distribution scheme led to a strong reduction in both the level of intake and apparent feed use efficiency. How can we explain these results?

Two factors could have played a significant role in the experiment: the animal behavioral reaction to new feeding practices and the fibrous hay quality. These factors led to the persistence of the learning period. During this phase the bulls from the S-HC and S-LC groups were forced to drop some meals as long as they did not eat their hay fraction. As many as four meals were dropped in some weeks. This led to a reduction in the intake level, not only in quantity but also in quality and especially in terms of ME content, as the dropped fraction was always the concentrate one. Another important consequence of this learning phase was the occurrence of an important ruminal condition instability in contrast to the initial objective.

Hay characteristics, in terms of fibre content and palatability, are also key parameters in implementing such a distribution scheme. The hay must be palatable to ensure an intake rate of 2 kg DM hour⁻¹ at the beginning of the meal and fibrous enough to ensure salivation and the formation of a fibre network in the rumen in order to regulate the intake rate and the fermentation of other meal components (Sauvant and Mertens, 1998). As there was no clear evolution of animal behavior after this learning process, even when a large panel of organic hays was tested, the distribution scheme moved from the distribution of two S meals to the distribution of two NS meals for period II. These results support the observations of Provenza *et al.* (2003) about the importance of an early learning of rough forage valorization by the ruminants. They also accord with the comments made by the veterinarian of 'Zone Verte' who stressed the need to distribute such fibrous meals in order to boost the development of rumen muscular tunica, rumen volume and microbial populations (Sautey, 1995; Lechner-Doll *et al.*, 1995), from the beginning of the ruminant's life until its full development at 36 months, by using fibre-rich diets. Breeders also had a view on this learning process: *"This is not silage, this is just like a cake...they get a soft mouth with such a quality...they always want the best quality...it becomes impossible to make them eat some hay"*. So their practices remained opposed to such a concept, even in organic systems. The bulls usually received concentrate feeds from the time of weaning, even at pasture. Under cowshed conditions, their diet included, apart from these concentrate feeds, the best silage, and so most of the bulls involved in this experiment had never eaten hay before.

Such an extended learning phase led to significantly lower levels of DM intake in the S meal groups and thus to significantly lower levels of animal performance, together with lower apparent feed efficiency. We can demonstrate that such apparent feed efficiency reduction is linked to the use of a higher proportion of the ME for animal maintenance under a longer low-performance period. The observed marginally significant effect of the 'distribution scheme' on the feed efficiency indices disappeared once we only took into account, by subtracting the maintenance energy from the intake energy (from Vermorel 1988: maintenance energy (UFV) = $0.00004 * (\text{metabolic weight})^2 + 0.0386 * \text{metabolic weight} + 0.214$), the fraction of the ME available to increase animal weight ($F(1,12) = 0.27$; $p = 0.612$). Across the four diets, after the subtraction of maintenance energy, 2.9 UFV were used per kg of liveweight increase (2.7 to 3.4 UFV kg⁻¹). This means more than 42% of the intake energy in the NS groups and less than 35% of the intake energy in the S ones (Table 10).

Vermorel (1988) stressed that maintenance energy needs were linked to diet characteristics; intake, rumination and digestion energy represented between 4% and more than 8% of the maintenance energy for concentrates and forage-based diets, respectively. The ME calculated for the production could therefore be a little overestimated in the LC diets compared with the HC diets.

Table 10: Diet metabolisable energy efficiency before and after the subtraction of maintenance energy.

Diet	Apparent metabolisable energy efficiency (kg lw*UFV ⁻¹)	Net metabolisable energy efficiency (kg lw*UFV ⁻¹)	Proportion metabolisable energy used for production (%)
NS-HC	0.140	0.283	49
S-HC	0.136	0.356	38
NS-LC	0.152	0.365	42
S-LC	0.126	0.399	32

These various considerations underline the fact that the poor performances observed under S meals were linked to low level of intake rather than poor feed use efficiency.

The extent of the response in terms of ADG to the diets with S meals could be linked to the cumulative effect of the reduction of the level of intake and of its feeding value (Steen and Kilpatrick, 1995, 2000), with a greater part of the ingested energy used to meet maintenance needs, as well as to a reduction of diet digestibility linked to the instability of the feeding scheme (Giboudeau, 2001; Demaquilly *et al.*, 1995) due to bulls' feeding behavior. This was illustrated by the distribution of the net ME efficiency index in the function of the level of intake (Figure 3). This figure illustrates the increase of the net ME efficiency index together with the reduction of the level of intake (Demarquilly *et al.*, 1995), as well as the strong variation of this index, at the low level of intake, for the diets with S meals. This demonstrates the importance of adaptation and learning phases when there are significant modifications being made to breeding conditions.

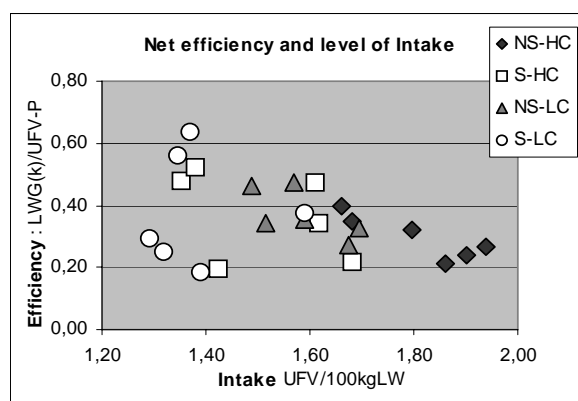


Figure 3 : Dispersion of the net metabolisable energy efficiency in function of the level of intake

4.2 Effect of the concentrate level

At the relatively high level of concentrate (46–66%, on average, throughout the growing-fattening period) included in the diet, a 13% increase of the concentrate fraction, whatever the distribution scheme, did not lead to a significant improvement in animal performance or feed efficiency. This is an important point which underlines the finding that, under our trial conditions, the maximum level of concentrate was not the optimal one in terms of either animal or economic performance. This opens

up some evolution possibilities for reconciling organic rules and organic beef agro-food chain expectations, especially if better quality forage is used.

So why did organic fatteners use a fattening mode that maximized animal performance without any consideration for economic performance? To answer this question we must raise the issue of supply flexibility in narrow markets characteristic of food chains of differentiate quality. The work we did with people involved in the agro-food chain underlined the strong impact of calving seasonality on supply flexibility, access to the market and decisions about whether or not to fatten an animal.

In the short term, fatteners had two possibilities. (1) They could accelerate the fattening process as Delfosse (2005) shows in Figure 4, where five out of the six main breeders performed early fattening (>50% beef < 22 months) and therefore complied with the benchmark in their agro-food chain (See Chapter 1.1). Thus, they improved the management flexibility of supply with a reduction in downgrading (animals older than 24 months) and refusal (supply > demand) risks. (2) In contrast, they could also slow down the fattening process in order to achieve better economic performance, thus increasing the downgrading risk (animals older than 24 months) during the maximum calving period. Such downgrading led to strong economic repercussions, with losses as high as 60%, as decided in the initial convention on agro-food chain qualification (See Chapter 3.2, qualification convention).

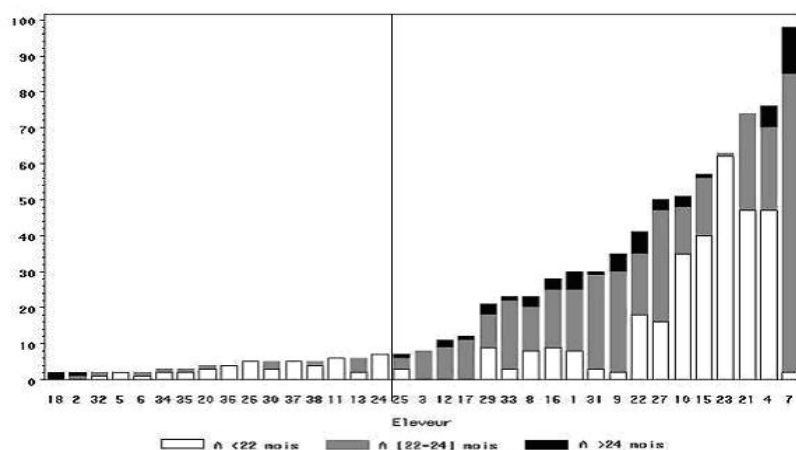


Figure 4: Age class distribution of the bulls delivered by the different breeder-fatteners in a supermarket organic beef meat chain (Delfosse 2005).

4.3 Impact on animal health and welfare

The lack of a 'diet' impact on the evolution of the faecal pH can be explained by the concentrate mix composition (Sauvant *et al.*, 1999). This mix, used by most of the organic beef fatteners, integrated 15% of beet pulp, 53% of cereals, 5% of malt radicle, some chalk (0.6 %), bicarbonate (0.2 %) and yeast (0.08 %), so it was well buffered and reduced the risk of acidosis. In addition, its palatability was improved by the integration of beet molasses at the rate of 2.5 %. Such characteristics could lead to concentrate integration rates as high as 80%. This could not have been achieved using a commercial concentrate with 80% of cereal, such as the feed mixtures commonly produced in local organic systems.

4.4 Product qualification

Finally, a first product qualification was obtained through the recording of the butchers' observations during carcass carving. Although no major defect was highlighted, the butchers regularly noted the lower tenderness and conformation of the Limousin carcasses compared with Belgian Blue carcasses, and the drier character of the bulls from the LC diets (Dufey and Chambaz, 2004). Carcass post-mortem management can now strongly modify carcass characteristics linked to animal breeding methods (Dufey and Chambaz, 2004; Moloney *et al.*, 2000).

4.5 Economic efficiency

Zootechnical performance does not take into account the relative costs of the different diet components, so the zootechnical optimum can be far from the economic optimum. None of the UFV had the same economical value. Therefore, in the NS-HC diet, with a concentrate level of 65%, the additional cost of the diet (+14%) linked to a reduction in feed efficiency (-9 %) compared with the NS-LC diet, led to economic efficiency equivalent to that observed for the S diets.

5 Conclusions

In spite of the difficulties encountered in implementing the different distribution schemes, these results show that there are possibilities for fattening bulls under a less intensive scheme (NS-LC) or a slower rate (S-LC) scheme than the conventional fattening scheme, without a negative impact on carcass quality (fat level, meat tenderness, etc.). The first scheme resulted in similar environmental and improved economic performance (+20 %) and needs further investigation to determinate the level of reduced intensification that could optimize the fattening period – in other words, to determine the best compromise between speed and efficiency. The second scheme, because of the incompressible maintenance needs and the rumen instability it induced in our experimental scheme, led to an increase in both environmental costs (an increase of 11% of the protein needs per kg of liveweight gain, compared with the NS schemes) and economic costs (an increase of 10% of the feeding costs). Nevertheless, further work on such schemes in line with organic rules and principles would have to include increasing the slaughtering age limit from 24 to 28 months, which opens up new questions: What is the benefit of fattening bulls within the organic farming framework instead to focusing on extensive alternatives such as heifers, steers or, if we want to produce lean and tender meat, suckling calves? What importance do we attach, as breeder or consumer, to animal life, animal welfare in breeding practices or to the length of animal life necessary to establish pertinent breeder to animal ties (Porcher, 2004).

We have shown, in other chapters, the importance of the frame of reference shift and of the food chain organization. We have taken these aspects in the implementation and analysis of our experiment conducted to explore a new fattening model in tune with organic production principles. Agro-food chain organization defines the relevance of the technical solution. Similarly, a new technical coherence can be applied to production systems only if the conventions of collaboration of the corresponding agro-food chain take it into account.

In addition, apart from the need to adopt a systemic approach at the agro-food chain scale, we have highlighted the importance of the learning process related to

the animals history impact on their behavior in reactions to the experiment conditions (Provenza *et al.* 2003).

Therefore, all experiments concerned with establishing a new referential in farming system must take into account the shift in breeding practices, the real difference between the whole breeding practices applied to the herd of origin and those applied under the tested referencial. Indeed, experimental animal responds to the new referential, not as we expect as researcher but in compliance with its real experience in the referential of origin.

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3.5. Transformation of gastro-intestinal parasites management scheme in the context of suckling herd conversion to organic farming

A comprehensive approach of breeders practices : from concepts learning towards a coherent modification of the systems of practices

Daniel Jamar, Pierre Stassart, Virginie Decruyenaere, Didier Stilmant

1 Context

In a first hand, we have identified, based on the driving forces that have led to suckling farms conversion to organic farming, three mains types : The ones who have made their conversion for the "market", "environment" and the "holistic" conversion (**Chap. 3.6.** "Link between market access and environmental pressure of organic beef production systems"). In a second hand, some tensions, between organic rules and agro-food chain expectations (**Chap. 3.2.** "Missing protocols and legitimacy systems"), have been highlighted by breeding practices close by organic rules limits and focussed on the knowledge, the coherence and the competencies of the conventional frame of references. Indeed, face to this conventional frame of reference, the organic frame and its actors remain, from a conceptual and a technical point of view, are not well fitted out (**Chap. 1.1.** "Equipping sustainable production chains").

1.1 The tensions in link with the animal health and the grazing managements

From the organic rules point of view (EU regulation 1992), it is prohibited to administer allopathic treatment in a preventive way and the herbivores have to graze as soon as the soil and climate allow it.

- **ANN.I.B.5.4.b** : *If the product aforementioned (not allopathic) are not efficient enough to fight against the disease **and** if the care are essential to reduce animal distress and pain, it is possible to use, under the responsibility of a veterinarian, allopathic veterinarian drug from a chemical origin or antibiotics, (...)*
- **ANN.I.B.5.4.c** : *the use of allopathic veterinarian drug from a chemical origin or of antibiotics to perform preventive treatments is prohibited. [is considered as preventive : ... all the treatments performed without or before any symptom manifestation by the animal....*
 - *... treatment applied without or before that the health problem have been diagnosed*
 - *... treatment applied in a repetitive and collective way on an animal group (AMB)⁽³⁾*
- **ANN.I.B.8.3.1** : *..... herbivores have to have free access to grasslands as soon as the conditions allow it.*
- **ANN.I.B.8.3.4** : *as a derogation to the point 8.3.1., the final phase of cattle fattening ... can take place in the cowshed if the time spent inside does not*

⁽³⁾ Belgian Ministerial Order

exceed one fifth of animal lifetime and, in any case, a period higher than three months ...

1.2. Hypothesis and objectives

The following hypothesis can be drawn from these observations :

- 1) In link to their re-conversion mode (**Chap. 3.6.** "Link between market access and environmental pressure of organic beef production systems"), breeders will face the parasitism problem and develop different practices more or less in coherence with the conventional approach.
- 2) The analysis of the grazing management of these groups of farmers will inform us about their perception of the parasitism problematic.
- 3) There is a difference between the means obligations of the organic rules and their translation in the field that the under-equipment of the organic frame of reference does not allow to face.
- 4) A re-conceptualisation, through cross learning process, of the triangular relation existing between the cattle, the parasites and the grassland is necessary to equip organic farmers with coherent and efficient practices, and this more especially during the re-conversion phase.
- 5) Such learning process re- questions (1) the pertinence of organic system to answer the environmental challenge and (2) the tensions existing between the agri-food chain (convention of qualification and convention of effort) (**Chap. 3.2.** "Missing protocols and legitimacy systems") and the organic convention (agri-environmental premiums, certification) (**Chap. 3.6.** "Link between market access and environmental pressure of organic beef production systems").

In this context, the aims of this research are (1) to identify the diversity and coherence of the parasite management practices, (2) to understand breeder conceptions under-leading these practices, (3) to interpret them, together with some co-constructed alternatives, in terms of farming system management, environmental pressure, food-chain management and product qualification.

2 Material and methods

This research, even if "eco-centered", is in keeping with the "holo-centered" research intervention (Hubert 2004) performed in the field of a super-market organic meat agri-food chain. However, the breeding taken into account in this work are not limited to the furnishers of this chain.

2.1 Heifers follow up during the grazing season

Fifteen suckling farms, representative of different Walloon agricultural areas and from different re-conversion mode to organic farming (**Chap. 3.6.** "Link between market access and environmental pressure of organic beef production systems") (table 1), were followed up.

Table 1 : Typology of the 15 farms followed up in linked to their location and conversion mode

	Location					
Conversion mode	Hesbaye Limoneuse	Condroz	Famenne	Gaume	Ardenne	Ardenne Liégeoise
Market				MER	PIE, LOT, DEL, DEL, ANN, BUR, GUI	STE
Environment	DUM	GRE	HER, DEC			
Holistic	PAQ			HAY	KIE (meat and milk production)	

Within each of these farms, heifers groups were followed up from weaning till covering during two seasons : 2003 and 2004. Each animal was weighed at turnout (April-May), during the grazing season (July-August) and at the end of this season, in November. Each weighing was coupled to the sampling of blood and faeces for, respectively, an analysis of the pepsinogen content within the serum (Vercruyse) and coproscopic analysis, both by floating and Baerman methods in order to quantify the eggs of the main parasite groups and the larvae of the dictyocolus parasite responsible of the pulmonary bronchitis.

Grazed grasslands were visited monthly in order to characterize grass availability, through sward surface height measurement, and quality, through the characterization with NIRS technique of the feeding value of a grass sample picked up in a transect of the grassland. A mixed sample of fresh faeces was also picked up in order to perform the same coproscopic analyses as presented here over. Farmer practices (treatment, animal rotation on the different grazed grasslands batching, supplementation, mowing, refusal cutting, ...) were recorded all along these two grazing seasons.

2.2 Recurrent intervention with the farmers and learning groups

We have reaped advantage from the sampling and weighing process to maintain, in a recurrent way, an interactive and close contact between the different actors and heifers within a informal group composed of technicians, researcher, farmer, veterinarian,... The aim of these interactions, going beyond the weighing frame, was to allow us to highlight, to identify the conceptions existing behind these practices, their justification as the question they generate. In fact we did not want to define the common rules existing across the different systems of production but, at the opposite, to identify the particularities, the surprises that do not find some explanations in the conventional frame of reference in order to draw new hypotheses, to open new perspectives in terms of herd – environment and of breeder-consumer interactions.

In an other side, learning groups, including breeders, popularizers and experts, had been organized on thematic such as parasitism management, grassland quality evaluation, ...To modify principles well established in the collective experience in order to favor cross-learning phenomena is an unusual work in term of knowledge implementation, in term of actors networking and in term of scale shift.

- 1) Time scale : from the instantaneous scale of the coughing animal to the period during which it get thinner, from the animal getting thinner to its breeding career, from its life to the herd dynamic;

- 2) Space scale : from the parasite to the animal, from the animal to the grassland²⁴, from the grassland to farm and from farm to territory and European Union management;
- 3) Management scale : from the infected lung to the coughing animal, from the animal to the group of cattle sharing the same grassland and the same history, from the animal group to farm herd, from herd to farm management and from farm management to the corresponding agri-food chain management.

Such permanent scale shift needs an outbreak towards other forms of knowledge mobilization and networking, forms having to face the closure of the conventional and shared referential. So it was necessary in the learning groups setting up to operate a displacement in a double move : one move allowing to have a distant view of the problem through the introduction of new competencies, images, models or projects in regard to the shared referential²⁵ and, simultaneously, a move, induce by the introduction of new relations²⁶, allowing to set side by side the knowledge so mobilized and the previous, actual or future experience of these different actors. In order to allow such a double learning move, it is fundamental to meet two conditions of work : (1) to stand such intervention on some 'tensions', to say on some questions that are real stakes for the actors involved in the research, and (2) to evolve in 'protected condition', to say out of the short term and of its menace of detrimental and irreversible consequences.

2.3 Interpretation and results analysis

Due to the high systems' diversity, in terms of breed, stocking rate, type of end product, pedoclimatic conditions, ...these results did not allow the establishment of statistical analysis and comparison. We focused our attention on graphical and so qualitative representation of the interaction existing between the grasslands and the stock which valorized it including the observed parasitic pressure. This in order to understand, to develop and to present practices allowing parasite problematic management in organic systems.

In order to allow such representation and comparison, a synthetic index of the parasitic pressure (IPP) exerted by gastro-intestinal worms was established on the basis of the results of the coproscopic analyses and of worm species fertility and virulence..

$$IPP=[(OEST*2)+(TRIC+COOP+NEMA+STGO+STGU)]*2$$

with OEST, TRIC, COOP, NEMA, STGO, STGU are the semi-quantitative quotation, on a 1 to 5 scale, of the eggs densities observed in the faeces, respectively for the worms of the groups OESTERTAGIA, TRICHOSTRONGYLUS, COOPERIA, NEMATODIRUS, STRONGYLOIDES.

The Dictyocolus presence index (IPD) takes the value 0 or 1 if the Baerman's test is, respectively, negative or positive. An index of internal parasitic pressure (IPA) was also defined as the pepsinogen content within the cattle serum (Utyr).

²⁴ A grassland 'in state' does not develop the same biodiversity, the same landscape than a grassland in 'bad state'.

²⁵ Homeopath, natural grassland from naturalist point of view, autonomous model,

²⁶ Relations between breeders and veterinarians, breeders and their stocks, ...

3 Results

3.1. Parasitism representation inherited from the conventional referential (Chap. 1.1. "Equipping sustainable production chains")

These approaches have confirmed at which extend organic farmers have conserved the conventional representation of the parasitical problematic, specific to the Belgian Cattle Breeding sector. This specificity was confirmed by independent evidences from three professionals outside of the local frame of reference.

Breeders are aware of the forms taken by the parasites within their stocks; external parasites such as mites, intestinal or pulmonary worms, liver or rumen fluke; but not of the forms taken by these parasites in the grassland. In particular, the mites responsible of the scab is a crucial problem in Belgian Blue Breeding system as this breed, with a very thin skin, is highly sensitive to this parasite. In a few weeks, exasperated by the itching sensation, the skin consumed by these microscopic mites, the animal covers itself from black scabs that are bleeding slightly and have a putrefaction odor. Such view is totally incompatible with the breeder's image of the animal in good state. Defenseless, face to this mite, the animal "tired out" quickly loses weight. To control this pest, the breeder has to perform a triple intervention : to shave the animal, to 'wash' it with a product killing mites through a contact action and to inject a double dose of a product with some ivermectin acting in a systemic way. Such treatment allow to improve, temporarily the animal health status and performances till next scab crisis that can reach young as well as adult Belgian blue cattle, needing a permanent attention from the breeder side.

We insist on this parasite, even if organic breeders have, for the greater proportion of them, initiated the re-conversion of their cattle herd towards breeds with a high level of scab resistance, because we observed that this scab model is the reference for these breeders and, as a reference, it define the way the breeder represent themselves the other types of cattle parasites, their virulence in the animal and the efficient way to control them. However, gastro-intestinal parasites have, with the grassland and the herd, a complex interaction, very different from the one developed by scab mites : eggs or larvae are disseminated through the faeces in the sward where, once they have evolved towards infestant forms, they 'wait' to be ingested by grazers to start a new cycle within their host. Cattle is mainly sensitive to such parasite during the two first years of its live during which it develops an immunity without memory. Such cyclic, eco-centered, representation of worm live is difficult integrate by veterinarians and breeders focused on scab model. From the animal suffering from external and perceptible parasites, breeder shifts to the animal suffering from internal parasites. From this conceptual model, breeder imagine a defenseless cattle, with digestive guts 'crawling with worms', and have some difficulties to apprehend the complexity of the host-parasite-grassland interaction. Now this model is in harmony with their perception of a good grazed grassland, close from the over-grazing, favoring worms pressure. So, the grazing cattle, without any immunity, any competence to face its parasites, had to be 'protected' while the parasite has to be extirpated from its host and eradicated : a good parasite is a dead parasite !

Breeders and veterinarians have a wide panel of anti-parasitic product or vermifuge, to be use to extirpate all the internal parasites from the ruminants. In order to promote the use of such products, in the field, animal health industry use some

representation on which you can see young cattle without defense aside with all the panel of isolated parasites, magnified more than 100 times, focusing, in this way, on the polarity existing between the parasite virulence and the animal disease, without any place for the role played by the grassland. In consistency with this shared model, searchers, veterinarians and breeders have developed the knowledge, the know-how and the tools necessary to perform preventive, systemic and highly persistent, wide spectra, vermicide treatment schemes. The performance of such scheme is measured by the absence of gastro-intestinal worms and by a good "animal state". The concept of total parasite control has led to the development of the bolus concept in order to 'protect' the cattle against 'parasite aggression" during all the grazing season or, in a more radical way, to the zero-grazing concept.

So, an healthy cattle is a "protected" animal, "in condition", without parasite. He does not cough and has regular performances (milk yield, liveweight gain, ...). All these criteria allow, to the veterinarians and to the breeders, to manage the parasite problematic in an efficient way in an eradication scheme in coherence with their perception of "a good parasite". Nevertheless, such perception, in preventing the expression of cattle immunity and of the complex relations existing between the herd, the grassland and the parasites, has an opacity effect on other human and no human knowledge

3.2 Possible modifications, in terms of representations and practices, following the conversion to organic farming

Such perception is not coherent with organic rules principles leading to practices flirting with the limits of minimalist translation of organic rules. However, in the organic referential, these practices, reliable to the parasite perception within the conventional frame of reference, loss their coherence and efficiency without to emerge on new coherence allowing to reach both organic norms and an efficient parasite management. In such intermediary and uncomfortable situation, breeders have developed three parasitism conceptions in link to the driving forces that led them to convert their system to organic (**Chap. 3.6.** "Link between market access and environmental pressure of organic beef production systems").

The "market" breeder, who does not find any efficient alternatives, comes back to practices very close from conventional ones with :

- Systematic treatments, i.e. for the heifers, qualified as curative on the basis of faeces analysis or of veterinarian prescription;
- Important grassland access restriction for the fattened bulls.

His parasitism perception as his performance criteria remain unaltered. He remains in the conventional frame of reference to perform his learning.

The "environmentalist" breeder remains in an intermediate position and let the nature make its job. Without taking into account preventive measurement, recommended in the organic principles, he has to face, some years, some diseased animals needing curative allopathic intervention. His practices, more extensive, on the one hand, limit the pressure exerted by the parasites and, on the other hand, could accept some delay in the development of the heifers, going even till a highest calve mortality. His performances criteria shift from the individual conformation and average daily gain (ADG) to the herd rusticity with a simplification of the management rules in order to insure himself a good quality of life. The main responsibility, in term of parasitism management, lies on the herd that performed the

greater part of the learning process. In such a way, on long term, the "environmentalist" breeder selects a more rustic and resistant herd.

The "holist" breeder goes further than simply the respect of organic rules. He wants to develop some practices to avoid all the allopathic treatments against the parasites while vouching good animal performances and a minimum number of sick animals. Herd rusticity is high enough to be treated by methods accepted in the organic rules such as the homeopathy or the phytotherapy. Such practices evolution lies on an holistic representation of the parasitic problematic allowing a new interpretation of this problematic in which cattle and parasites are indissociable and in which the breeder can sustain the animal in its 'learning' process. So, he accepts that an animal losing some weight or coughing does not necessarily has digestive guts 'crawling with worms' and that this is not necessarily good for this animal to give it an anti-helminthic product. Such a representation of this problematic must be associated to new performances criteria : animal health reflected by its career in the herd, herd health reflected across the generations,... The grassland is also taken into consideration in this representation and grazing management may modify host-parasite interaction at cattle benefit. Refusal is not the reflect of a bad grazing management but well a reflect of the host-parasite interaction...

3.3 Identification of four functional types of grazed grasslands

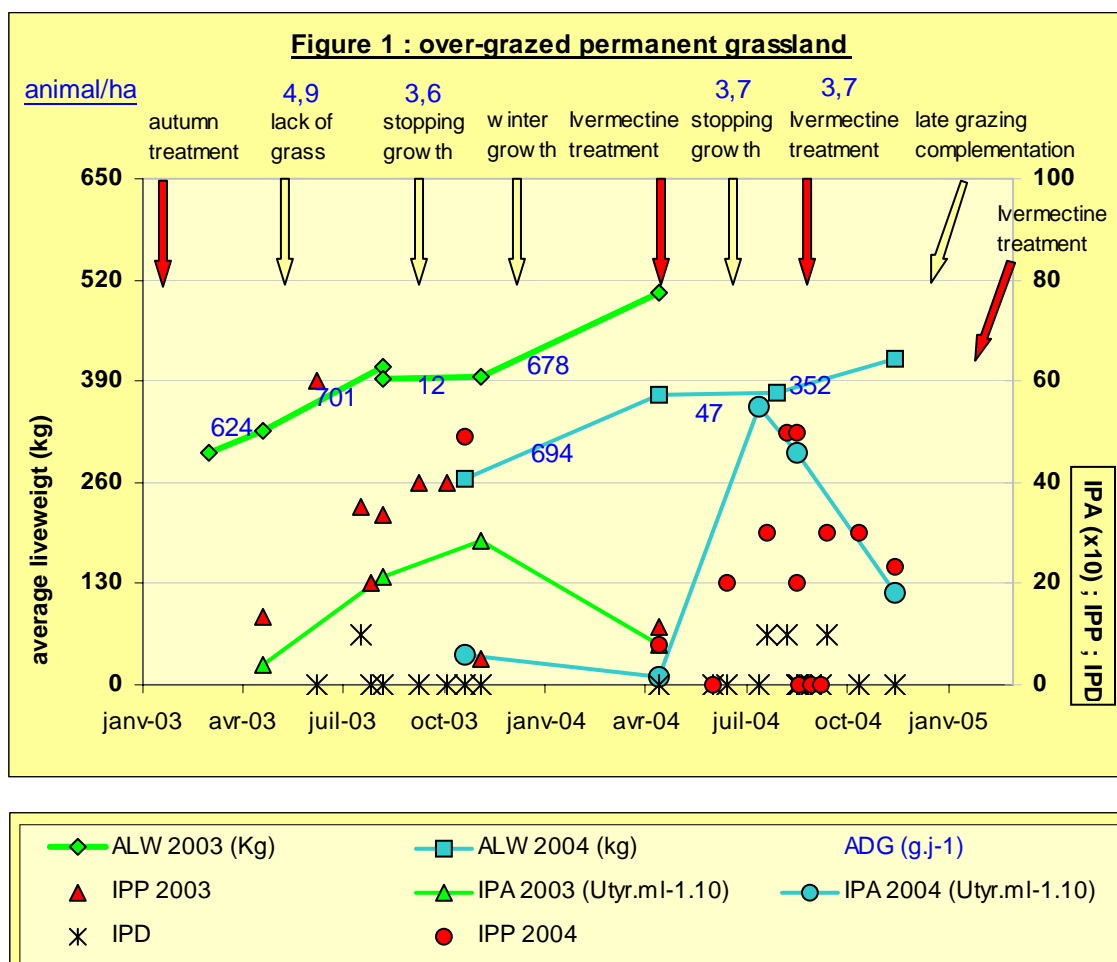
Across the two seasons we followed up, in the 15 farms, 16 heifers groups per year, evolving in 16 grasslands. Each grassland may be, in some cases, divided in several parcels and is integrated in a farming system in interaction with (1) its soil and climatic conditions and (2) its commercialization channel (calve sold at weaning, fattened animal, short or long channel, ...). We did not choose to work on a representative farms sample allowing cross comparison but well on heterogeneous systems in order to apprehend model and point of view diversity and, in this way, to stimulate cross learning and knowledge emergence. Such knowledge is not an experimental demonstration, supported by a rigorous statistical scheme, but some hypotheses and concepts, to be experimented, reflecting the observations. The description of these 15 organic farms, with cattle meat production, will not be developed. We focused our attention on the heifers as they allow an analysis of the mechanisms mobilized in parasitism management and as they are a common point allowing a formal link between the different systems.

A typology performed across these 16 grasslands have identified four main functional types describe hereafter on the basis of four representative systems selected within the farms followed up. We described, in a first step, the farmer conception of his grasslands with his objectives and performance criteria. In a second step, we focused our attention on the evolution of animal performances and of the parasitic pressure (gastro-intestinal worms) in 2003 and 2004. We have to keep in mind that 2003 was dry and warm; conditions unfavorable to parasitic worms development; while 2004 was wet and warm and so, especially favorable to parasitic worms development and survival in grassland.

3.3.1 The over-grazed permanent grassland

Such grasslands are typical for systems with "market" based conversion with more intensive practices inherited from the conventional frame of reference. In particular, these breeders have some difficulties to reduce their cattle number when shifting from conventional to organic farming. So, without surface increase and following the reduction of their surface productivity, there is an effective increase of the grazing pressure. Grassland management lies on a strict segregation of the cut and grazed grasslands. The first breeder's target is to control, by grazing, grass growth. He performs early turnout and adjusts the animal stocking rate (increase in spring, decrease and/or herd supplementation in autumn) in order to limit the extension of refusal zones. His performance is to maintain a close-cropped grassland all along the year ('zero refusal at turn in'), with a young and rich grass. From his point of view, this target is more difficult to reach in organic system as he observes refusal, in spite of a high stocking rate, and weeds (thistle and broad-leaves dock) development. Weeds that he can not manage with herbicides. So, to reach his target, he performs several refusals mowing all across the season.

Figure 1 : Heifers performances and parasitic pressure evolution, during 2003 and 2004, in an over-grazed permanent grassland (DELMOGE)



The breeder representative of this group shifted his breed from the Belgian Blue to the Parthenais and Limousin breeds. In 2003, 19 heifers (327 kg of liveweight; 13,3 months old); 10 Belgian Blue, 4 Parthenais and 5 Limousin; were allowed to graze, since the 20 of April, a parcel of 3,9 ha. In the context of our intervention, with regular

animal performances and parasitic pressure follow up, the farmer agreed to adjust his treatment to the analyses results.

First of all, in 2003, he suppressed the first treatment, in the spring, at turn out. Due to the ivermectin treatment performed in autumn 2002, at turn in, the heifers revealed a low level of parasitic pressure ($IPA = 0,4 \text{ Utyr.ml}^{-1}$) in 2003 spring. From May till August the heifers valorized a good grass, available in quantity and quality, as reflected by their good performances : 701 g.d^{-1} . Nevertheless, the eggs excretion, quantified by the IPP and reflecting the level of grassland contamination, quickly reached a 60 value in June. However, in July, the dry conditions had stopped the evolution of the infesting larvae and reduced the classical pick of infestation observed in August/September (Mage 2004). Indeed, during this period, eggs excretion remained moderated ($20 < \text{IPP} < 40$). So the heifers had tolerated a moderate pressure of the parasites in their fourth stomach, as highlighted by the pepsinogen content (IPA) remaining under $2,0 \text{ Utyr.ml}^{-1}$ till July and under $3,0 \text{ Utyr.ml}^{-1}$ till November, before to decrease during the winter period. Under such conditions had allowed them to develop their immunity even without anti-helminthic treatment. From the animal performance point of view, the dry conditions had decreased grass availability since the mid of August leading to very low liveweight gain of 12 g.d^{-1} , this in spite of a reduction of the heifer stocking rate, from $4,9$ to $3,6 \text{ heifers.ha}^{-1}$, and a late supplementation. Across all the grazing season the performances were of 119 g.j^{-1} and grassland productivity was of $0,549 \text{ kg liveweight(LW).ha}^{-1} \cdot \text{d}^{-1}$. Once in cowshed, the heifers performances increased till 678 g. d^{-1} . So, they reached, at 24-25 months, liveweight close from 500 kg at first insemination.

In 2004, at turn out, the 22 of April, a new group of 14 heifers (13,4 months, 373 kg LW) was put on the same grassland ($3,7 \text{ heifers.ha}^{-1}$, $1394 \text{ kg LW.ha}^{-1}$) after winter performances of 694 g.d^{-1} . This time, unsatisfied from the performances observed during the preceeding season, that the farmer assigned to the occurrence of parasite; the analyses being positives ; the farmer decided to perform an anthelmintic treatment at turn out.

The mild 2003-2004 winter allowed the survival of numerous eggs excreted in autumn, so the grassland remained infested in spring. So the heifers ingested the infesting larvae and started a new excretion cycle in June, as underlined by an IPP of 20. As the climatic conditions allowed a good parasite survival in grassland, they infested the heifers in a massive way ($IPA = 5,5 \text{ Utyr.ml}^{-1}$) leading to a permanent increase of the excretion till the end of August ($\text{IPP} = 50$). *Dyctyocolus*, favored by wet and moderately warm conditions, was observed since the end of July with some light cough symptoms. Animal performances were low during these four first grazing months (47 g.d^{-1}), this in spite of good grass availability.

At the end of August, the farmer decided to perform a new treatment (ivermectine) stopping directly all excretion. Now this excretion started again 4 weeks later underlining the quick cycle of the parasite and the moderate but permanent heifer re-infestation ($1,8 \text{ Utyr.ml}^{-1}$). In parallel to this treatment and in spite of good grass availability (sward surface height of $5,7 \text{ cm} + 30\%$ of refusal area), the farmer started to supplement his animal with $1,5 \text{ kg of cereal.heifers}^{-1} \cdot \text{d}^{-1}$ and to cut the refused areas. These different measures led to moderate animal performances with 325 g.d^{-1} . So, at the end of the 7 months of the grazing season, grassland productivity was of $0.818 \text{ kgLW.d}^{-1} \cdot \text{ha}^{-1}$ with mean liveweight gain of 222 g.d^{-1} . Heifers reached a mean liveweight of 426 kg at 20,1 months, needing some performance as high as 1132 g.d^{-1}

if the breeder want to reach his target of 550 kg at 24 months, for the first insemination. In spite of a third treatment performed at turn in and an important supplementation, such high performances are very difficult to reach. Moreover, these heifers, without any parasite pressure during all the winter, had to stimulate their immunity during the next season, during their period of gestation or at calving, period during which immunity reaction are very weak.

This analysis highlights that such grazing management did not allow, during these two grazing seasons contrasted from the climatic point of view, to reach breeder targets. In 2004, three treatments, among which two were performed in a preventive way, did not control the parasitic pressure in an efficient way. And, overall, did not reach the organic rules principles allowing to stimulate cattle immunity reaction.

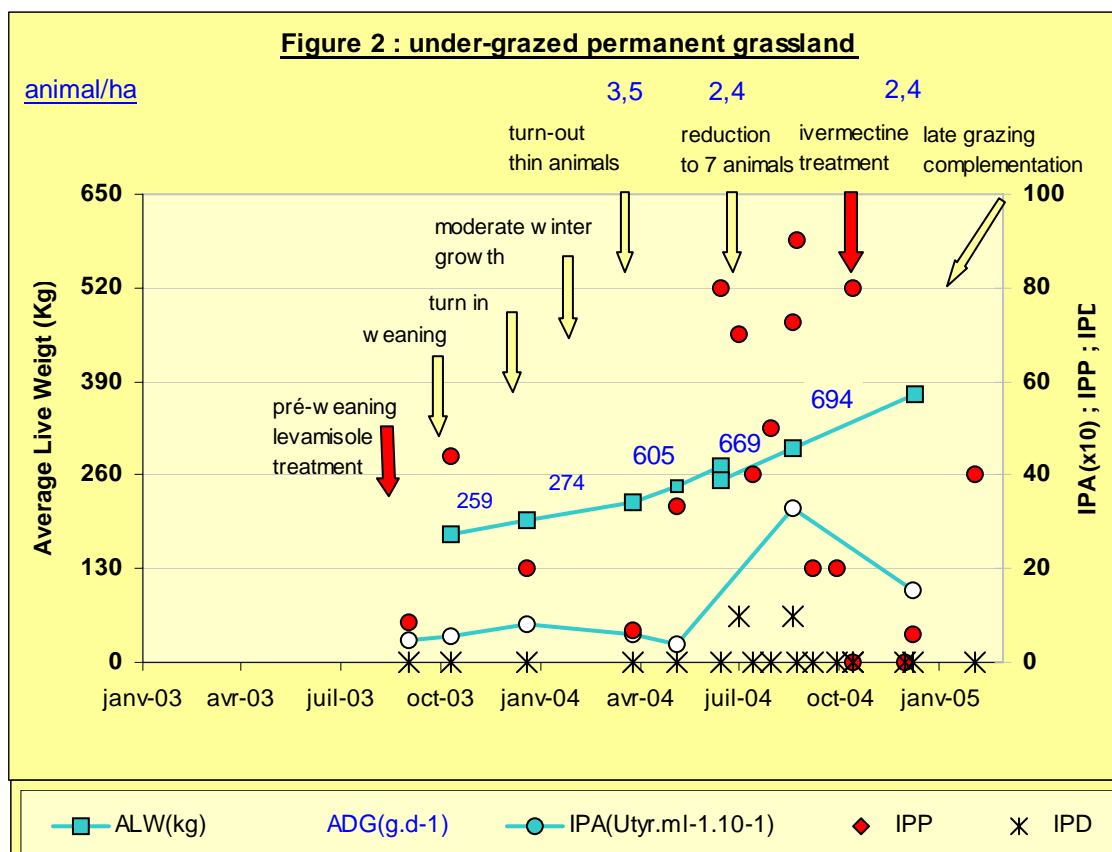
Based on these observations, the breeder has to make a choice. Either he comes back to the coherence of the conventional frame of reference, with persistent and systematic treatments in order to protect the animal while sharply reducing the level of grassland infestation, or, face to the inefficiency of the punctual treatments, he tries to understand and to represent himself the host-parasite-grassland interactions, to learn some new performance criteria and practices in phase with organic farming frame of reference. However this frame of reference is not stabilized. We can find, within it, different 'truths', once infirmed, once confirmed.

3.3.2 The under-grazed permanent grassland

Such grasslands are found in systems with "environmental" based conversion. Their Utile Agricultural Surface integrates mainly permanent grasslands with a low stocking rate. These farmers manage wet grasslands, grasslands included in a landscape with a high variety, grasslands without farming lease, ... In all these situations, farmer aims is to adjust animal stocking rate to a level low enough that to be sure that, whatever the climatic conditions and the season, he will not have to intervene for example to decrease the stocking rate, to supplement his stock, ... Usually, there is a late turn out to insure grass availability and the establishment of grass reserve 'on feet' to cover dry periods. These grasslands receive a low level of fertilizer and graminiae are the dominant species. A late turn in is usually observed.

The breeder representative of this group shifted from a crossed Belgian Blue * Charolais herd to the Blonde d'Aquitaine and this through a progressive incorporation. In his grasslands management, he distinguished cut temporary grasslands in rotation with cereal crops, permanent grassland exclusively cut and permanent grassland exclusively grazed. His forage stocks were higher than his herd needs. He considered this situation as securising. Finally, his farm is broken up in a high number of small parcels : the 70 ha of the Utile Agricultural Surface included 49 parcels. This increase the complexity of grazing management in term of group size *versus* parcel surface ad equation : "if I do not take care I spent all the season to move the groups from one field to the other".

Figure 2 : Heifers performances and parasitic pressure evolution, during 2003 and 2004, in an under-grazed permanent grassland (PIERMOGE)



The 2nd of September 2003, while young calves, of less than 2,8 months, remained under their mother, the pepsinogen concentration in the calves blood was at a normal level of 0,5 Utyr.ml⁻¹ underlining a low level of fourth stomach infestation by the worms. Parasite eggs excretion was linked to tricostrongle occurrence. These parasites, with a low level of virulence, colonize the small intestine of young cattle. Due to a hot and dry summer, *Dyctyocolus* was not identified, nevertheless the breeder, being in the habit to perform a treatment with the Levamisole (non persistent drug), did it : "each year I make it, at this season, when calves cough... Three to four days later this is over, they don't cough any more. Usually they start to cough at the beginning of august".

One month later, the 10th of October, the calves were weaned. They weighed 197 kg at 4 months. The parasitic pressure in the fourth stomach remained low (IPA = 0,6 Utyr.ml⁻¹) while the excretion (IPP) reached levels as high as 44 but always with a high tricostrongle occurrence that was not interrupted by the Levamisole treatment. These calves remained in grassland till the mid of December. At turn in, the pepsinogen level had lightly increased (IPA = 0,8 Utyr.ml⁻¹) while the IPP decreased till a level of 20. After weaning, the calves performances were, in mean, of 259 g.j⁻¹ and stabilized themselves at 274 g.d⁻¹ during the winter.

In spring 2004, the 25 of march, a group of 10 heifers, weighing 223 kg at 9,5 months, were turned out on permanent grassland of 2,87 ha. With 779 kg LW.ha⁻¹, The animal stocking rate was low, half than the one observed in the over grazed grassland, but the potential of parasite dissemination was highest as we have 3,5 young, not immunized, animals per hectare. In agreement with the farmer, the treatment usually

performed at turn out was suppressed : the level of excretion (IPP = 7) and of fourth stomach infestation (IPA = 0,6 Utyr.ml⁻¹) being low.

There was plenty of grass, with a sward surface height of 6,7 cm at turn out, and the stocking rate was not high enough to control grass growth; the refusal covered 58 % of the surface the 7th of July; leading to a sharp decrease of the feeding value. From May till June, in spite of grass excess, the levels of excretion (IPP = 80) and infestation (IPA close from 1,8 Utyr.ml⁻¹) quickly increase. This confirmed that these young heifers were not immune and so were quickly infested. *Dyctyocolus* was detected twice : the 1st of July and the 19th of August with some light cough symptoms.

Following the low performances observed during the preceding winter, the Breeder expected a good compensatory growth. From his point of view, with 605 g.d⁻¹, the performances observed were too low. So he decided to reduce the stocking rate (2,4 animal.ha⁻¹ ; 614 kgLW.ha⁻¹) rather than to perform an anti-helminthic treatment: three heifers were discarded. The refusal of 25 % of the parcel was cut. In spite of these actions, grassland infestation still increased with an IPP of 90 the 19th of August. The IPA was of 3,3 Utyr.ml⁻¹ while animal performances reached 669 g.d⁻¹. From the breeder point of view, the heifers did not grow, they "got dirty" on their hindquarters, their hair was not nice, they needed a treatment he performed the 12 of October with a long lasting product : the ivermectine. At this time the grass was in excess, with refusal covering more than 60 % of the field, however, in order to improve the performances the breeder supplemented his heifers with 2kg.heifers⁻¹.d⁻¹ of a breeding concentrate and, since the mid of November, with pre-wilted silage.

Following the anti-helminthic treatment parasite eggs excretion stopped to start again 7weeks later while the fourth stomach infestation was also reduced to reach 1,5 Utyr.ml⁻¹ at turn in, the 20th of December. This level of infestation can be high enough to maintain animal immunity for next grazing season. In spite of this treatment, the complementation and the grass availability, the performances remained unchanged with 694 g.d⁻¹. Nevertheless, the breeder was satisfied as animal appearance was better. Grassland productivity, for the all grazing period (285 days), was of 1,808 kgLW.ha⁻¹.d⁻¹ while the mean ADG was of 653 g.d⁻¹, to say, more than twice the values observed, during the same season, in the over-grazed grassland. At turn in, the breeder was obliged to mow the grass excess in order to insure sward quality and grassland perennality.

When the breeder using over-grazed grassland asks himself if this is not better to come back to the conventional way to manage parasitic problems, the breeder using the under-grazed grassland questions his management scheme : "How to explain these poor performances ? I had make every thing right, they had all what they needed and my heifers did not grow well... ? We can argue as much as we like, ... young cattle are sensitive to worms,... when they have worms they do not growth anymore ! Next year I will perform the treatment earlier ! ... This is an experience to take into consideration, ... a so low stocking rate, to be oblige to mow the grassland at the end of the season...I will not make this again !". However, at the end, he wants to come back to more conventional treatment schemes : a litigious treatment (preventive with a long lasting drug) was performed in 2004 and he wants to come back to systematic treatments.

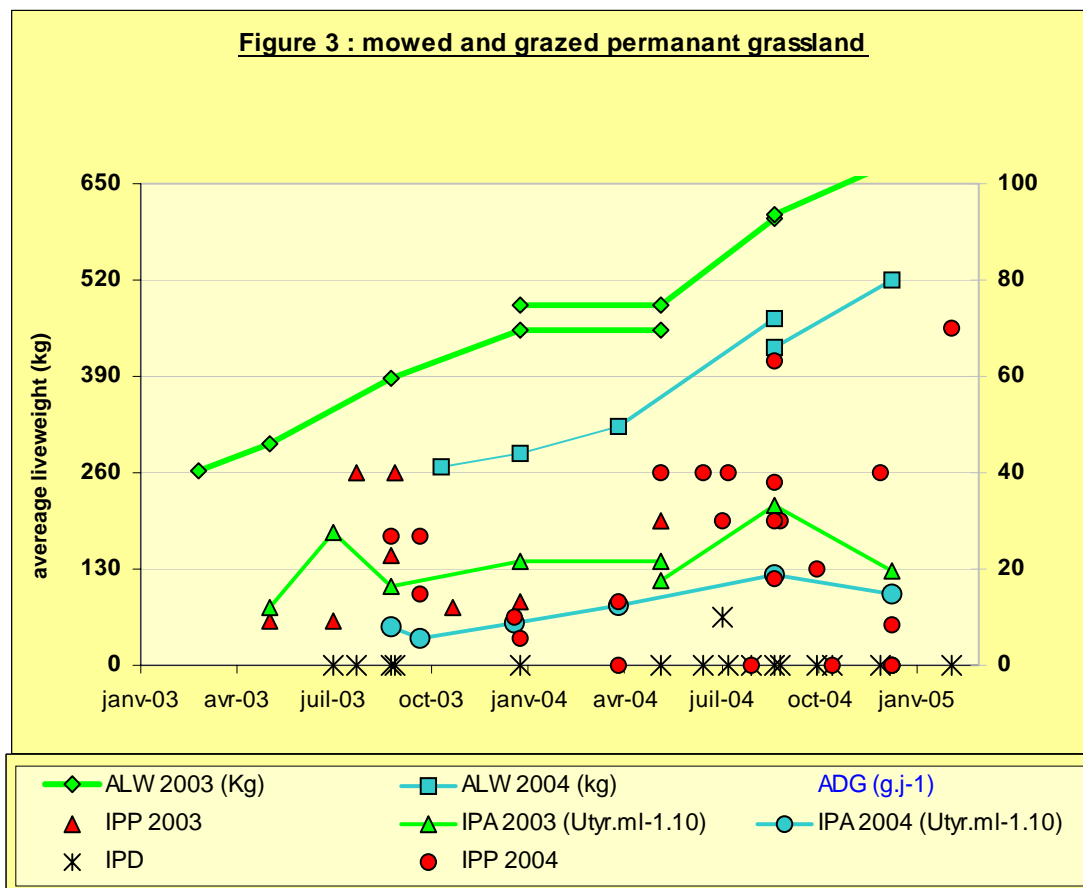
3.3.3. Mowed and grazed grassland

Such grasslands are found in some systems with "market" based conversion in Ardenne. These systems have large size fields easy to access for silage or hay making. These breeders work with a high stocking rate and manage their grassland intensively, harvesting every grass excess. Initially, they imported the greater part of their winter feedstuffs. However, following the feedstuff price increase coupled to a decrease of the stock value, they were pushed to produce a greater part of their winter feedstuffs and to reduce the stocking rate of their system. This was done by stabilizing the herd size while increasing the utile agricultural surface. The best parcels are exclusively mowed and reseeded at regular interval while the herd valorizes "mowed and grazed" permanent grasslands.

Such grassland management lies on the adjustment of the stocking rate to the autumnal production. An early turn out, allowing to depress lower the grass, is also performed together with the mowing of the spring excess on surfaces removed from the grazing rotation. In order to maintain grassland homogeneity, there is an alternance of the removed surface from year to year. If needed, a reduction of the stocking rate or an early turn in may be done in autumn while the supplementation is avoided. All over-grazing is avoided at the end of the season as the farmer is aware that such phenomenon will delay grass growth and so turn out in spring.

Breeder performance is to maintain a young and short grass, *ad libitum*, all over the season with a homogenous grazing and this together with a low workload. The sward is rich in perennial ryegrass and white clover.

Figure 3 : Heifers performances and parasitic pressure evolution, during 2003 and 2004, in a mowed-grazed permanent grassland



The breeder representative of this group shifted his breed from the Belgian Blue to the Blonde d'Aquitaine. In 2003, among the 15 heifers of 12,3 months, 5 were F1 cross (Belgian Blue * Blonde), 4 were F2 cross ((Belgian Blue * Charolais) * Blonde) and 6 were pure Blonde d'Aquitaine. They grazed a field of 6,8 ha leading to a stocking rate of 2,1 animal.ha⁻¹ or 618 kg LW.ha⁻¹.

After a moderate winter growth (536 g.d⁻¹), with a forage-based diet, the heifers with a low level of parasite infestation (IPA= 1,5 Utyr.ml⁻¹) got in the grassland the 2nd of May. They received no anti-helminthic treatment since weaning, in September 2002. Half of the parcel is subtracted from grazing, on the 20 of May, in order to be mowed. This double the stocking rate with 4,2 heifers.ha⁻¹. The conditions were close from the 'over-grazed grassland' ones. So, in spite of dry conditions, heifers were quickly infested in June (IPA shifted from 1,2 to 2,8 Utyr.ml⁻¹) and excreted a high amount of eggs in July (IPP ranged from 40 to 60). After mowing, on the 30th of June, the animals had again access to the 6,8 ha. The dry and hot summer led to a reduction of both the level of heifers infestation (IPA = 1,8 Utyr.ml⁻¹ at the end of August) and parasite eggs excretion (IPP shifted from 50, in July-August, till 10, in September-October). *Dyctyocolus* was not identified at all. Under such conditions, animal performances reached, in mean, 755 g.j⁻¹ from May till September.

At the end of August, thistles patches were crushed at a height of 15 cm. Sward surface height, in autumn, was relatively low leading to an increase of the level of heifers infestation (2,1 Utyr.ml⁻¹), mainly with encysted larvae as no excretion increase was observed while the level of pepsinogen remained high during the winter. Turn in was late. It occurred at the end of December, always without supplementation. Animal performances reached 555 g.d⁻¹ from October till December. So, they were, in mean, of 652 g.d⁻¹ for the all grazing season of 235 days. During winter, these heifers maintained their performances.

Mean grassland productivity was, for the 2003 grazing season, of 1345 g LW.d⁻¹.ha⁻¹ with, in addition, 4200 kg of dry matter.ha⁻¹ of conserved forage (0,6 UFV and 68 PDIN). Taking into account an apparent conversion efficiency of 150 g of LW per UFV, this forage would have allowed the production of 804 g of LW ha⁻¹.d⁻¹. Total productivity was then equivalent to 2150 g LW.ha⁻¹.d⁻¹. At turn in, the mowed fraction of the grassland was grazed in a short and uniform way (Grazed Sward Surface Height < 2 cm; Refused Sward Surface Height = 12 cm (5 %)) while the exclusively grazed fraction was grazed in a more heterogeneous way (Grazed Sward Surface Height < 2 cm; Refused Sward Surface Height = 13 cm (30 %)).

In the spring 2004, 6, out of the fifteen heifers from the preceding group, with some inseminated ones, took part to a new sub-group of 9 heavy heifers (GDGE : 486 kg at 26,3 months, the 4th of May 2004). This group was mixed with a group of light heifers (MOGE : 320 kg at 13,8 months, the 25th of March), in first grazing year, on the mowed and grazed grassland described here above. After one winter, with an outdoor access, the occurrence of encysted parasite remained unchanged (IPA= 1,8 Utyr.ml⁻¹) in the GDGE sub-group. Early in the spring, these parasites restarted their evolution towards the adult stage. So, in April, eggs excretion restarted, under 'good' hot and wet conditions, to reach levels as high than 30 to 40 in May-June. *Dyctyocolus* was identified once in July without cough symptom.

The MOGE sub-group followed the same evolution but with some delay : the maximal excretion was recorded at the mid of August (IPP = 60) while the infestation level remained moderated (IPPmax = 1,9 Utyr.ml⁻¹). Even if 40 % of the surface was mowed in July, a good grass availability led to performances close from 1000 g.d⁻¹ till the mid of August.

The 19th of August, the breeder sorted his animals. He took 3 heifers, to be inseminated, out of the MOGE sub-group and 3 heifers, in calf since 4 to 5 months, out of the GDGE sub-group. So the grazing pressure shifted from 2,3 to 1,5 animal per hectare. The two sub-groups GDGE (608 kg LW at 30,4 months) and MOGE (430 kg LW at 17,7 months) had grazed, without any supplementation, till the 7th of December with performances of, respectively, 644 and 825 g.d⁻¹. At this time, the excretion had a tendency to diminish while the level of infestation was clearly in regression with values of 2,0 and 1,5 Utyr.ml⁻¹ respectively for the GDGE and MOGE sub-groups. At turn in, the mean animal liveweights were of 679 and 521 kg respectively for the GDGE and MOGE sub-groups, giving full satisfaction to the farmer. The mean performances of these heifers were of 928 g.d⁻¹ across the 257 days of the grazing season.

Total grassland productivity was, calculated on the same basis than here above, equivalent to 2325 g LW.ha⁻¹.d⁻¹. As in 2003, the mowed fraction of the grassland was grazed in a short and uniform way (Grazed Sward Surface Height = 2,1 cm; Refused Sward Surface Height = 6,5 cm (5 %)) while the exclusively grazed fraction was grazed in a more heterogeneous way (Grazed Sward Surface Height = 2,6 cm; Refused Sward Surface Height = 10 cm (40 %)) leading to refusal mowing in December.

3.3.4 Rotational grazing

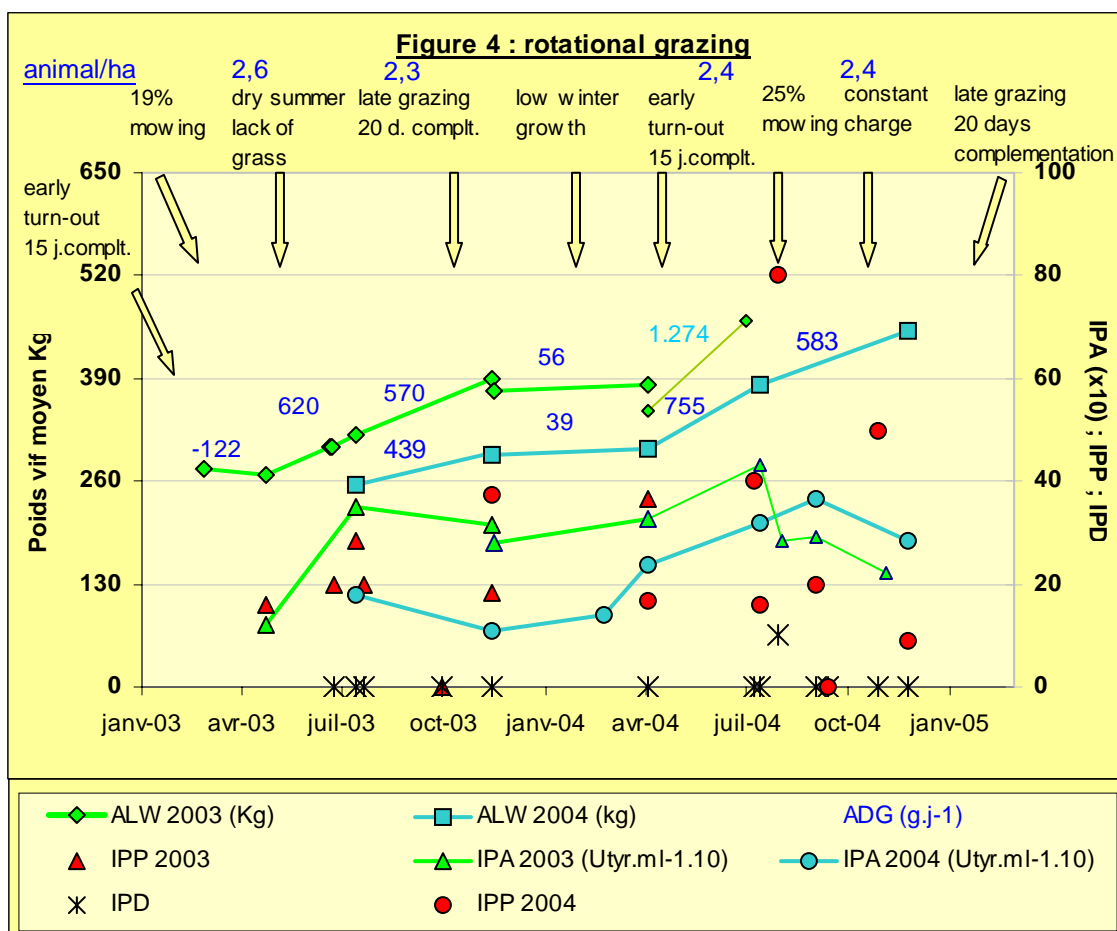
Such grazing system, inherited from the dairy model, aims to control grass growth with a synchronization of grass availability, in quantity and quality, and cattle needs. It wants to control seasonal variations linked to differential grass growth in order to maintain and intensified animal production. Nevertheless, it is more complex to manage asking more anticipation capacities and daily reaction from the breeder. This explains its easiest adoption in dairy farms, maintaining there high producing cows under grazing, than in suckling ones, where the fattened animals are in cowshed.

In segregating, in a recurrent way, the animal from its parasites, rotational grazing may participate to the control of parasite pressure in adjusting grazing cycle to parasite cycle. However, among the 14 farms followed up, only one "holist" breeder, with a mixed suckling (Third generation of Blonde d'Aquitaine crossing on the initial Belgian Blue herd) and dairy (Normand Breed) herds, applied such grazing scheme for his young stock. His motivations did not lie in the intensification of his production but well in the valorization of small and marginal parcels (forest skirt, grassland with strong slopes, ...) at the merge of his farm and in the management of the parasite problem, on growing animals, without anti-helminthic treatment.

During the first grazing season, the young cattle group followed up was heterogeneous : 6 heifers from the suckling herd, 3 Normand heifers, 5 crossed steers and 3 Normand steers. In order to allow the comparison with the preceding grazing systems, we will focus our attention on the performances from the heifers of the suckling herd while taking into account the entire group for the expression of the other parameters. The grazed grassland, with a total surface of 11 ha, included 10

paddocks. Among these paddocks, 5, for a total of 1,3 ha (19 %), were mowed before to be grazed while others were removed from the rotation once grazed. When we perform a mean of the surfaces occupied by the group of interest balanced by the proportion of the grazing season it occupied them, we conclude that this group valorized, in reality, 6,66 ha all across the season. This grazing system had a quick rate of rotation : the animals stayed, in mean, 7,6 days in a paddock while the resting period was of 31 days. Such configuration led to 31 paddock shifts.

Figure 4 : Heifers performances and parasitic pressure evolution, during 2003 and 2004, in a rotational grazing system



The pedo-climatic conditions of this Jurassic Area allow an early turn out, occurring, in 2003, the 23rd of March. However, during a transition phase, lasting 15 days, a supplementation was performed. The animals (270 kg LW at 11 months) had a grazing pressure of 2,6 (or 687 kg LW) animal.ha⁻¹ and a low parasite load (IPA=1,2 Utyr.ml⁻¹). In spite of a winter period with low performances, compensatory growth, at turn out, remained moderated (ADG = 620 g.d⁻¹). In August, there was low grass availability with Sward Surface Height of 3 cm, leading to an increase of the levels of fourth stomach infestation (IPA= 3,5 Utyr.ml⁻¹) and eggs excretion (IPP = 29). Nevertheless no disease symptom was detected and the performances were of 570 g.d⁻¹. The IPA had progressively decreased from August till December to reach a stable level of 3,1 Utyr.ml⁻¹ during the whole winter, underlining the occurrence of a high number of encysted parasite in the fourth stomach during this period. In spite of a quick rotation and of the valorization of grass regrowth, after forage making, during 31 % of the season, the level of infestation reached quite high levels.

During the winter period, the stock received only poor forage and, so, reached only poor performances ($ADG = 56 \text{ g.d}^{-1}$). They were transferred, in spring, in grassland situated in a richer area : the Condroz. High level of, both, fourth stomach infestation and eggs excretion were quickly observed ($IPA = 43 \text{ Utyr.ml}^{-1}$ and $40 < IPP < 80$). Nevertheless, good levels of animal performances, to be linked to compensatory growth, were also recorded ($ADG = 1.274 \text{ g.d}^{-1}$). This was only during July 2004 that a regression of the infestation level was observed under the normal value of $2,5 \text{ Utyr.ml}^{-1}$. So, under such pedo-climatic conditions, a rotational grazing and a lack of treatment had allowed to develop the immunity of the 27,4 months old animals. This immunity was reached without a high reduction of the animal performances reaching, in mean across the 237 days of the 2003 season, 583 g.d^{-1} , with a grassland productivity of $1,504 \text{ kg LW.d}^{-1}.\text{ha}^{-1}$. At the end of the grazing season, all the paddocks have been well (over-) grazed ($2\text{cm} < HH < 3,5\text{cm}$) without refusal.

The 23rd of March 2004, a group of 17 young stocks (8 heifers from the suckling herd, 2 Normand heifers, 5 steers from the suckling breed and 2 Normand ones', had followed a rotational scheme on 13 paddocks for a global surface of 12 ha 48. 25 % were mowed before to be grazed while, as in 2003, others were removed from the rotation once grazed leading to a equivalent surface of 6,95 ha. Stocking rate was of $2,4 \text{ animal.ha}^{-1}$ or $718 \text{ kg LW.ha}^{-1}$. The heifers, from the suckling herd, had a mean weight of 201 kg at 12,7 months

Resting time was of 5,9 days while the grass regrowth, between two grazing phase, was, in mean, of 20 days. At turn out, the young stock infestation ($1,3 \text{ Utyr.ml}^{-1}$) was light, however it increase quickly during the spring till the end of August when it reached its maximum value ($3,7 \text{ Utyr.ml}^{-1}$). Thereafter it regressed to a value of $2,9 \text{ Utyr.ml}^{-1}$ at turn in, in November. Eggs excretion (IPP) followed the same evolution with a maximum of 80 in July/August. So, under good conditions for parasitism development, a rotational grazing including more than 40 of grass regrowth do not reduce drastically the parasitism development. However the mean performances, over the 247 grazing period, were of 664 g.d^{-1}). Heifers reached liveweight of 450 kg at 20,8 months while grassland productivity reached, with $1,829 \text{ kg LW.ha}^{-1}.\text{j}^{-1}$, value close from the under-grazed grassland ones, and this without grass excess as in this last situation. This underlined the low level of productivity of these surfaces.

4 Discussion

If it is easy, from an eco-centered point of view, to understand the observations performed on the over-grazed grassland in which the under-feeding led to a reduction of the immunity while amplifying parasites cycle. Parasite that remained under control ($IPA < 3,0 \text{ Utyr.ml}^{-1}$), even if animal performances were nil, during dry season such as 2003, while it exploded under wet climatic conditions ($IPA > 50 \text{ Utyr.ml}^{-1}$) and remained difficult to control even with an allopathic treatment.

We observed that preventive treatments were inefficient to control the parasitism problematic at grassland but it proved their usefulness at turn in leading to compensatory growth... not under grazing but during the winter period at cowshed! Such situation reinforces the breeder in its options: to reduce the use of the permanent grazed grassland; becoming more a range; at the advantage of the temporary grasslands producing the forage for the winter phase. It reinforces also its representation of the animal without any defense face to the parasite and leads necessarily to an eradication strategy without any possibility for the animal or the

breeder to develop new managing competencies through learning process. The conversion to organic and the breed shift had no impact on the coherence of this representation.

In the under-grazed grassland the breeder limits the winter performances to profit from the compensatory growth phenomenon under grazing. In such system, parasite pressure and the excretion level were similar to the ones observed in the over-grazed grassland but they did not reach a level high enough to block animal growth, that remained moderate, while this level allowed the development of animal immunity. However a huge difference was observed between grass availability and animal performances with the formation of large areas of refusal. Such situation led to over-grazed area, between these refusals. Nevertheless, such refusals could also be linked to the occurrence of parasites in the animal digestive track. Indeed, Hutchings *et al* (1998) and Forbes *et al* (2000) demonstrate, respectively on sheep and cattle, that the level of animal infestation modifies the grazing behavior and the occurrence of the refused area. They claim that high infestation leads to a reduction of the appetite and to an avoidance of the area close from the faeces. Can we translate that the anti-helminthic treatment transform a trained animal back to a naïve one's as it conducts to the refusal intake? Provenza (2003) says that the animal does not avoid but select some forage in accordance to their physiological status. These three alternatives, appetite modification, rejection of some areas or, at the opposite, the selection of other areas, lead to different interpretation of what was observed in the under grazed grasslands.

5 Conclusions

Through this exploration of the parasitism problematic in organic systems, we illustrate how the research intervention can contribute to the identification of the diversity of the alternatives and technical referentials mobilized by the actors to face a problem. This phase is necessary in the construction of innovative techniques needed in the development of new food-chain frame of reference.

Such holocentered posture, where we explore the 'world' heterogeneity, diversity and contradiction (interactions between the different frames of reference), leads the research on new conceptual coherence, yet flexible, opening new representations and practices.

However, from a scientist point of view, such new alternatives must be validated through techno-centered experimentation while, from the actors point of view, shared experience is necessary.

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3.6. Link between market access and environmental pressure of organic beef production systems

Daniel Jamar, Didier Stilmant

Organic farming takes part to the Rural Development Program and more especially to the Agri-Environmental Schemes taking more and more importance since their implementation in 1992. However, agri-environmental schemes do not always reach their target and there is a real danger that environmental objectives will be misused to provide financial support to farms that are of intrinsically low environmental value, leading to potential problems during GATT negotiations process. In such context, does organic farming lead to clear benefit for the environment ? Indeed, as in conventional systems, there is a tendency, in organic systems, to separate the 'conservation' (extensively managed) from the 'production' (intensively managed) areas and not to integrate this ecological externality into the method of organic farming as a whole (van Elsen, 2000). So, the aim of this paper is to test the hypothesis that there could have an opposition between organic products commercialisation (market support) and the environmental benefits (public support) expected from organic farming systems. It is articulated in three parts. Firstly, typology of the Belgian organic beef production sector, based on socio-economical issues was performed. Secondly, based on this typology and on mechanist model of farm functioning and externalities (Stilmant *et al.*, 2004), technico-environmental performances of these main types were quantified and validated through reference farms follow up. Thirdly, nitrate profiles, an indicator of the nitrogen leaching risk and so of the environmental pressure at the parcel scale were measured in the systems identified as being the more intensive.

The typology underlined the different driving forces that can lead to system conversion to organic farming. On this basis : the 'opportunist', the 'environmentalist', the 'market driven' and the 'holist' groups were characterised.

For the 'environmentalist cluster', organic premiums, added to the other agri-environmental premiums, are the reward for the orientation given to their farming system characterised by a very low level of intensification as underlined by the low level of stocking rate. These systems can reach both environmental and economical performances with a high dependency to premium supports. This questions farmer profession statute.

The 'market conversion' cluster benefited from both the 'organic premiums' and the 'crisis atmosphere' advantages. However this second driving force was a short lasting one and so, only the producers remaining in the group furnishing the remaining organic meat food chains have the opportunity to fatten all their animals and to increase their market. The ones who remain in this clusters are the most performing ones in term of breeding and fattening know how. However, as underlined by their practices and externalities, it is legitimate to question the sustainability of these systems in the organic frame of reference and in term of environmental return for the premium they receive. Indeed they maintain intensive practices (importation of a huge amount of concentrate feeds to respond to the food chain referential, long term grassland ploughing, stimulated by the Belgian organic premiums system, that could lead to high nitrate leaching risk and to a reduction of biodiversity level. Finally, we also underline that 'market driven' systems do not adopt, aside from organic farming premiums, any additional agri-

environmental measure. This underlines the low compatibility existing between market and environmental driven forces.

Holistic system led to good margin, expressed per hectare or per BLU but to poor performances once expressed at the man-power unit. This could be linked to its high level of diversification, in term of products valorisation (crops, milk, cheese, meat with on farm marketing, ...), coupled to short marketing channel and to the parallel need in labour power. Now these conclusions have to be validated on additional farms from this group.

Crossing the typology set up in the present work, including socio-economical criteria, to the model parameterised on the basis of our field observations and to the agrofood chain dynamic has allowed to explore the combined effects of norms systems, premiums systems and market mechanisms on the sustainability of the organic meat farming systems promoted by the CAP at an European scale following the translation of this CAP frame at a regional scale.

1 Introduction

The first concern of organic agriculture pioneers wasn't to preserve the environment *per se* but, aside from the production of healthy food, to improve the richness and the stability of the soil by restoring its organic matter and avoiding synthetic inputs. In the nineties, environmental issues have been integrated in the organic farming functions and organic farming is now part of the Rural Development Program and more especially of the Agri-Environmental Schemes. Other concerns such as biodiversity, animal welfare, ... have been added later to the organic rules (Macilwain, 2004a).

The agri-environmental schemes are taking more and more importance since their implementation in 1992. In Belgium, they covered 1,4 % of the FEOGA funds while in the whole Europe this fraction is near from 5 % (Mulders, personal communication). Their target is to switch a proportion of financial assistance to farmers from commodity support to incentives to carry out environmentally beneficial measures (Ovenden *et al.*, 1998). However, agri-environmental schemes, if implemented on parcels with a low potential in term of biodiversity, if implemented at a too low level, ... do not always reach their target (Kleijn *et al.*, 2001). So there is a real danger that environmental objectives will be misused to provide financial support to farms that are of intrinsically low environmental value (Bignal, 1998), leading to potential problems during GATT (General Agreement on Trade and Tariffs) negotiations process. Kleijn *et al.* (2001) concluded that it is imperative to accompany agri-environmental schemes by scientifically sound evaluation plan.

So, does organic farming lead to clear benefit for the environment ? This aspect seems an evidence for organic farmers and for consumers and, in this way, is not, for them, an interrogation any more (Stassart and Jamar, 2005). From the scientific point of view, there is some evidences that organic systems could lead to some benefits in term of biodiversity index (Mäder *et al.*, 2002; Macilwain, 2004b; Vickery *et al.*, 2004; Hole *et al.*, 2005), however, as in conventional systems, there is a tendency to separate the 'conservation' (extensively managed) from the 'production' (intensively managed) areas and not to integrate this ecological externality into the method of organic farming as a whole (van Elsen, 2000).

Taking into account nitrate runoff the differences between organic and conventional systems are less clear (Macilwain, 2004b). Indeed, today conventional system has to be more and more aware of their environmental impact in link to their public support (eco-conditionality of European premiums). So, for all the European livestock farming systems, nitrate directive limits organic nitrogen spreading to the rate of 170 kg N ha⁻¹ year⁻¹ that is also the rate defined in the organic rules. Nevertheless, in Walloon area, in conventional systems, a rate of 210 kg N ha⁻¹ year⁻¹ can be applied on grassland. This could lead to a difference in the systems with more than 50 % of their UAS (Usable Agricultural Surface) under grassland. Such systems represent the majority of the conversions in Walloon area where 87 % of the surfaces under conversion are grasslands (Anonym, 2005). Moreover, the 170 kg N ha⁻¹ year⁻¹ value is an upper limit in organic systems while mineral fertiliser could be added to the organic fertiliser in conventional system till a total amount of nitrogen (organic + mineral) as high as 350 kg N ha⁻¹ year⁻¹. In consequence, organic farms generally operate at lower levels of N input than conventional farms in Belgian Walloon area that is intensive in regard to other European areas. Indeed, with a mean value of 134 kg organic N/ha, it is ranked in the top 10 of the 130 European areas (Mulders, personal communication). So, organic systems are expected to lead to lower nitrate leaching risk (Brangeon and Chitrit, 1999; Eriksen *et al.*, 2004).

However, to maintain their productivity, organic systems can intensify some rotations and practices with an important negative environmental impact such as ploughing in clover rich grasslands to produce cereal., As illustrated by Eriksen *et al.* (1999) in Danish dairy systems, this can lead to nitrate concentrations in drainage water higher than the European threshold of 50 mg l⁻¹. Organic systems can also intensify their practices by purchasing fertiliser and fodder, leading to level of production diverging from local capacity (Granstedt, 2000) and to lowest environmental and economical scores in comparison to system looking for self-sufficiency between crop and animal productions (Nicholas *et al.*, 2004).

Due to the high cost of the organic inputs, as fertilisers or animal feeds, we can draw the hypothesis that such intensification scheme, that seems to be in opposition to the environmental objectives of the organic way of production, could only be operated by the systems having an access to the organic market. So there could have an opposition between organic products commercialisation (market support) and the environmental benefits (public support) expected from organic farming systems.

The aim of this paper is to test this hypothesis in the context of organic beef production in Belgium where less than 25 % of the lean beef produced under organic conditions remain in this system to be fattened (**Chap. 1.2.** "Characteristics of Belgium Organic Beef Sector"). It is articulated in three parts. Firstly, typology of the Belgian organic beef production sector, based on socio-economical issues was performed. Secondly, based on this typology and on mechanist model of farm functioning and externalities (Stilmant *et al.*, 2004), technico-environmental performances of these main types were quantified and validated through reference farms follow up. Thirdly, nitrate profiles, an indicator of the nitrogen leaching risk and so of the environmental pressure at the parcel scale; indicator not always correlated to the nitrogen balance (Lord *et al.*, 2002); were measured in the systems identified as being the more intensive.

2 Material and methods

2.1 Typology of organic beef production sector in Belgium based on socio-economical dimensions

The data necessary to done this typology, taking into account Walloon area, were obtained from the organic certification services and focussed on the year 2001.

So, in 2001, from the 427 registered organic farms, 319 performed livestock production, 59 were specialized in plant productions, 32 focussed more on territorial management, with 100 % of their UAS under grassland but without self-animal production, and 17 were in a transition and undefined group. Amongst the 319 farms with livestock production, 27 were specialised in mono-gastric breeding, 107 had a dairy herd with, for 5 of them, a unit of mono-gastric production representing more than 10 % of the BLU, 119 had suckling cows (3 with a unit of mono-gastric production), 49 had dairy and suckling cows (3 with a unit of mono-gastric production) while 17 were specialized in other herbivores production. In the following step we focussed on the 157 farms : the 162 with a suckling herd but without an important mono-gastric production unit minus 5 farms with more than 20 % of their BLU represented by sheep or horse herds.

Some of the variables, such as the usable agricultural surface (UAS), the number of Big Livestock Units (nBLU), reflect farm size while other were retained to characterise farm structural organisation : the number of years since farm conversion to organic rules (NYC), the animal stocking rate per ha of UAS (BLU/UAS), the proportion of dairy cattle (%DC), the proportion of cattle BLU (%CBLU), the proportion of permanent grassland (%PG), of grassland (%G), of fodder crop (%FC), of fodder surface (%FS), of commercial crops (%CC) and the number of lean young cattle bought (YCB) or sold (YCS) per suckling cow.

As we were interested by the long term sustainability of organic farming, the typology also included socio-economical issues aiming to characterise farmers attitude towards long term and technological/environmental strategies (Flamant *et al.*, 1999). This typology crossed external (crisis, market, premiums, social demand) and internal (farmer objectives and projects) driving forces that have led to system conversion to organic rules.

To reach such a target, our data set was completed (marketing strategy, breed conversion strategy, fattening strategy, livestock's feed self-sufficiency, farm organisation, ...) and/or validated by expert knowledge (Landais, 1998) through individuals interviews; with privileged informants such as development agents, economic operators, key farmers; or collectives interviews. More than 165 actors were contacted in these ways.

The data were then processed 'by hand' and aggregated around the different strategies that have been identified in terms of socio-economical issues (Landais, 1998).

Therefore, an *a priori* groups segregation, through principal component analysis (PCA) including the variables NYC, BLU/UAS, %G, %FS, %PG, YCS was performed within each of the clusters obtained in the preceding step. The aim of this phase was also to identify aberrant structures to be removed before to characterise the remaining groups from a structural point of view and to allow systems modelling in the second part of this work (Flamant *et al.*, 1999).

2.2 Modelling of the economical and environmental externalities for the main types – adjustment of model parameters through farms follow up

Economical and environmental externalities of the main farm types identified in the first part of the work were quantified with the help of a mechanist model of farm functioning, optimising on farm recycling of manure and of fodder crops (Stilmant *et al.* 2004). The main module of the model take into account the different fluxes within the farm (herd composition and animal fluxes, surface allocation and productions, herd needs and fodder allocation, organic fertiliser production and allocation) to determine inputs needs. One module focussing on economical and one module focussing on environmental (N, P and K balances) externalities are connected to the main module.

The inputs and outputs of the model were validated through the follow up (animal moves, herd feeding strategy and productivity, feedstuff and fodder values, fertilisation scheme, crops rotation, crops productivity, ...), in 2003 and 2004, of four reference farms representative of the main types identified in the typology based on farmers attitude towards long term and on technological/environmental strategies.

2.3 Nitrate profiles measurement

Equivalent nitrogen balances can lead to different environmental pressures in link to farmer practices at the field level. For example, in system with 100% of its UAS under grasslands, a great proportion of nitrogen excess is immobilised through its re-organisation in soil organic matter, while in system where the grasslands are integrated in the rotation scheme, this excess will increase the leaching risk.

So to quantify real environmental risk in link to nitrogen balance excess and to farmer practices, nitrate profiles were quantified in 4 and 6 farms, respectively in 2003 and 2004, all, with the exception of two farms in 2004, driven by the market. In order to be representative of the sampled farms, at least 10 fields per farm were sampled, between the 15th November and the 15th December, during these 2 seasons. Three samples were collected per field. Excepting in the grazed grasslands, the samples integrated the 0-30 cm and the 30-60 cm profiles. In the grazed grasslands, each sample integrated the collection of 30 soil sub-samples, in the 0-30 cm profile, mixed before to analysis (Hennart *et al.*, 2005). Indeed these agro-ecosystems are characterised by the heterogeneity of nitrogen deposition through animal urination, leading to patches with deposition of between 400 and 1200 kg ha⁻¹ (Eriksen *et al.*, 2004), and need an adapted sampling scheme to take this heterogeneity into account. Moreover, 0-30 cm profile is a good indicator of the 0-60 cm N-NO₃⁻ load, however the relation between both has to be brought up to date each autumn (Hennart *et al.*, 2005).

The history of each sampled field was recorded to explain the observed nitrate load.

3 Results

3.1 Typology of organic beef production sector in Belgium

3.1.1 Types identified, based on the analysis of the organic conversion driving forces

The meeting of the internal driving forces (farmer's project and his undertaking) and signals from the socio-economic environment in which farmer exerts its activity (market, premiums, and social demand) leads to four coherent combinations of conversion motivations' (table 1). In all the clusters, premiums programme supporting the conversion and the upholding of production system to organic farming was a clear external driving force together with the sanitary crisis that have occurred in the traditional beef production sector. For the cluster qualified as **'financial opportunity' (I)**, integrating 22 % of the converted units, organic farming premiums are an opportunity and make part of a temporary survival strategy without clear product development. This concerns small holdings that are run by elderly farmers without successor or engaged in a secondary activity. They are interested to convert their system if this does not involve major investments or technical modifications. The cluster qualified as **'environmental conversion' (II)**, integrating 39 % of the converted units including a suckling herd was less sensitive to this last driving force. Indeed, even in the conventional referential their productivity didn't rely upon produce marketing but well on alternative agricultural function in phase with social demand : production of an environment of high quality with the support of agri-environmental premiums. On such farms, the professional activity is seen as a way to make use of the land, rather than to develop a product. Their conversion is relatively easy as it concerns only meadows and pastures and as stock conversion, from Belgian Blue to a more rustic breed, often precedes land's organic conversion.

Table 1: Typology of the conversion motivations taking into account external (crisis, market, premiums, social demand) and internal (farmer objectives and projects) socio-economical driving forces. In bold : percentage of the 157 converted units with a suckling herd took into account in our work and livestock stocking rate per hectare of UAS.

Breeder's projects	4 External signals				Organic conversion mode
	Sanitary crisis in beef sector	Support program organic farming premiums	Organic produce market development	Changes in social demand and consumption	
Declining agricultural activity	+++	+++	+		1° Financial opportunity 22% 1,4 UGB/ha
Livestock = auxiliary and/or extensive	+	+++	+	++	2° Environmental conversion 39% 1,2 UGB/ha
Livestock = Produce valorisation	+++	+++	+++	+	3° Conversion for the market 31% 1.8 UGB/ha
Looking for a new farming system coherence	++	++	++	+++	4° Farming system, holistic conversion 7% 1.2 UGB/ha

For a third cluster of farmers, with the label '**conversion for the market' (III)** (31% of our analysed data set), developments in the agricultural and agri-food sector in general, with the beef crisis and the development of a market, a demand for organic produce in particular, are opportunities to redefine their business plans and their technical and economic orientations. Aware of the difficulties that the agricultural context holds out to them, the first steps in system adaptation in order to meet market needs usually precede the conversion to organic agriculture, that is seen as a good commercial opportunity with a good premiums support programme. They are also aware that, to get products, destined to long 'stable-to-table' chain, meeting both the specifications and demands from downstream, a high technical nature is necessary. This means acquiring new skills and competence (nutrition and animal health), making appropriate technical and genetic choices, etc. These farms are primarily engaged in breeding and fattening and are grassland based systems with or without fodder crops.

The last cluster, qualified as '**holistic farming system conversion' (IV)**, is looking for coherence and consistency between technical, economical and environmental imperatives, between his produce and consumer demands, between organic rules and retailers demands, etc. These innovative farmers gradually perceive organic

rules as being the normative translations of the principles to which they subscribe, rather than simple constraints. Moreover, they go further than the strict organic rules observance through self-experimentation in areas such as 'how to reach a 100% organic cattle's feed?', 'how to reach cattle's feed self-sufficiency?', 'how to manage animal health', 'how to organise meat marketing in a sustainable way?'.

3.1.2. Groups identifications and characterisation within these 4 main clusters

3.1.2.1. Groups identification within the 'Financial opportunity' cluster

Following the first ACP two farms, with less than 40 % of PG (mean value without these farms : 81,4 % [Min : 40 % - Max : 100 %]) and with more than 10% of Crops of Economical value (mean value without these farms : 0,4 % [0% - 4%]), out of the 35 'opportunist' farms were removed.

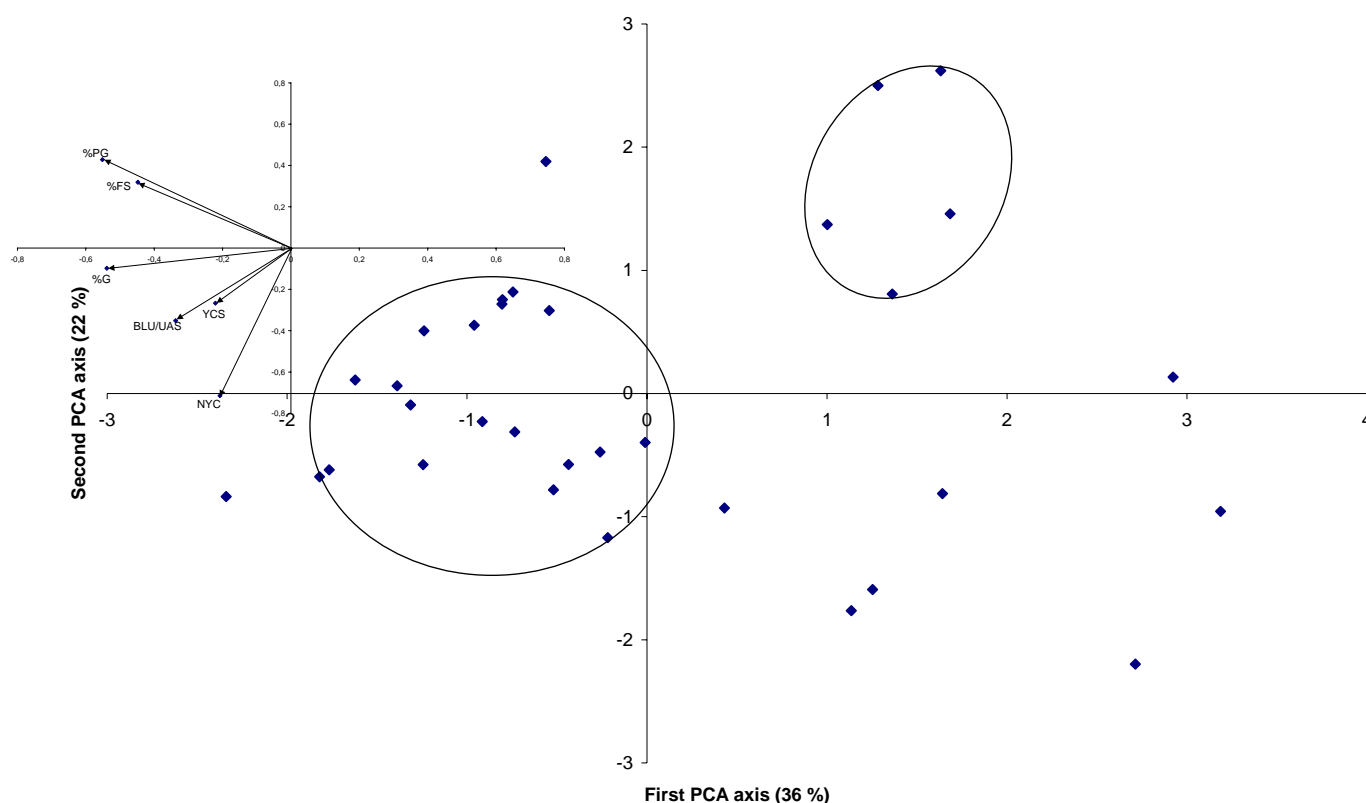


Figure 1 : Projection of the farms from the 'financial opportunities' cluster on the two first principal components from the PCA integrating the variables NYC, BLU/UAS, %G, %FS, %PG and YCS. On the top, sub-graph with the contribution of these different variables to these 2 PCA axis.

Three groups could be identified within this cluster. The first integrates 19 farms with a medium to high level of animal stocking rate based on grassland valorisation. Within this group 6 farms had more than 55 % of dairy cows. The second includes 5 farms recently converted to organic farming, with a low level of animal stocking rate and with a high proportion of fodder surfaces including a good level (14 %) of fodder crops. The last group, more dispersed, includes 6 farms, of a higher size (72 hectares), converted to organic farming since a higher number of years, with a higher proportion of temporary grasslands and with some commercial crops (Table 2). The

three farms at the periphery of the 1st group are characterised, respectively, by a very high stocking rate (4.4 BLU/ha), a low NYC (1 year) and a low level of permanent grasslands (52 %). Mix, dairy and suckling systems, are distributed in the 3 groups but at lower extend in the 2nd one.

Table 2 : Characteristics of the three groups identified within the 'opportunist' cluster (nSC : number of Suckling Cows).

Cluster I	N	NYC	%Fattening	BLU/UAS	nBLU	nSC	%DC	UAS	%G	%FC	%CC	%PG	YCS
1	19	4,5	33,158	1,411	51,189	31,579	20,619	37,931	99,021	0,925	0,054	91,396	37,474
2	5	1,4	0,000	0,779	22,828	16,600	9,524	31,722	85,754	14,186	0,060	80,565	12,800
3	6	4,5	36,667	1,342	96,623	52,667	24,112	71,848	88,906	8,912	2,182	49,051	18,667

3.1.2.2. Groups identification within the 'Environmental conversion' cluster

Following a first PCA analysis, a first group of 11 farms out of the 62 'environmentalist' farms, highly dispersed and characterised by their gradient of Commercial and Fodder Crops proportions (mean value of this group = 30 % [8 – 70 %] against 1 % [0% - 9%] for the other farms), was identified and extracted from the data set before to restart an analysis without the % FS variable, equal to 100 % for all the remaining farms.

The second PCA identified two outliers (figure 2) having a %G close from 100 % with a %PG lower than 3%. They were not included in the following GLM analysis.

There was not significant size difference between the 5 groups took into account, even if their mean average UAS ranged between 47 and 78 ha ($F(4,54) = 0.39$; $p = 0.816$) and if their mean number of BLU ranged between 59 and 102 ($F(4,54) = 0.66$; $P = 0.625$). This can be due to the low effectives observed in some of these groups.

Table 3 : Characteristics of the five groups + 2 outliers (group 6) identified within the 'environmental' cluster (nSC : number of Suckling Cows).

Cluster II	N	NYC	%Fattening	BLU/UAS	nBLU	nSC	%DC	UAS	%G	%FC	%CC	%PG	YCS
1	11	3,9	18,2	1,0	68,9	36,0	5,6	63,8	70,3	12,4	17,3	53,8	37,8
2	5	2,4	14,0	1,4	101,9	64,6	0,0	70,3	93,4	6,6	0,0	63,7	27,2
3	6	2,2	15,0	1,2	58,8	34,0	0,0	47,5	99,4	0,6	0,0	74,3	0,0
4	7	0,7	0,0	0,8	75,1	55,6	0,0	78,5	100,0	0,0	0,0	95,8	0,0
5	30	4,0	1,5	1,4	92,2	53,9	5,3	66,3	99,9	0,1	0,0	92,1	64,1
6	2	3,5	0,0	1,1	58,2	50,0	0,0	52,3	99,7	0,3	0,0	3,0	64,0

As underlined above, the first group was characterised by its high level of commercial (17 %) and fodder (12 %) crops. This allowed it to fatten some of its products, as this is the case for the group 2, having 6.6 % of fodder crops, and for the group 3, including more temporary grasslands. The group 4 was characterised by its low animal stocking rate (0.8 BLU/ha) and, as for the group 5, by systems mainly based on permanent grasslands ($F(4,54) = 100$; $p < 0.001$). In all these groups, dairy cows represented, in maximum, 5% of the cows. From the 'length of conversion' point of view, the groups 1 and 5 presented the oldest organic farms (table 3). They were followed by the groups 2 and 3 and, fare behind, by the group 4 ($F(4,54) = 15.7$; $p < 0.001$).

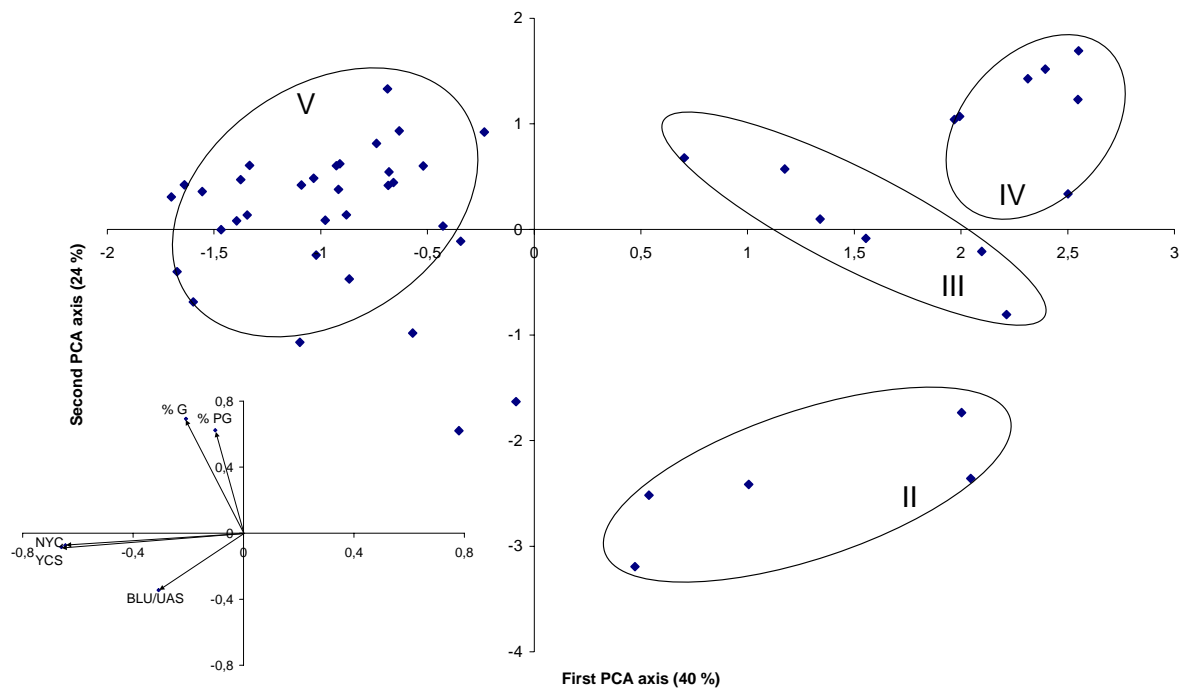


Figure 2 : Projection of the farms from the 'environmental conversion' cluster on the two first principal components from the PCA integrating the variables NYC, BLU/UAS, %G, %PG and YCS. This together with the contribution of these different variables to these 2 PCA axis.

3.1.2.3. Groups identification within the 'Conversion for the market' cluster

Following a first PCA analysis, one farm, characterised by its relatively high level of Commercial Crops (29 % against 1 % [0 – 6 %] for the 47 other farms of this group) was discarded.

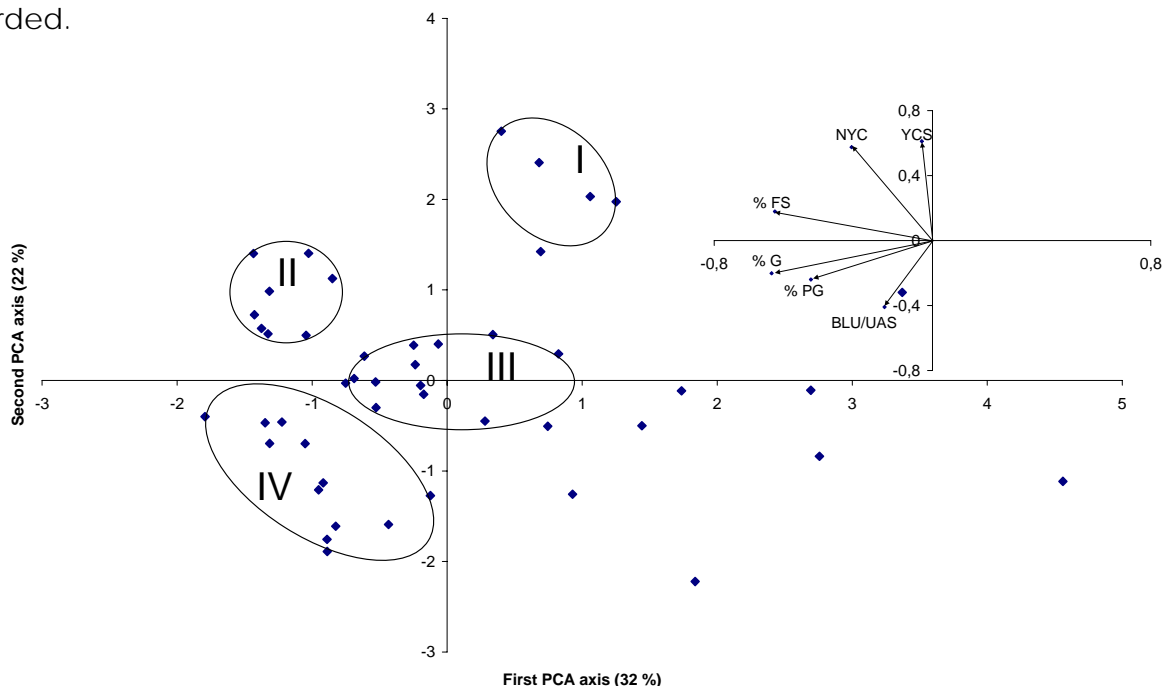


Figure 3 : Projection of the farms from the 'market conversion' cluster on the two first principal components from the PCA integrating the variables NYC, BLU/UAS, %G, %FS, %PG and YCS. This together with the contribution of these different variables to these 2 PCA axis.

In this 'Conversion for the market' cluster we can identify 5 groups including 5 to 14 farms. Mean farms sizes, ranged from 55 and 77 ha, were quite similar between these groups ($F(4,42) = 0.8$; $p = 0.55$) while stocking rate vary significantly ($F(4,42) = 3.0$; $p = 0.03$): the first (1,5 BLU/UAS) and third (1,7 BLU/UAS) groups had a lower stocking rate than the fourth one (2,2 BLU/UAS) (table 4). The groups 1, 5 and 2 as a significant proportion of dairy cows, ranged from 29 to 42 %, while only 4 out of 14 and 1 out of 12 farms had dairy cattles respectively in the third and fourth groups characterised, especially for the third group, by a important fattening activity.

Groups 1, 5 ($F(4,42) = 15.5$; $p < 0.001$) and, in a lower extend, 3 included a significant amount of Fodder Crops and/or temporary grasslands while farms from the groups 2 and 4 were based on permanent grassland valorisation ($F(4,42) = 13.9$; $p < 0.001$) (table 4). Group 5 was more heterogeneous.

Table 4 : Characteristics of the five groups identified within the 'conversion for the market' cluster (nSC : number of Suckling Cows).

Cluster	N	NYC	%Fattening	BLU/UAS	nBLU	nSC	%DC	UAS	%G	%FC	%CC	%PG	YCS
1	5	4,6	46,0	1,5	93,7	34,8	42,1	64,5	86,2	13,7	0,1	31,7	42,3
2	8	4,8	38,8	1,7	93,5	38,9	29,1	54,7	99,1	0,9	0,0	92,9	34,0
3	14	3,7	72,1	1,7	117,8	48,9	16,0	69,3	95,5	4,4	0,1	56,2	2,9
4	12	2,8	51,7	2,2	135,5	62,8	3,3	59,9	99,6	0,4	0,0	88,8	0,7
5	8	1,8	27,5	1,8	140,4	41,0	41,7	76,9	83,5	13,4	3,2	43,4	3,0

3.1.2.4. Groups identification within the 'Holistic Conversion' cluster

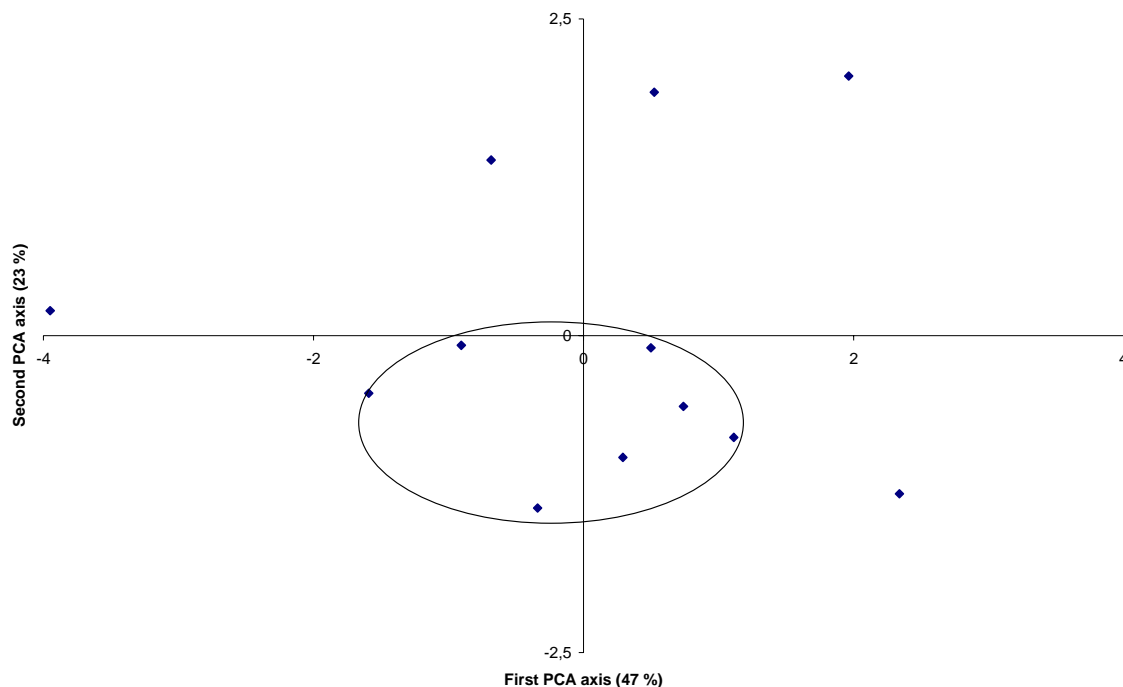


Figure 4 : Projection of the farms from the 'holistic conversion' cluster on the two first principal components from the PCA integrating the variables NYC, BLU/UAS, %G, %FS, %PG and YCS. This together with the contribution of these different variables to these 2 PCA axis.

Out of the 12 farms included in this cluster, 7 were quite similar in term of surface occupation, animal stocking rate, ... (figure 4). The main part of their cows were dairy or mix ones (89 % [43 – 100 %]) with only two farms having suckling cows. The

males are fattened. They ensured their autonomy with a relatively high proportion of fodder crops (17 % [2 – 37 %] and all but one produced Commercial crops (7 % [0 – 15 %]). These farms of 47 ha, in mean, had a moderate stocking rate (1,4 BLU/ha UAS [1,1 – 1,6]).

3.2. Modelling of the economical and environmental externalities – adjustment of model parameters through farms follow up

Based on this typology, we will model the externalities of the more representative group of the 'environmental conversion' and 'market conversion' clusters. For the 'market conversion' we will focus on the third group as the fourth one is in a transition phase as underlined by its stocking rate higher than 2 BLU/UAS, limit defined by organic rules.

The economical (gross margin) and environmental (N, P and K balances) externalities of these systems will be compared among them and to the one observed within the farms followed up and representatives of these groups.

For the 'holistic conversion', we will only present the externalities observed in the followed-up farm. Indeed These systems are characterized by a high level of complexity with the inter-connection of numerous production units; meat, milk, fodder crops, commercial crops, on-farm cheese production, ... ; and so are difficult to model.

We will not focus any more on the 'opportunist cluster' including only farms under a transition phase before farmer retirement or towards one of the other clusters.

The table 5 integrates the mean farms characteristics of the groups retained for modelling organic meat production systems externalities.

Table 5 : Initial characteristics of the two types for which the economical and environmental externalities will be modelled (nSC : number of Suckling Cows) They correspond to the groups described here above without the farms including a dairy herd.

Groups	N	NYC	%Fattening	BLU/UAS	nBLU	nSC	%DC	UAS	%G	%FC	%CC	%PG	YCS
Cluster II - 5	27	4,0	1,3	1,4	92,1	56,7	0,0	65,2	99,9	0,1	0,0	93,8	64,2
Cluster III - 3	10	3,6	70,0	1,7	103,4	52,6	0,0	59,8	95,5	4,4	0,1	54,7	2,9

3.2.1. Externalities of the representative group of the 'environmental conversion' cluster

The farm followed up as representative of the 'environmental conversion' group was characterised by a higher UAS, of 72 ha, and a lower stocking rate, of 1 BLU/UAS, in comparison to the cluster II-5 group (table 5). This means a herd of 50 instead of 56 suckling cows. 80 % of the products were sold at weaning or kept for breeding, the remaining 20 % were fattened as steers or heifers. Cull cows, sold to produce minced meat, are linked to a 18 % replacement rate.

In term of soil occupation, while grassland cover 100 % of the cluster II-5 group UAS, the environmental farm followed up included 7 % of cereal crops for self consumption. Surface productivity observed on the environmental farm was of 6 T of utile dry matter per hectare of grassland and 2.4 T of cereal/ha. Based on the stocking rate difference observed between this farm and the cluster II-5 group, we can expect a production of 6.9 T of utile dry matter per hectare of grassland, after

the deduction of drying losses of twenty percents (Stilmant *et al.* 2004), in this last group.

While in the environmental farm followed up, the cereal produced on farm allowed to cover all the herd needs, the farms from the cluster II-5 group had to buy concentrates to complement their diet during the winter period : 0.5 kg/day till weaning, 1.5 kg/day for the young cattle and 2 kg/day for fattened animals.

Fertilisation schemes are based on composted manure valorisation. The environmental farm can spread 15 T/ha, every year on temporary grasslands and every two years on permanent cut and grazed grasslands. While the mean farm from cluster II-5 group can spread 20 T/ha/year and 10T/ha/year, respectively on temporary and permanent cut and grazed grasslands.

Such management schemes led to the economical and environmental performances recorded in the table 6. These performances are quite similar between both these alternatives.

The gross margins of these extensive farms, expressed per hectare, were more than 40 % lower than the ones of market driven systems. However these performances were very close when expressed per manpower unit. Premiums, from which around 30 % were linked to organic conversion, represented more than 65 % of these margins.

Taking into account legume N fixation, representing 79 and 90 % of the nitrogen inputs respectively in the group II-2 and the environmental farm, the nitrogen balance excess reached, respectively, 47 and 36 kg N/ha with an efficiency of, respectively, 13 and 21 %. Without the N fixation pool, these nitrogen balance excess reached, respectively, 4.4 and -5.3 kg N/ha with an efficiency of 62 and 227 %.

3.2.2. Externalities of the representative group of the 'market conversion' cluster

These farms were characterised by a mean UAS of 60 ha and by a stocking rate of 1,7 BLU/UAS. This means a herd of 56 suckling cows with the production of 12 cull cows (minced meat production), of 8 heifers and of 24 fattened bulls. The replacement rate reached 23 %.

While the cluster III-3 group was characterised, on the basis of data from 2001, by a low proportion of fodder crops ($\pm 5\%$), we observed the development of these fodder crops in the two farms followed up where they reached 20 % of the UAS at the detriment of permanent grasslands. Such strategy, based on the stimulation of organic matter mineralisation following legume rich grasslands ploughing, allowed to reach good cereal (4 T/ha) and haylage (8,5 T of utile dry matter per hectare) productions.

In the modelled III-3 group, based on permanent grasslands, this productivity, valorising nitrogen fixation by legume species, was limited to 7,5 T of utile DM/ha.

Even if rough forage was the main fraction of cattle and heifers diets, a high amount of concentrates was bought to be included in fattened bulls diet, since weaning in order to be finished as young as possible, and in the fattened heifers diet during the finishing phase. During these phases the proportion of concentrates in the diet can represent more than 80 %. In the modelled III-3 group, the concentrate fraction never

exceed 60 %, as we demonstrated the feasibility of such an alternative (**Chap. 3.4.** "Re-conversion to organic farming").

The strategy of these farmers is to sold their fodder cereals in order to buy commercial concentrates with a standard and stable composition to allow such high level of integration in the diets of their animals under fattening. In the same way the excess of rough fodder production was sold.

Fertilisation schemes are based on composted manure valorisation with spreading of 20 T/ha on temporary grasslands, 10 T/ha on permanent cut and grazed grasslands and 10T/ha every two years on the exclusively grazed grasslands.

Such management schemes led to the economical and environmental performances recorded in the table 6. These performances are quite similar between both these alternatives.

The gross margin of the reference farms of the 'market conversion' equalled 102 % of the group III-3 one's. Premiums, from which around 30 % were linked to organic conversion, represented 45 % of these margins, to say 20 % less then on the systems driven by the environment.

Taking into account legume N fixation, representing 55 and 43 % of the nitrogen inputs respectively in the group III-3 and the reference farms, the nitrogen balance excess reached, respectively, 98 and 90 kg N/ha with an efficiency of, respectively, 13 and 28 %. The highest efficiency of the reference farms could be linked to the fact that the importation of an additional 17,4 kg d'N/ha under the form of concentrates is widely counterbalanced by (1) the reduction of the amount of nitrogen fixed by legumes (-8,6 kg d'N/ha) and (2) the fodder product exportation (-20,6 kg d'N/ha).

Without taking into account legume N fixation, the nitrogen balances were close from 35 kg d'N/ha in both groups with efficiency of 30 and 50 % respectively in the group III-3 and the reference farms of the 'market conversion' cluster.

Table 6 : Economical and environmental performances of the main groups of the 'environmental' and 'market' driven clusters together with representative farms of these two clusters and of the 'holistic' cluster.

	Market (reference group III-3)	Market (reference farms)	Environment (reference group II-5)	Environment (reference farm)	Holistic (reference farm)
Economical performances					
Gross Margin/ha (%)	100,0	102,01	59,97	54,94	103,49
Gross Margin/UGB (%)	100,0	102,01	76,11	91,90	174,46
Gross Margin / UTH (%)	100	102	99	99	46
Premiums/Gross Margin (%)	44,0	45,3	65,3	65,6	31,5
Organic premiums/Premiums (%)	29,1	32,6	30,0	33,8	46,3
Gross Margin / Gross Production (%)	74,5	68,3	82,9	87,9	93,1
Environmental performances					
N balance					
Feedstuffs and straw inputs (kg N/ha)	50,01	67,44	11,54	4,16	2,63
Fertilizers input (kg N/ha)	0,00	3,75	0,00	0,00	0,00
Nitrogen fixation (kg N/ha)	62,36	53,79	43,00	41,82	41,43
Fodder and (cereal crop for the holist) output (kg N/ha)	2,35	22,98	0,00	4,17	3,71
Meat (and milk for the holist) output (kg N/ha)	12,44	12,44	7,15	5,30	10,90
N balance with legumes (kg N/ha)	97,58	89,57	47,40	36,51	29,45
N efficiency with legumes	0,13	0,28	0,13	0,21	0,33
N balance without legumes (kg N/ha)	35,23	35,78	4,40	-5,31	-11,98
N efficiency without legumes	0,30	0,50	0,62	2,27	5,56
P balance (kg P/ha)					
	3,51	3,50	-0,14	-1,82	-3,15

3.2.3. Externalities of the holistic farm followed up

The farm followed up was characterised by a higher UAS, of 53 ha instead of 47 ha, with a similar stocking rate (1,3 instead of 1,4 BLU/ha) than the mean farm from the 'holistic conversion' cluster. However this farm had dairy, Normand bred – 3700 l/cow, and suckling herds. Suckling cows represented more than 40% of the cows. All the animals were fattened on the farm : 20 % as baby beef, 20 % as young bulls, 40 % as steers and 20 % as heifers. Cull cows, sold to produce minced meat, are linked to a 18 to 20 % replacement rate.

In term of soil occupation, the farm followed up was also, with 79 % instead of 76 % of grasslands, very close from the mean farm from the 'holistic conversion' cluster. The remaining surface was covered by fodder crops (11 %) and commercial (9 %) crops. They ensure, in this way, 98 % of the feeding needs of their herds.

Surface productivity observed on this holist farm was of 7 T of utile dry matter per hectare of grassland and 2.7 T of cereal/ha, this with fertilisation schemes based on composted manure valorisation. It spread 10 T/ha, every year on crops and temporary grasslands and every two years on permanent cut and grazed grasslands.

The cereal and commercial crops by-products produced on farm allowed to cover 75% of the herd needs in concentrates.

Such management scheme led to the economical and environmental performances recorded in the table 6. However it is difficult, due to the dairy and commercial crops productions, to compare these performances to the ones observed in market and environmental driven farms. Indeed, this led to similar or better economical performances than the ones observed in market driven systems when expressed, respectively, per hectare or BLU, but to lower performances when expressed per man-power unit, as 3 man-power units are used on this farm.

Premiums, from which around more than 45 % were linked to organic conversion, represented around 30 % of these margins, to say less than in the other systems.

Taking into account legume N fixation, representing 94 % of the nitrogen inputs, the nitrogen balance excess reached 29 kg N/ha with an efficiency of 33 %. Without the N fixation pool, this nitrogen balance excess reached – 12,0 kg N/ha.

3.3. Nitrate profiles measurement

In cropped land the results obtained in 2003, characterised by a very hot and dry summer, after cereals, highlighted N-NO₃⁻ loads higher than 100 kg/ha, so we focused our attention on such fields in 2004 in order to define the link existing between the number of years since temporary grassland ploughing (NYSP) and the nitrate load. As the interaction between the sampling year and the NYSP was significant ($F(2,40) = 13,0$; $p < 0.001$), we analysed our data set separately for each year.

In 2003, 13 fields, from 4 farms, were sampled. Six were sampled two months after grassland ploughing, 5 after the first cereal crop (spelt or wheat) following grassland ploughing and 2 after the second cereal crop (triticale, oat and pea mixture) following grassland ploughing. These data were integrated in a two way ANOVA analysis taking into account the factors 'farm' (fixed – 4 levels) and NYSP (fixed – 3 levels) without interaction after to have tested the absence of such interaction on the basis of two farms for which all the NYSP were represented ($F(2,2) = 11.9$; $p = 0.08$). The two way ANOVA underlined the absence of 'farm' effect ($F(3,7) = 2.0$; $p = 0.197$) together with a highly significant NYSP effect ($F(2,7) = 24.8$; $p = 0.007$). The nitrate load after the cereal crops, one (112 kg N-NO₃⁻ ha⁻¹) or two (104 kg N-NO₃⁻ ha⁻¹) years after ploughing were significantly higher than the value observed just after grassland ploughing (37 kg N-NO₃⁻ ha⁻¹).

In 2004, 33 fields, from 6 farms, were sampled. Fourteen were sampled two months after grassland ploughing, 8 after the first cereal crop and 11 after the second cereal crop. As in 2003, after to have tested the absence of 'farm' * NYSP interaction ($F(6,14) = 1.04$; $p = 0.443$), the data were integrated in a two way ANOVA analysis taking into account the factors 'farm' (fixed – 6 levels) and NYSP (fixed – 3 levels) without interaction. This analysis underlined a 'farm' effect ($F(5,25) = 6.0$; $p < 0.001$) and a NYSP effect ($F(2,25) = 6.3$; $P = 0.006$). The farms were separated in two groups with one farm having an intermediate position. A first group included three farms clearly driven by the market, with a mean load of 81.9 kg N-NO₃⁻ ha⁻¹. The second group integrated the holistic farm (24.1 kg N-NO₃⁻ ha⁻¹) and two 'market driven' farms (33.7 kg N-NO₃⁻ ha⁻¹). In opposition to the results obtained in 2003, the nitrate load after the cereal crops, one (49.8 kg N-NO₃⁻ ha⁻¹) or two (47.2 kg N-NO₃⁻ ha⁻¹) years after ploughing, were significantly lower than the value observed just after grassland ploughing (85.4 kg N-NO₃⁻ ha⁻¹).

In grassland, 29 and 32 fields were sampled, respectively, in 2003 and in 2004.

In 2003, meadow (9), grassed (10) and mix (10) grasslands were sampled. As expected meadow ($13.8 \text{ kg N-NO}_3^- \text{ ha}^{-1}$) led to lower, even if the difference was not significant ($F(2,17) = 0.5$; $p = 0.617$), nitrate load than grassed ($24.9 \text{ kg N-NO}_3^- \text{ ha}^{-1}$) or mix ($24.7 \text{ kg N-NO}_3^- \text{ ha}^{-1}$) grasslands. So, grassed (22) and mix (10) grasslands focused all our attention in 2004. No 'farm' impact was highlighted in 2003 ($F(3,17) = 1.0$; $p = 0.418$).

In 2004, as in 2003, with a mean nitrate load of $22.7 \text{ kg N-NO}_3^- \text{ ha}^{-1}$, there was no beneficial environmental impact to include a cut in grassed grasslands ($F(1,21) = 0.11$; $p = 0.744$). Once again, as for cropped land, holistic driven conversion ($6.7 \text{ kg N-NO}_3^- \text{ ha}^{-1}$) led to significantly ($F(5,21) = 3.0$; $p = 0.033$) lower environmental impact than market driven conversion ($24.5 [18.8 - 32.6] \text{ kg N-NO}_3^- \text{ ha}^{-1}$). However this conclusion has to be taken with caution as only 3 grasslands from this 'holistic' system were sampled.

4 Discussion and conclusions

The typology underlined the different driving forces that can lead to system conversion to organic farming and the importance of the organic farming premiums as such a driving force. These premiums represented 15, for the 'market' and 'holistic', to 20 % of the gross margin, for the 'environmental' driven systems. So to maintain premium support, even after the three years of conversion phase, will allow to maintain a greater proportion of farms under organic rules.

More than 20 % of these farms are under an opportunistic and so in a transition and undefined situation. 77 % of them are small structures of less than 40 ha in comparison to the 65 ha of the 'environmentalist' and 'market' clusters. Now, as for the 'environmentalist', due to their low stocking rate, their adhesion to organic rules implied few adaptation of their system. And, as for the 'market' cluster they fattened a part of their animals and valorized their production on the organic market. However, this contribution is temporary and linked to a demand higher than the offer, with the development of a weak know-how in term of fattening management. They will be the first to loss the market as soon as the demand will decrease (**Chap. 1.2.** "Characteristic of the Belgium Organic Beef sector").

Another group (23 %) identified within this 'opportunist' cluster includes bigger structures with a higher proportion of dairy cows and of commercial crops.

For the 'environmentalist cluster' these premiums, added to the other agri-environmental premiums, are the reward for the orientation given to their farming system characterised by a very low level of intensification as underlined by the low level of stocking rate. However is the first groups of this cluster, including 18% of these farms, in the right cluster. Indeed this group, with a high proportion of commercial and fodder crops, seemed to have an intermediate position between the 'environmentalist' and 'holistic' clusters.

The 'market conversion' cluster benefited from both the 'organic premiums' and the 'crisis atmosphere' advantages. However this second driving force was a short

lasting one and so, only the producers remaining in the group furnishing the remaining organic meat food chains, mainly included in the groups 3 and 4 of this cluster (= 55 % of these farms in 2001, less today), have the opportunity to fatten all their animals and to increase their market. The ones who remain in this clusters are the most performing ones in term of breeding and fattening know how. However, as underlined by their practices and externalities, it is legitimate to question the sustainability of these systems in the organic frame of reference and in term of environmental return for the premium they receive. Indeed they maintain intensive practices, with possible unexpected environmental impacts, at the margin of the organic rules. Practices such as :

- (1) The importation of a huge amount of concentrate feeds in the diet of their animals during the fattening phase. This practice is support by the rules imposed by the food chain and its conventional referential (Chapter 1.1. "To equip sustainable production chains" and chapter 3.4 "organic fatening referencial") asking for fattened bulls of less than 24 months. To secure the performance of their animals and so their good economical valorisation, farmers prefer to sell their cereal crops and to buy standard concentrate products even if this reduce their economical performances... at the animal scale but not, due to a reduction of the carcass rejection risk, at the annual scale. However our results underlined that such practice did not modify deeply the nitrogen balance but, at the opposite, increase the nitrogen use efficiency as these farms exported an important amount of fodder products ! Is this practice sustainable ? At short term, it becomes more and more difficult to sell such type of fodder products (low demand). So breeders increase their animal stocking rate to valorise these excess : they valorise their cereals in a mono-gastric production unit and/or they increase their cattle herd. In this way, they produce additional manure to valorise on their field and to maintain the fertility of their system. As N use efficiency is never of 100 % and as more N is mobilised in these systems the global N leaching risk is increasing.
- (2) This high N mobilisation level could be linked to ploughing practices to valorise the potential offered by the mineralisation of the huge amount of organic matter included in the soil of long term grasslands. The sustainability of this practice, stimulated by the Belgian organic premiums system, promoting mixed systems including crop and animal production by decreasing, per block of 32 hectares, the premiums support on grasslands and on crop surfaces, is questionable from two points of view. Firstly, as we demonstrated, through N-profile measurement at parcel scale, this practice increases the nitrate leaching risk with higher nitrate loads under cereal crops following ploughed grasslands (Eriksen et al., 2004) : amount upper than 100 kg d'N-NO₃⁻ ha⁻¹ were recorded during dry year (2003) with a high autumn mineralisation rate coupled to a low level of exportation by the crop. Secondly, such practice mobilises the important carbon sink represented by long term grassland soils becoming in this way more a source than a sink. Thirdly, this reserve of organic mater, that is limited, question the long term sustainability of this management way.
- (3) Nevertheless, once we exclude N input through legume fixation, intensive organic management allow to reach lower nitrogen balances, at farm scale, than conventional suckling systems (without fattening), (Stilmant et al., 2004a). This is supported by nitrate leaching risk observations under grasland. Indeed, in spite of the high productivity of these grasslands, to be linked to high

legume proportion, there was no important risk, in term of nitrate leaching, under grasslands. In the market driven systems, the critical level of 40 kg N-NO₃⁻ ha⁻¹ (R. Lambert, personal communication), was nevertheless reached in 12 % of the sampled.

- (4) The generalisation of 'market driven' practices should also have a negative impact on the biodiversity : high stocking rate in grassland and increase of the temporary/permanent grassland ratio.

Finally, we can also underline that 'market driven' systems do not adopt, aside from organic farming premiums, any additional agri-environmental measure. This underlines the low compatibility existing between market and environmental driven forces.

Environmental driven systems underlined the possibilities to reach both environmental and economical performances with a high dependency to premium supports. This questions farmer profession statute.

Holistic system led to good margin, expressed per hectare or per BLU but to poor performances once expressed at the man-power unit. This could be linked to its high level of diversification, in term of products valorisation (crops, milk, cheese, meat with on farm marketing, ...), coupled to short marketing channel and to the parallel need in labour power. So the conclusions drew up for this study case have to be validated on additional farms from this group.

Crossing the typology set up in this analysis, including socio-economical criteria, to the model parameterised on the basis of our field observations and to the agrofood chain dynamic (**Chap 1.1 and 3.2**) has allowed a deeper exploration of the different organic farming systems dynamic in their complexity, and from their sustainability point of view. This approach has explored the combined effects of norms systems, premiums systems and market mechanisms on the sustainability of the organic farming systems promoted by the CAP at an European scale following the translation of this CAP frame at a regional scale.

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PART IV

IMPACT ON SOCIO-ECONOMICAL DEVELOPMENT

Impacts on the players

The area of collective action should be considered an area of the simultaneous reconstruction of both the players' and researchers' knowledge as well as of player-researcher relations. In our study, this area was located on a transitional trajectory that aimed to explore a specific course towards forms of organisation of products and competences that were not there and would open up toward more sustainability. Part III of the report gave an in-depth presentation of the sociological, economic, and agricultural results of this action. In Part IV we shall present briefly the outcomes for the various partners in the research, *i.e.*, impacts that can be divided into three categories, as follows:

- socio-economic impacts on the chain studied,
- sectoral impacts on the organic operators' federation, and
- territorial impacts on the development of a local development project.

1 Impact on the mass distribution organic beef chain: Limousin/breeder-fattener

The mass distribution organic beef chain underwent a series of significant changes. When it comes to the overall situation, the distributor with whom we signed a co-operation agreement saw his mass distribution market share of organic beef rise from 30 percent in 2002 to 70 percent in 2005. This was indeed part of an overall strategy of promoting organic produce lines. However the project was able very specifically to create the conditions that made it possible to achieve the objective of switching from the Belgian Blue to the Limousin breed with a 100 percent conversion rate by May 2005 whereas the distributor and stock farmers had foreseen twice that amount of time to achieve this result (100 percent white 2006).

For the grouping of organic farmers and the collection co-operative, the recognition of their status as breeder-fatteners and their importance in respect of the safeness of the chain's products, the players' nearness with a view to qualifying the product, and the supermarket's reputation made it possible to set up a unique type of organisation in Europe, according to the distributor's remarks. This model of organisation completely revamped the agrifood chain's industrial organisation, which was aimed on the contrary at separating and specialising each link in the chain. This recognition, which was at the heart of the transaction effected by the intervention research, made it possible in return to develop the procedure for switching from the Belgian Blue to other, more rustic, cattle breeds such as the Limousin. This was the initial jumping-off point of the research into the chain's sustainability. This transformation had been stalled within the chain for five years, and in return blocked all differentiation processes, since the "multiple breed" situation prevented the development of the convergence that was necessary for the qualification project. In particular, it left the middlemen, whose competences when it came to picking up the animals enabled them to introduce a highly heterogeneous supply of cattle into the chain, free to do as they felt. This stalemate prompted many of the stock farmers to disengage, as they saw no clear signal on this point.

Recognition of the breeder-fattener status and the change of breed were the driving forces of the chain's consumer communication and promotion campaign.

This campaign, which was launched in October 2004, revolved around three operations, namely, labelling, consumer information, and the distribution of coupons. As a result of the labelling and entire traceability system described in Chapter 3.3, it is now possible in Belgium to inform consumers of the chain's qualification project through the three references of "*naisseur*" (calf producer), "*éleveur*" (stock farmer), and "breed". The October-November issue of the distributor's bimonthly information bulletin, which went out to several hundred thousand households, contained a two-page explanation, under the heading of "sustainable development", the effort that the chain was making, to wit, the existence and importance of hardier breeds when it came to herd health and meat quality, the respect for various types of balance by restoring the consistencies between the breeders' and fatteners' trades, and an explanation of the product's new characteristics of firmness and the link with taste. A promotional campaign conducted from 7 October to 3 November 2004 offered consumers various advantages if they bought organic beef, e.g., coupons and redeemable points. One year later, the sustainable development column in the distributor's monthly magazine focused on the case of a representative of the organic beef chain's farmers in order to illustrate its twenty-year presence in the organic food sector. This showed how much importance the distributor attached to this experience as a beacon, especially as regarded his organic clientele. The farmers' grouping, for its part, had each farm post a large advertising hoarding showing a cow and its non-Belgian Blue calf so as to signal clearly and assert the identity of its organic stock farmers.

These visible commercial impacts must not masque what in our view is the greatest added value of this intervention research, that of having given various operators in the chain the opportunity to sit around the table in a setting that was conducive to dialogue through the presence of a third party, namely, the researchers. So, the stock farmers, distributor, butchers, slaughterhouse, and collection company participated overall in fifty-seven meetings. This repetitive exercise enabled the various parties to learn about and appreciate each other. In the spring of 2005, at which point the intervention research and come to a close, the farmers' representatives for the first time took the initiative of meeting to consider how to deal with the difficulties that plagued the co-operation between the slaughterhouse and collection company. Thanks to the ability that they had developed to deal directly with the distributor, they were able to propose a way out of the crisis. In a perspective of sustainability that allowed for fairness, the central choice of the research project in favour of an innovation aimed primarily at production (breed and breeder-fatteners) created a new balance in the chain, one in which the farmers' concern for fairness had a stronger voice.

2 Institutional impact: Bioforum Strategic Plan for 2005-2010

The dynamics of confrontation with the agrifood industry and entry of new stock farmers in the organic beef sector reflect a more general process that affects the entire organic sector rather than just the cattle industry. Consequently, the thoughts of the researchers involved in this project were mobilised in various bodies of this sector, such as the *Conseil de Filière Bio* (Organic Industry Board) and the General Assembly and Board of Directors of Bioforum, which is the umbrella organisation of the various associations that are present and active in Belgium's organic sector.

Under its "chain policy", the Walloon Region requires the various recognised Chain Boards to present a strategic plan. The organic chain as a sector thus had to draw up a strategic plan concerning the development of beef farming, which occupies 88 percent of the land that has switched to organic farming in Wallonia. The project's researchers participated actively in drawing up the organic beef strategic plan and the final version of this plan was drafted jointly by Bioforum's leader and this project's researchers.

We proposed a diagnosis of the sector based on the economists' inventory of the situation. This diagnosis can be summarised by the following two points:

- problem in developing the organic beef consumption market, which takes up only some 15 percent of the organic livestock on the market, with the remaining 85% ending up on the conventional fattening market (Chapters 1.2 and 3.1).
- difficulty choosing and equipping the new organic reference frame and its consequences when it comes to breed, selection, and reproduction choices on the one hand and feeding choices on the other hand (see the debate about feeding the stock 100 percent organic rations).

This diagnosis was subjected to discussion by all of the sector's players, *i.e.*, producers, processors, distributors, consumers, and the public authorities, in the spring of 2005. The consultation work culminated in the joint drafting of three successive versions of a strategic plan to develop organic production. Its proposed axes are as follows:

- Operational axis: *stabilising and boosting tomorrow's sales*. That means striving at all costs to increase the sales volumes whilst differentiating the bulk market (processed products and factory cuts) from the more sensitive market of retail cuts. This axis necessarily calls for differentiating and diversifying beef production and products on all levels of the chain.
- Strategic axis: building tomorrow's beef chains on the basis of lasting qualitative progress that seems necessary today to ensure the organic market's quantitative development the day after tomorrow. This axis will be based on prospective scenarios that are in line with consumers' desires thanks to a consumption observatory and "taste academy".

This strategic plan, which was co-signed by Bioforum and the project's researchers, was validated and reviewed by the Walloon Region's Steering Committee (*Comité d'Orientation de la Région Wallonne*), which is the body in charge of approving the strategic plans. A summary of the strategic plan (in French) is available on Bioforum's website: <http://www.bioforum.be/fr/index.php?txt=125>

3 Territorial impact: The Semois steer project

The research project "How can organic agriculture contribute to sustainable production and consumption patterns?" showed that the sector considered the matter of the activity's environmental impact as a given, whereas, on the contrary, various representatives of the public authorities have questions about organic agriculture's environmental performance, especially in the area of animal husbandry. This question, which the sector (Users Committee) deemed irrelevant, was nevertheless studied, but in this case by the Walloon Agricultural Research Centre (Centre de Recherche Agronomique Wallon) using a classic research model

(see Chapter 3.5). Such conventional tools as weighing, nitrogen profile analysis, and modelling were used to assess the current situation. Seen from this point of view, they have produced a series of satisfactory results that nevertheless remain limited because they do not enable one to advance hypotheses about the branching points or bifurcations that allow the transformation of organic production systems to take an environmentally more sustainable direction.

We hypothesised that a sectoral approach steered by the market (the distributor) might be an obstacle to taking various facets of the environmental issue on board, especially those linked to the territory in which they crop up. How then might a switch from a sectoral to a territorial approach be made? How could the issue of the environment be "reterritorialised"? To answer these questions, we explored two avenues, namely, the steer raising system and the Gaume territory.

Fairly early on in our research we had identified an alternative to the "rapid fattening" model based on feeding-finishing (diet of concentrates) and delocalised resources. This was the "grass-fed" or "range" steer model, that is, a scheme based on steers (castrated bulls) that are raised and fattened almost exclusively through extensive pasturing in the summertime and a diet of hay in the wintertime. To our great surprise, we "discovered" that a few stock farmers were testing this scheme in the wings. This scheme, it might be added, concerned both the ranching *per se* and the commercialisation of its products (prices, outlets for the less noble cuts, etc.). Our exploratory work brought to light and connected up this very small number of experiments (about a dozen steer farmers) and showed that there was room for a "product" that was more closely linked to grazing and thus the land. This experience ended with various taste tests and gastronomic trials that showed that

- this steer farming approach could be linked to a product that offered a different taste from those offered by the organic and conventional chains and
- the issue of providing references for the different cuts of meat, that is, the butcher's work, was a difficult barrier to overcome in the Belgian context.

Our exploration of the steer model did culminate in something in actual practice, for a Hainaut farm products co-operative took up and expanded upon the idea. Today it offers quality grass-fed beef in its points of sale. So, having blazed the steer trail, it remained for us to discover that of the territory.

In visiting this steer experiment, the non-profit association Cuestas (a Leader + Local Action Group), and Ansart's Farmers' Market asked Liège University and CRA-W to investigate the possibility of creating a Gaume Range Steer label. The Gaume region is effectively one of extensive grazing: 52 percent of the meadows in the municipalities belonging to Cuestas have Natura 2000 status, they have the lowest cattle stocking rates in Belgium, and herds of rustic French breeds are very present. Two operations were thus conducted. First, a think tank of fourteen people was set up in the course of 2005 to explore the possibility of combining territory (Semois area) and slow fattening of cattle (steers). This gave rise to a list of questions to be put to two separate groups, a group of citizens and consumers and a group of farmers. These two working parties met in 2006 under the leadership of ULG and CRA-W, respectively. The citizens-consumers group, half of whom were local naturalists and the other half consumers interested in a local development project, reasserted the importance of the territorial dimension of this project and showed the relevance of

choosing the Gaume area, which made it possible to cross biodiversity with the farmers and consumers' specific identities. This project has since been taken up in the activities of the Leader+ programme (Cuestas LAG) and is recognised by Luxembourg Province in its "Luxembourg 2010" plan

PART V

CONCLUSIONS

Conclusions

Mormont, M., Stilmant, D., Jamar, D., and Stassart, P.

Irreversibilities that are well known to economists (path dependency, technological lock-in, etc.) are created in all processes of socio-economic development. They constitute one of the crucial problems of sustainable development strategies. The latter effectively postulate that it is possible to re-orient production and consumption chains more or less strongly. Seen from this angle, one must pay special attention to the **bifurcations** that occur in the sector's development. By bifurcation we mean the choice that is made at a given time in favour of a technique, standard, or form of organisation when this choice leads to a series of other choices, such as investment choices, that will make the current course relatively irreversible. Irreversibilities can also result from the abandonment of earlier knowledge that is rendered obsolete by a chosen technique.

The sustainability stakes that are riding on organic agriculture are thus twofold: In the first place, it is a matter of knowing if the methods and techniques that are used are better in terms of environmental and social criteria. However it is also matter of knowing if organic agriculture keeps the various technical options, and thus the concomitant potentials for development and learning, open. This research focused on these two issues in a context in which the organic chain under study was gradually taking its place in conventional distribution circuits.

Organic agriculture enjoys greater legitimacy than conventional agriculture with regard to sustainable development right from the start. This legitimacy is recognised politically through specific support measures for organic agriculture in the European agricultural policy as well as in Belgium's national sustainable development policy. In addition, several food crises have reinforced consumers' interest in organic commodities and boosted the organic meat market, which is at the centre of this research. The immediate consequence of these two tendencies was the arrival of new players in the market, i.e., a new type of producer of (Chapter 3.4), mass distribution (Chapter 3.1), a new type of consumer (Chapter 3.3), and finally, industrial processors, all although we studied the last group very little.

These new players in turn have introduced conventional technical models of production and processing, opacity concerning the consumers of organic products, and new tolerance in local interpretations of organic standards. The paradox is thus that the market's expansion has allowed new producers in but is also transforming the chains: mass distribution's entry and increased competition in the sector, along with new consumers, are changing the relationships between the partners in the chain. This phenomenon, moreover, is comparable to what is going on in the fair trade sector²⁷. The process of conventionalisation that follows designates the garage will alignment of organic production with the organizational and technical standards of conventional chains. This process is not without potential consequences for the chain's sustainability, in terms of both its ability to comply with

²⁷ See the report on fair trade *Le commerce équitable face aux nouveaux défis commerciaux : évolution des dynamiques d'acteurs*, SFPS, 2006, project CP/10/481 under the same research programme.

environmental standards and its ability to develop a technical and social alternative, such as production patterns, sustainably.

We also showed (Chapter 3.4) that the market's growth and organic conversion bonuses attracted new producers to the organic sector, but part of them at least introduced in exchange conventional technical models of production that enter into conflict with organic standards and carry the risk that of no longer being able to claim the environmental benefits of organic production. In other words, the conventionalisation of organic farming in this specific sector is tending to bring it closer to intensive farming patterns.

In this process of growth and conventionalisation the chain's sustainability is exactly what is at stake. This concerns its environmental impact as much as its ability to constitute an independent technical model. Our approach was more than an evaluation of production patterns in light of standards or indicators. It strove rather to understand this chain's course, how it was developing and changing. One theoretical principle guided this analysis. It consisted in considering that techniques, organizational standards, strategies, and identities were not independent spheres but, on the contrary, linked in configurations or **compositions**, as a result of which developmental paths are inextricably social and technical.

We thus re-examined the **chain** concept with the help of two important hypotheses. In effect, where economists see above all forms of organization of transactions between economic operators, essentially producers and middleman, we enlarged this notion to include the two extremes of "economic chains": First, we quickly ascertained that producers and distributors' representations of consumers are the key problem in this chain. Second, meat production mobilizes living beings at the other end of the chain about which farmers are asked what they can do, what they're able to do in systems that are not just technical but "ecological" as well. Doubtless one of the other challenges for research into sustainable development is to have to broaden the field of study, which almost necessarily requires a multidisciplinary approach. Allowing for the livestock and pastures on the one hand and consumers on the other hand obviously increased the complexity of the subject under study, but at the same time this enlargement was likely to increase the number of possible choices, bifurcations, and thus options.

From this standpoint – the search for bifurcations and irreversibilities and broadening the field of study to include the natural world and consumers – we obviously had to renounce the purely deterministic approach, since, on the contrary, we were trying to identify the possible pathways that might become the objects of choices that were not predetermined. The corollary of this epistemological position is that we had to consider development to be both an autonomous process in which we had to try to reveal the potentials of what existed and a voluntary process in which choices were made that would reveal possible paths. At the end of the day, the sense of this research - identifying what is possible in a context of socio-technical complexity - is what led us to adopt an intervention research method. Indeed, identifying - and even testing - possible developments in a complex network of relations entails the need to include at least some of the players in the research so as to understand not only the factors that are linked to a given development but perhaps above all the steps that enable these players to subscribe to the possibilities that cannot be built without them. It then becomes important to start with the diagnosis in which their

points of view, questions, expectations, and/or fears are ingredients of the research on a par with the questions that the researchers legitimately ask in their own fields. In a nutshell, the idea was to trigger situations of choice that could teach.

Analysing the enlarged chain enabled us to show that the exchanges, contracts, and transactions between partners were framed by a series of beliefs, standards, knowledge, and representations that were shared or distributed, depending on the case, to form a sort of skeleton onto which not only the practices and relations between players, but also the questions could be hung. The question of the future of organic chains could then be formulated as generally as possible as that of the very difficult compatibility between organic standards on the one hand and the conventional chains reference frame on which the players relied on the other hand. This is because this reference frame comprised mainly a definition of the product, which itself was linked to a certain representation of consumers, but also because this product definition was closely linked to the farmers' skills and expertise, to their livestock breeding, rearing, and fattening know-how, as well as the processor's competency. This quasi-incompatibility between organic standards and conventional standards/knowledge also created a mood of suspicion amongst the players, suspicion that in turn created uncertainty not only about the product but also about the partners' loyalty in a sort of vicious circle of mistrust.

Our research approach then had to proceed via several operations (researchers' actions) that would serve as analysers. On the one hand, we had to start with the questions asked by the chain's partners and understand their points of view in order to identify the areas in which action could be taken and bifurcations would be possible. On the other hand we also had to invent organizational arrangements so as to be able to forge new ties and re-create enough trust to be able to experiment. In such a context of complexity and weariness, putting all the problems to all of the partners at the same time could indeed practically be ruled out. On the contrary we had to identify partial areas in which issues could be handled as separate steps, as separate bricks in a rebuilding project. All of these research operations can thus be summarized around three main "building sites", as follows.

The first one concerned what we called the issue of the product's qualification, and obviously related back to the issue of the consumer. It was crucial to see the consumer in a new way, neither as a passive recipient of marketing ploys nor a sovereign buyer for whom producers were merely servile suppliers. The consumer is an agent to the extent that s/he follows a host of prescriptions of various origins, be they gastronomic, health, or even civic. Consequently, what is important from the perspective of sustainability is to construct a system that serves as both a prescription (that gives consumers cognitive landmarks) and a recording (feedback) of their reactions to these prescriptions. We were able to validate the hypothesis that in this case the cattle breed was the crucial point of an arrangement making it possible to connect organic production, health value, environmental values, and gustatory value. However, this arrangement had to be created and reinforced on the basis of a representation/prescription of the **negotiating** and learning consumer.

The second worksite was one that we called the qualification convention that was supposed to subtend the chain's organization. The qualification convention designates how the partners' competencies and commitments around a product with a fixed quality are defined. So, in this case it was a matter of determining what

the farmers' and distributor's, or even the processor's, respective responsibilities and competences were. How and by whom could the planning of production among the producers be organized, given that this planning had to meet the criteria of the fishes the, flexibility, and fairness simultaneously. In this regard we were able to show, through the proposals that we may need and bargain over with the partners, that the organization of such relations code and she would rely on procedures and concrete instruments that could guarantee the fairness of their transactions, but we also stressed the fact that the profession of organic farmer lacked legitimate references, that's to say, the renewed effort convention, in order to define its responsibilities and competencies. Similarly, relations with consumer suffered from a lack of legitimate, "equipped" representations of what the job of a person responsible for a product with identified qualities entailed. Here we put our fingers on the growing gap between the tendency to reduce the job to its purely economic dimension of supplier and ambitions of an organic factor that could not exist without seeking justification in other environmental or social qualities. Economic mechanisms alone (incentives, support and, and bonuses) cannot suffice to enable chains that are based on other commitments to flourish, because they have other ambitions and other ways of being recognized. We felt it was relevant to examine this in light of Sen's remark to the effect that the "use of incentives and private calculations of personal gains and profits" may well enable efficiency gains, but this might end up being brought at the cost of "undermining general values that support mutual help and cooperation."²⁸

The third worksite consisted of more "scientific or technical" research that strove to explore the technical transformations that making the chain's economic demands compatible with the organic standards would involve. The standards that we considered were the share of forage in the animals' rations and parasite control in a context of limited parasite control treatments. These standards were chosen for two reasons, namely, they concern key points in the organic production scheme and they are highly significant for consumers and thus for product differentiation on the market. In the first case, we relied on an experimental design that enabled us to show that other feeding systems that maximised the use of forage to the detriment of concentrates were possible but in practice came up against (1) the need for early learning by the livestock of this type of feeding and (2) the chain's organisation, which in this case had to accept to revise certain end product quality standards. The second case concerned parasite management and was handled through learning groups that brought together the stock farmers, veterinarians, and researchers for on-the-farm monitoring. Parasite infestations are closely linked to the ways that the pastures are used, but it issues a deeper challenge to another approach to animal health that allows for not only the individual animal and the parasite but also the "ecological" link between the parasite's life cycle, the individual animal, and the entire herd. In other words, a preventive approach to parasitism that would avoid the use of medicines means forsaking the will to eradicate parasites in favour of combined heard and pasture management to control a form of co-existence that would not be detrimental to either the herd's performance or its health. This result was located upstream from the experimental approach and consequently required both experimental and practical confirmation, but it nevertheless enabled us to confirm the hypothesis that the

²⁸ Sen, A. (2000) "What Difference Can Ethics Make?" in Lecture at the International Meeting on Ethics and Development of the Inter-American Development Bank in collaboration with the Norwegian Government.

development of a sustainable chain also meant redefining the players' relationships with nature and more specifically the combined competencies of the farmers and livestock. These two worksites also enabled us to show how different disciplines and research methods were combined in this multidisciplinary research.

The primary objective of this research was effectively methodological. The results concerning the organic chain, for all that they were partial and temporary, are worthwhile above all because they show how research into sustainable production and consumption modes can be designed. While a production-consumption chain is conceived of as a composition of techniques, knowledge, standards, and identities, it is not rooted in a single way of thinking that would be deployed in a straight line from consumer demand to the ecological environments from which it draws its resources. Rather, it is a composition of different rationales that are interconnected in a series of socio-technical nodes. The parasite control technique provides a good illustration of this partial connection between the technical knowledge of veterinary medicine, feeding practices, and demands concerning the end product that refer, through a series of mediations, to both agricultural knowledge and marketing-related consumer demands. The usual scientific approach – that of the applied sciences – treats each of these nodes separately. It isolates the constraints that it deems to be exogenous to tackle a clearly bounded subject and explore the possibilities of rationalising it, keeping all things equal, we should add. If we consider, for example, consumer demand, we give ourselves a fixed point that facilitate the exploration of the possible "products" and production patterns that correspond to this point. The risk of such an approach is that at the same time as we internalise a vision of the consumer, we externalise a series of consequences resulting from this choice.

In our methodological approach it was effectively crucial to start by producing a shared diagnosis of the situation under study. This diagnosis revealed various avenues for research as well as, via exchanges with the players, avenues for action. In this diagnosis we gave an important place to the players and their points of view and questions to the extent that their viewpoints and questions revealed possible research questions or initiatives. However, the researchers, who were inspired in this case by the matter of sustainable development, also gave priority to the approaches that they felt were the most relevant. So, this was neither a perspective of responding to the players' questions nor one of imposing research questions on the players. Rather, it was a transaction or series of transactions between partners with interests that differed but could converge in research operations.

A second methodological principle consisted in considering that the actors' knowledge and relations with each other likewise conditioned each other. In other words, some questions could emerge only if the relations, especially the relationships of trust or equity, were changed, just as new knowledge could lead to the reorganisation of a chain. This was particularly true of the knowledge that was generated around the consumer. This principle was well illustrated in our research.

Finally, the research was guided by a third principle, that is, that the various research "worksites" mentioned above had to be consistent and this was possible only by constantly drawing connections between the achievements or findings made in one field and the questions or progress made in another field. This is how we treated the more technical worksites that explored technical potentials that answered major

questions about the chain and its sustainability. That is how, for example, the questions linked to parasite management or feeding answered some crucial questions about pasturing (organic standard) but also some concerns that were relevant to consumers.

Through these three principles we believe that we have developed a methodology that is specific to asking questions about sustainable development. This methodological effectively seems to enable one to meet two crucial requirements, namely, keeping diversified technical options open against all possibilities of technical irreversibility, and allowing for ecological, efficiency, and fairness criteria at one and the same time. These three dimensions of sustainable development, as our research shows, cannot be tackled separately. On the contrary, they must be tackled simultaneously, by plunging resolutely into the heart of the socio-technical complexity. In this connection, animal husbandry is an excellent subject for shedding light on the subtle and often hidden links that stretch from the natural environment to techniques and from ecology to society. Deconstructing what was forgotten in earlier choices then becomes a necessary condition for reconstructing sustainable chains.

This social deconstruction is heavy with the promise of sustainability but ticklish in terms of the irreversibility of the relations that it inevitably modifies. It does not occur by chance, however. It requires conditions and a method that our research has helped to render more precise. In any event, it does not dispense with the need for a constant shuttling by the researchers involved in it between the sincere attachment²⁹ necessary for intervention and methodical detachment that is indispensable for scientific integration.

²⁹ In the meaning given by M. Callon, 1999. "Ni intellectuel engagé, ni intellectuel dégage : la double stratégie de l'attachement et du détachement." *Sociologie du travail*, 41:65-78.

PART VI

SCIENTIFIC PUBLICATIONS

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