SPSD II

SUSTAINABILITY OF CERTIFIED PRODUCTION SYSTEMS: THE CASE OF LABELS IN THE FOOD SECTOR

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MIXED ACTIONS

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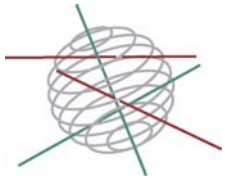
SCIENTIFIC SUPPORT PLAN FOR A SUSTAINABLE DEVELOPMENT POLICY
(SPSD II)



Part:
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FINAL REPORT

SUSTAINABILITY OF CERTIFIED PRODUCTION SYSTEMS: THE CASE OF LABELS IN THE FOOD SECTOR

MA/03

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Chapter 1 Introduction

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1. Context

During the past decades, the question for the introduction of sustainable production practices has grown steadily and significantly. The growing awareness of scientists and, through the media, of the general public has pushed industry and policy makers towards a more sustainable policy. Due to its close relation with nature, the agricultural sector has a specific role to play in sustainable development. Belgian agriculture is highly productive and especially in Flanders very intensive. Agricultural practices can have an adverse impact on natural resources. Pollution of soil, water and air, fragmentation of habitats and loss of biodiversity can be the result of inappropriate agricultural practices and land-use. Therefore the integration of sustainable practices is of even greater importance. To this end, several strategies can be pursued. In the past decades, European and Belgian policy mainly focused on restrictive measures. However policy analysis reveals that these measures are often difficult to check and evaded by farmers.

It is therefore that other initiatives arise, among which labeling and certification initiatives. These are market-oriented initiatives steering agriculture towards more sustainable production methods. Labeling and certification strategies are seen as a promising tool for the introduction of sustainable production, creating added value to the product by means of improved quality and environmental side effects. The aim of these strategies is to introduce extra product or production process features, above the obligatory legal standards. Their main economic objective is to guarantee differentiation from other products. This differentiation of certified production systems from conventional systems is based on quality, environmental or other standards.

In food production this approach is increasingly applied with initiatives from the distribution and transformation sector, the public authorities as well as the producers. Each of these initiatives has different objectives and applies different criteria. Compliance to these criteria are rewarded with the use of the label, from which farmers expect to gain profit by a higher production price, guaranteed sales or image building (de Snoo & van de Ven, 1999). By supporting these initiatives in the agricultural sector governments aim to stimulate the local economy or to reduce the environmental pressure.

Today's consumers are increasingly interested in the lifecycle of the product and want to know how, where and by whom the products are produced. Market actors try to focus on and even steer these consumer demands. With their sustainable consumption pattern, consumers contribute by their choice to a more sustainable production pattern. Labeling initiatives provide the market chain with an appropriate instrument for communicating extra product and production process attributes (origin, environmentally friendly production manners, fair-trade,...). The last few years industry or farmers associations are more concerned with increasing the confidence of the public in the agricultural products and improving a production process. The latter often influenced by the resulting costs and benefits. Yet, producers can participate in projects because they take up their social or ecological responsibility, either in response to public or political pressure or anticipating this and being pro-active.

2. Problem Statement

The labeling strategy is considered as having a strong potential to promote sustainability because of its non-restrictive nature, the cooperation between the different actors and the regulation of sustainability through the market principle. Hence, producers, industry and public agencies try to implement an optimal mix of measures from a social, economic and scientific point of view. The role and place of sustainability in this mix however is a question of debate, as well as the mix itself (Is it sustainable?). To what extent do

labeling strategies contribute to sustainable production and consumption and to what extent are these strategies sustainable?

The present situation is characterized by the multiplication of different labeling systems, a process that is accelerated by the market driving forces. Large food companies are developing their own certification strategies, but also producer organizations and the public authorities are active in this field. Each of these systems has its own purpose and puts emphasis on different criteria. Therefore labeling strategies as a solution for sustainable production are confronted with:

- The problem of relevance and credibility for the consumer. Credibility refers to the level of trust of the consumers regarding different labeling systems, hereby taking the level of information they have into account;
- The problem of feasibility and coherence for the producers;
- The problem of strategy for the public authorities that have to choose between norms, private labeling or adapting public norms. The public authorities responsible for the development of a general framework need to consider to what extent these strategies of normalisation and auto-control can contribute to national and international sustainability goals.

3. Objectives

The general objective of this project is to analyse to what extent labeling strategies in the food sector are in accordance with and comply with a long-term sustainability strategy. The overall research question, "*Is labeling an appropriate strategy to improve the sustainability of the current agriculture*" is dividable into two inextricably linked **questions**:

- 1. Are these mainly market oriented initiatives an appropriate and efficient tool for the introduction of sustainability traits?
- 2. Are labeling initiatives sustainable in the long run, i.e. do they last?

1. To fully rate the potential of labeling and certification strategies as an appropriate tool for the introduction of sustainable agricultural measures, a multidisciplinary approach, comprising environmental sciences, human health sciences, economy and sociology, was necessary. This assessment mainly focuses on the measures within the prescription books of the different labels. Other related research topics concern the clear understanding of initiatives for reduced pesticide appliance and the analysis of the different possible strategies and placement of labeling within these strategies.

2. The second question is of major importance because the long-term contribution of certification initiatives towards sustainable development is negligible when the strategy itself is not viable. This research question is predominantly situated in the socio-economic sphere.
To accurately describe and assess the sustainability of the initiatives and the socio-technical construction process of the labels, an in-depth analysis needed to be performed of:

- The processes underlying initiation and acceptance/continuation of a certification strategy.
- Division of power and decision making between the participants and stakeholders.
- Division of costs and benefits between participants within the initiative.

The combination of these three research topics resulted in a deeper insight in the acceptance by and the particular role of the different stakeholders (incl. consumers, to correctly assess purchase preferences and positioning of the different labels within the food market) within the labeling initiative.

The analysis of labels in agricultural crop production is taken as a case study in order to derive more general conclusions about the sustainability of certification strategies and to examine the influencing factors. Food crops not only involve long chains with numerous producers and intermediates, but also involve products with a lot of uncertainty for the final consumers. Moreover a high number of initiatives are presently taken in the food sector. The research in this context is limited to the study of initiatives for reduced pesticide appliance. This choice is defendable because pesticide use both influences the quality of food as well as the quality of environment, hence covering sustainability.

4. Structure of the project

The scientific results of this report are subdivided in three parts and encompass a total of eight chapters. Chapter 2 and 3 reside under Part 1, the contribution towards ecologic sustainability of labels and certification. Part 2 includes Chapters 4 to 6 and analyses labels and certification as socio-economic constructs. Chapter 7 and 8 are incorporated in Part 3 and assess the implications of greenlabels at farm level. In what follows the different chapters are briefly discussed, clarifying the objectives and applied methodologies. The report ends with conclusions and policy recommendations (Chapter 9).

The second chapter summarizes the different strategies for reducing pesticide use, aiming at enhanced sustainable development. A literature review regarding the principles of and the different tools/strategies for sustainable development is presented here. A clear understanding of the principles of sustainability had to be acquired, because of the broadness of the term ″sustainability″ in the food sector. The different aspects of sustainable development and the importance of each of these aspects herein are described incorporating the information obtained from interviews with key-persons involved in developing strategies for sustainable development. The research in this context is limited to labels in crop production for comparison reasons. The governments' objectives for sustainable development and sustainable production and consumption patterns in particular are identified and the specific role and importance of labeling with respect to sustainable development is clarified. This chapter relates to work package 1: 'Review of strategies for sustainable development and the potential role for labeling', outlined in the original project proposal.

Chapter 3 discusses the environmental sustainability of the selected certification standards. These certification standards were chosen on the basis of the work performed during the second work package. During this work package an inventory of the existing labels in the agro-food sector with respect to pesticide reduction both in Belgium as in neighbouring countries was made. Both the objectives and criteria as the promoters of the label and the actors involved were identified. The pre-selection of the greenlabels was made on the basis of three criteria: domain, level in the food chain and spread and impact in Flemish and Walloon regions. In this way the following labels were selected for analysis: EurepGAP, Flandria/FlandriaGAP, Biogarantie, Charte Perfect, Terra Nostra, Integrated Fruit Production and Fruitnet. In Chapter 3 the overall environmental sustainability of these certification standards is assessed by applying a technical-scientific analysis method of the code of practices in terms of options, technical choices, modes of operation, monitoring, sampling, etc. The analysis method used is based on a method already used in a similar study in France (Girardin and Sardet, 2002). This method is based on a detailed assessment of the impact on sustainability of each particular rule written in the label/certification conventions. Both environmental as human health aspects of sustainability were emphasised. More specifically, impacts on the following aspects were studied: Air Quality, Biodiversity, Climate, Food Safety, Water Quality, Landscape, Noise Quantity Reduction, Pest Pressure Reduction, Rare Resource Spillage, Soil Fertility, Water Quality, Waste Importance and Management, Worker Safety. Thus each rule out of the eight label/certification standards selected for a detailed study (cfr. WP2 results) was registered in a database and, when necessary, translated into English. Experts in the domain for which the impact is supposed to exist rated each rule's impact following the Simos' method (Simos, 1990). On the basis of these results the environmental sustainability of the labels is compared and assessed.

Chapter 4 and 5 relate to the work performed by the sociologic team. In these chapters the acceptance of labeling initiatives by consumers and producers is studied. Chapter 4 discusses labels in terms of different organizational strategies. How the certification standards organize the relations between producers, distributors and consumers is studied. The sociologic analysis is focused on participation procedures and the share of responsibilities between the stakeholders in order to improve risk prevention and ecological sustainability. The focus groups completed this approach in comparing the definition given by the different stakeholders of quality, pesticides risk, food safety, enabling the sociologists to analyse how the certification manages to meet these requirements. Also the evolution of rules stated in the standards is discussed. Chapter 5 concerns the acceptance of labeling strategies by the consumers. This was studied by the means of focus groups. Consumers were confronted with producers following a certain certification scheme as well as with the promoters of labeling initiatives. In this way the relevance and effectiveness of labels is studied.

In Chapter 6 the economic features of different labeling initiatives are outlined, hereby mainly focusing on those private initiatives that have become widespread in the fruit and vegetable sector. Amongst other things attention is given to the stakeholders and their different stakes in relation to labeling and certification. In addition, certification books are analysed as equilibria of stakes. Due to the composition of stakeholders and the weight of the different actors, every label initiative has a different objective, strategy and impact, resulting in a prescription book with a larger or smaller focus on sustainability. The different actors reach through their interactions an economic equilibrium, in which the stakes of the actors are translated in the prescription books according to the actors' weight in the chain. Possible changes of the equilibrium towards a more sustainable approach are suggested.

Chapter 7 gives an outline of the economic consequences for farmers of participation in a labeling initiative. This subject is approached by combining qualitative information from focus groups with all the relevant stakeholders and quantitative information from a farmers' questionnaire. This questionnaire consists of two stated preference experiments, in which farmers are asked to choose between different potential certification books. The first experiment relates to changes in the general institutional setting of a certification book, while the second focuses on the measures relating to pesticide application. The stated preference methodology enables the researchers to estimate farmers' attitude towards possible future changes in the certification books.

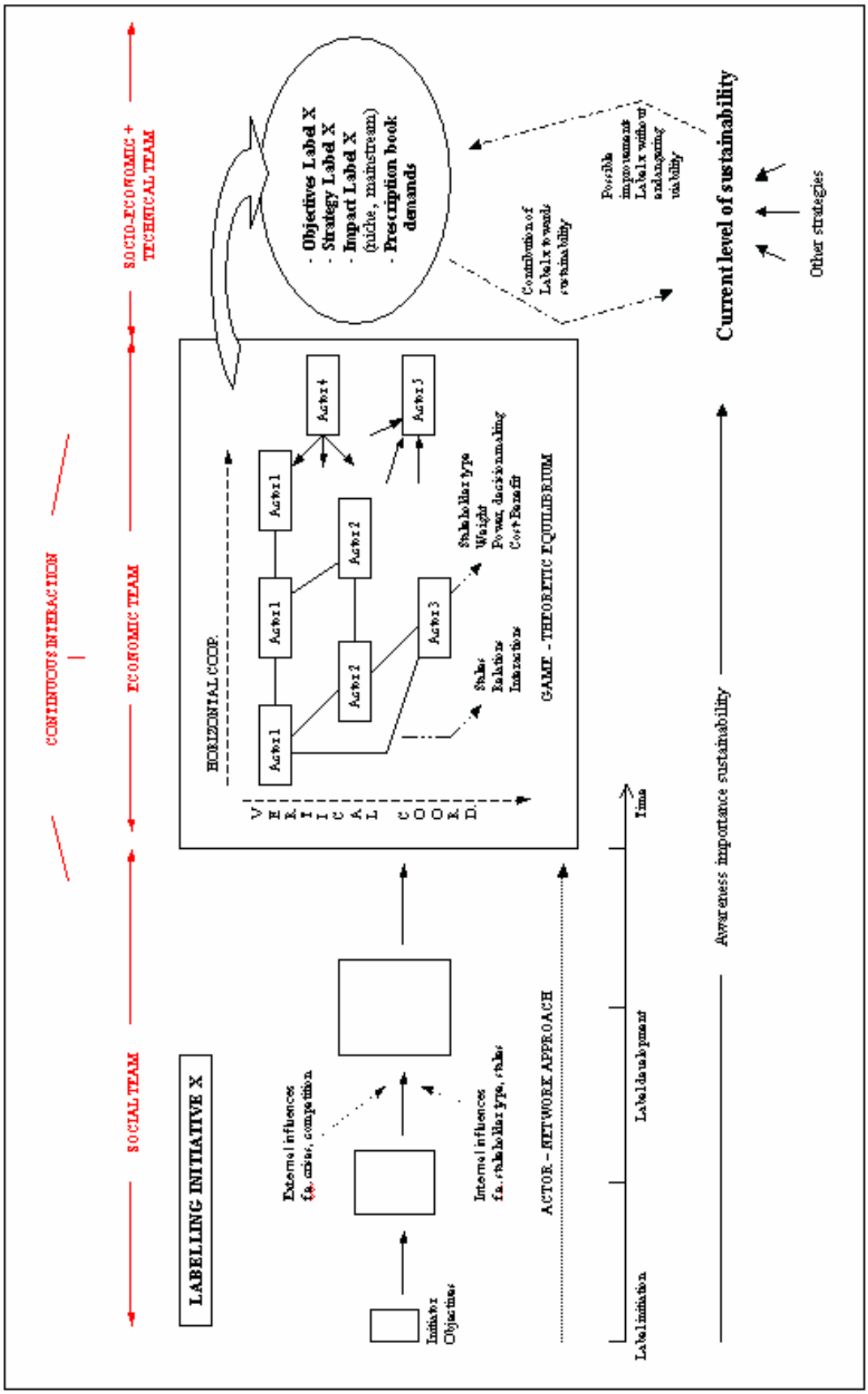
Chapter 8 is devoted to the analysis and discussion of the impact of specific rules promoted in the standards. Only the most effective rules are discussed in terms of their environmental impact but also in terms of their economical effect. The major chapters of the certification books structure (frame) the discussion. A great emphasis lies upon the consequences for the producers when taking part in labeling initiatives. For example, the necessity for producers to purchase material for mechanical weeding for organic production can be mentioned. This chapter discusses how the producer has to adapt his crop management methods in order to comply with the criteria set in the standards' certification books.

The last chapter formulates conclusions and recommendations in terms of possibilities of labels contributing to sustainable development, hereby emphasising the role of public authorities and other stakeholders. The teams together carried out a reflexive work by trying to generalize the findings with the aim of providing conclusions for public authorities and other stakeholders.

Figure 1.1 summarizes the general framework of the project, showing the main research objectives and strategies of the project teams and the cohesion of the overall research approach.

The research objectives clearly asked for a multidisciplinary approach as shown in Figure 1. In this interdisciplinary project, the different research teams have a specific but complementary focus. Each group approaches the matter from a different point of view, resulting in a different methodology. The sociologic team focussed on the development trajectories of labeling initiatives. The research performed by the agro-economic team mainly concerns stakeholder strategies and coordination mechanisms in the chain. The purpose of stakeholder analysis is to determine how consumers, producers and other stakeholders interfere in the certification construction. The different stakes, relations and interactions between stakeholders are visualized. Characteristics of the different stakeholder groups were identified. The power distribution between the stakeholders in the initiative explains the level of contribution towards sustainability of the initiative. Thus the joint output of the socio-economic teams gives an idea of the objectives and strategies of the stakeholders in a labeling initiative, and the current impact of the initiative. These teams approached the different labels in a more holistic way than the technical team, exploring reasons for existence and success. The agronomists' team mainly focussed on the analysis of the code of practices in relation to human health and environmental protection. The contribution of the different principles in the labeling prescription books towards sustainability is explored. The combination of the outcomes of the different research teams resulted in a profound and multidimensional assessment of the relevance of the different initiatives towards sustainability. This research provided the possibility of formulating conclusions and recommendations for enhanced contribution towards sustainability without endangering the viability of the initiatives with respect to the role of public authorities in labeling systems.

Figure 1.1: General framework for analysis



Part 1. Environmental sustainability and private voluntary certification initiatives

Comprising of:

Chapter 2: Labeling and certification versus other strategies to reduce pesticide use

Chapter 3: Do Belgian greenlabels attribute to environmental sustainability?

Chapter 2 Labeling and certification versus other strategies to reduce pesticide use

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Introduction to the chapter:

In the first instance, the concept of sustainability is briefly introduced, with focus on the ecologic and socio-economic features of the concept. Secondly, different approaches to sustainable production are clarified and the possible role of private initiatives is situated with respect to enhanced sustainability. In a third part, the concept of labeling is briefly explained. The chapter ends with a stakeholders' assessment of the contribution of the strategies mentioned before to economic and ecologic sustainability.

1. Sustainable development: definition and problem statement

1.1 DEFINITION

Since the beginning of the 1990s a large number of publications have defined and discussed sustainable development (SD). Many of these start from the initial definition by the so-called Bruntland commission, namely that SD is "*Development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (from the World Commission on Environment and Development's report Our Common Future – Oxford University Press, Oxford, 1987). This definition contains huge challenges as it comprises well-balanced strategies to achieve social, environmental and economic goals (figure 1).

The Belgian Federal Plan for Sustainable Development 2000-2004 indicates that the goals for SD can be divided into the following three groups:

(1) **economic goals** for SD should enable to meet the present needs without endangering the needs of the next generations. This implies the adoption of production and consumption patterns which comply with the human needs and which decrease the burden on the environment. This process should search for a balance between production and consumption that overcomes problems of over- or underproduction and over- or underconsumption of certain goods and services;

(2) **social goals** for SD should be pursued within and amongst communities, and include an equitable distribution of financial means, natural resources and cultural integration. These social goals urge for strategies to be developed and programmes to be implemented that aim at the decrease and eradication of poverty, the creation of jobs and income (stimulated by a dynamic labour market, promoted by an active labour market policy) and the provision of means and resources for all less/least developed areas over the world;

(3) **environmental goals** of SD are defined to ascertain the boundaries of natural resources in its management by taking technological development and institutional structures into account. These goals imply the recognition and respect for ecological norms, priorities for rational use of the environment and the development of national and international laws stipulating the responsibilities for pollution, environmental damage and the compensation for victims of both.

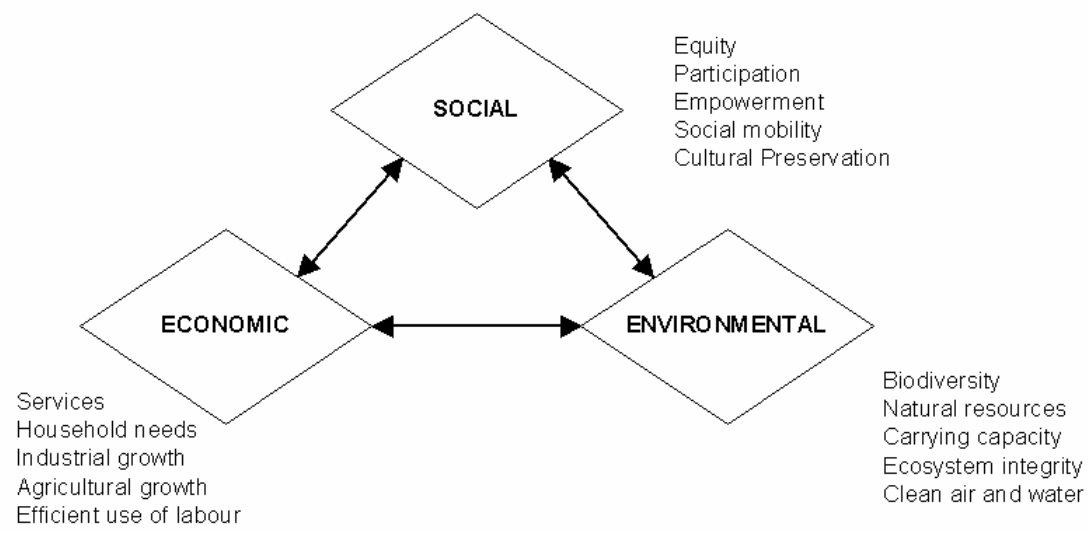

Figure 2.1: **Social, environmental and economic goals (World Bank, 2003)**

The Federal Plan for SD focuses on the following four actions:

(1) changes of consumption patterns and production methods: information, education and making the public sensitive, production policy, and policies regarding the consumption in public administration;
(2) actions regarding poverty and social exclusion, debts; health and environment;
(3) actions regarding agriculture, marine biology and biodiversity;
(4) actions regarding energy, transport, ozone and climatic change

1.2 PROBLEM STATEMENT: SUSTAINABILITY AND PESTICIDE USE

A booming economy producing increasing numbers of goods and services puts a high stress on the environment. Obviously the objectives of economic growth conflict with environmental concerns, with externalities in particular being the major problem. Often, the polluters do not bare the full cost of their actions. The challenge for policy makers is therefore to *"rectify market failures without losing the benefits that the market also brings"* (cf. Cairncross, 2000). Government interference is considered important in the case of environmental sustainability, because external products of agriculture have a collective nature (non-exclusiveness and non-rivalry; every one enjoys cleaner water, more biodiversity, cleaner air etc.). Private parties will not bear the transaction costs related to reducing the negative external effects of agriculture if other parties can enjoy freely from their efforts (free riders). Every one prefers a cleaner environment, but who will pay for it?

Pesticides have become merely indispensable to maintain the current level of high productivity in conventional agri- and horticulture. The current intensive form of agricultural production is in fact partly realized due to the use of chemical pesticides. Advantages concerning pesticide use include:

- harvest protection (quantity);
- high-quality production;
- efficient management (same production each year);
- stable price-making and production;
- employment (35.000 employees in EU);
- reduction of certain risks (mycotoxins).

The intensive production process, however, results into crops being more sensitive to diseases and plagues, creating techno-economic dependency on pesticides. Excessive use of pesticides can lead to undesired side effects because substances are assimilated by non targeted organisms or remain in the environment as residues.

The main problems related to the use of pesticides are:

- Human toxicity
  - For the applicator, field worker, bystander
  - For the consumer (pesticide residues on/in food)
- Environmental problems
  - Drift (pollution of surface water, toxicity for aquatic organisms)
  - Leaching (pollution of ground water, toxicity for soil organisms)
  - Reduction of biodiversity
  - Pseudo-estrogenic effects

The contradiction in case of pesticide usage is the fact that the ones that gain advantage (farmer, industry, consumer) differ from the ones that are at a disadvantage (civilians, consumers, environment, and bystanders). However, pesticide users continue to adapt their practices in response to market and pest pressures. The current drivers include:

- Public concerns over the health effects of pesticides including the cocktail effect and bystander exposure.
- Consumer sensitivity about pesticide residue levels in food, leading to action by supermarkets and the Food Agency
- Public concern over the impact of pesticides on the environment
- Costs of removing pesticides from water to meet EU drinking water standards
- Legislative measures and proposals including the Water Framework Directive, proposals for new EU laws on pesticide approval, on Maximum Residue Levels and for the EU thematic strategy for sustainable use of pesticides
- Continuing financial pressure on farming, despite some recent recovery in farm incomes
- Pesticide industry consolidation, coupled with the programme of reviewers under Directive 91/414, leading to reduced range of products. This creates particular problems for growers of minor crops in niche markets
- Need to encourage innovation, for example the development of new chemical pesticides with improved safety/efficacy profiles or the development of alternative products and techniques

The literature review in the next sections gives an overview of the importance of voluntary initiatives, and certification and labeling in particular, for an increase in environmental sustainability.

2. Different approaches to secure environmental sustainability

To maintain and even improve the current level of environmental sustainability and, more specifically, to address the adverse effects of excessive pesticide usage, initiatives can originate at public or private level. Basically, all measures aimed at reducing these effects can be subdivided into four distinctive categories. Two categories principally reside under public authority, while the third is situated in the private sphere. The fourth category, as outlined further in the text, encompasses strategies aimed at increasing knowledge and information dispersion (see Figure 2.2 also).

When the market is deficient in regulating the externalities caused by production processes, public authorities are there to intervene. Policy makers dispose of two different options to implement public regulations. The first one, the Command and Control option, is based on the coercive power of the State, in which the public authorities change the structure of property rights and impose regulations aimed at preventing the occurrence of negative externalities or at inciting the production of positive externalities. Although it certainly has its merits, the Command and Control instrument has been heavily criticised, mainly due to its environmental ineffectiveness with respect to certain types of pollution, its weak economic efficiency, the lack of flexibility, the absence of stimulations to innovate and the risks to be trapped in suboptimal technological solutions.

The second category resides under the market mechanisms that, by integrating price mechanisms, push the regulated agents to internalise the environmental externalities. These economic instruments (taxes, retributions, subsidies, trading in property rights) make it possible to attribute prices to environmental goods, enabling agents to integrate these in their cost calculations.

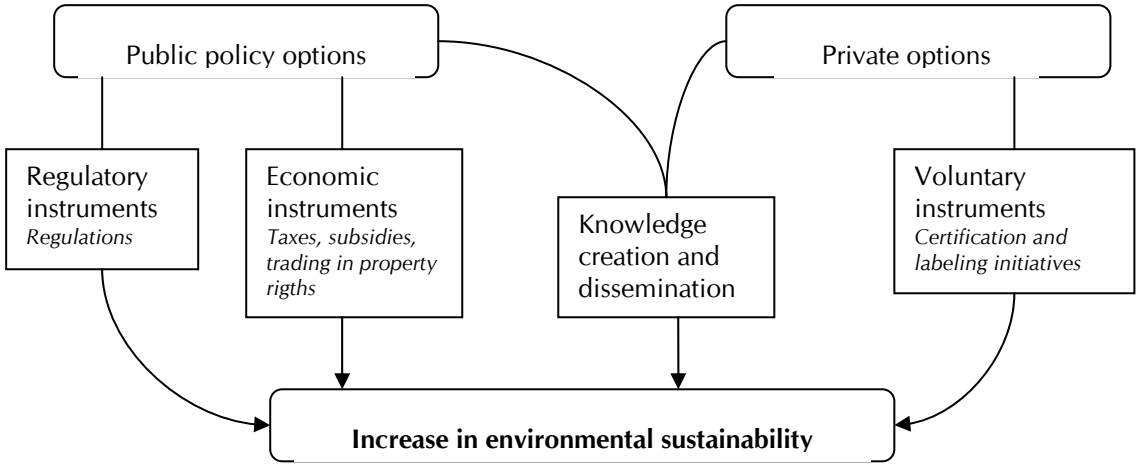

Figure 2.2: Public and private options for an increase in environmental sustainability

The third (and most recent) category corresponds with a more diverse set of options, with as principal and common characteristic its voluntary nature. This voluntary character mainly refers to the absence of the use of the State's coercive power, implying that the adoption of the approaches depends on the good-will of the involved actors. These instruments play on the moral responsibility of the actors involved and on the social sanctions to which the latter will be exposed in case of non compliance.

Although the idea is not new, the innovative character of the voluntary approach can be perceived at at least six levels (Mzoughi, 2005):
1. The emergence of new regulators in the civil society (such as NGOs, environmental and consumer associations, syndicates). These entities, not being part of the government agencies nor the regulated agents, are increasingly taking the lead in the creation, the promotion and the governance of these voluntary programmes.
2. The intervention and pressure tools in the possession of these new 'regulators'. The means are very divers, encompassing, among others, firm boycotts, the threat of lobbying for a more restrictive legislation, or the threat of contesting the firm's reputation through media campaigns.
3. The proliferation and the extension of these voluntary approaches to new fields such as the environment, animal welfare or ethics, in stead of a sole focus on the quality of the final product.
4. The use of these voluntary approaches for means other than purely environmentally inspired, such as commercial purposes, the alleged fulfilment of legal requirements or the increase in rivals' costs.
5. The resort to 'soft' means of regulation, bypassing the conflict option for the benefit of approaches based upon mutual comprehension, collaboration and alliances. This is a strategy applied by certain environmental organizations, assuming that collaboration will prove more productive than a conflicting approach.
6. The evolution of the role traditionally reserved for the State, with absence in some approaches and omnipresence in others. In a growing number of cases, traditional prerogatives of the State are transmitted to private actors (with certification organisms as an example).

Due to its diverse nature, different economic definitions circulate for the term 'voluntary approach':

- Voluntary commitment from the industry to pursue actions that permit the improvement of the environment (Börkey and Lévêque, 1998);
- Engagements of polluting firms or sectors to improve their environmental performance (Carraro and Lévêque, 1999; Higley et al., 2001);
- Engagement of firms to improve their environmental performance above the legal prescriptions (Krarup, 2001; Börkey and Glachant, 1999);
- Agreement between the government and the industry to facilitate a voluntary action with a desired social outcome, encouraged by the government and implemented by the participant based upon his own interests (OECD, 1997).

The next sections outline the different instruments both at the public and private level now (or potentially) applied in the field of pesticide use regulation.

2.1 SETTING THE SCENE: THE REGULATORY FRAMEWORK

2.1.1. The EU's thematic strategy

In its Communication 'Towards a Thematic Strategy on the Sustainable Use of Pesticides' of July 2002, the Commission launched a broad consultation of all stakeholders and institutions. With the adoption of the 6th Environment Action Programme the Council and the Parliament called for the elaboration of this Thematic Strategy and determined the goalposts and objectives of such a new tool. The main objective of the Thematic Strategy is to reduce the impacts of pesticides on human health and the environment and more generally to achieve a more sustainable use of pesticides as well as a significant overall reduction in risks, but also a reduction of the use of pesticides consistent with the necessary crop protection.
In particular, the objectives of the thematic strategy are the following:

1) to minimise the hazards and risks to health and environment from the use of pesticides;
2) to improve controls on the use and distribution of pesticides;
3) to reduce the levels of harmful active substances, in particular by replacing the most dangerous by safer (including non-chemical) alternatives;
4) to encourage the use of low-input or pesticide-free crop farming;
5) to establish a transparent system for reporting and monitoring progress including the development of appropriate indicators.

The 6th Environment Action Programme does not define the legal form of the Thematic Strategy. The Commission therefore has full flexibility to choose the most appropriate form. In the Communication, the Commission considers that in implementing the strategy, the Community and the Member States could use many different instruments: legally binding measures, (economic) incentives, research or voluntary measures. Combination of all types of instruments is also possible.

1) National Action Plans;
2) Improved systems for the collection of information on distribution and use and enhanced compliance/monitoring schemes including annual reporting;
3) Training of users, standards for spraying equipment and collection of containers and obsolete pesticides;
4) Measures to promote low-input farming and cross-compliance for CAP support measures.

2.1.2. Common Agricultural Policy

On 26 June 2003, EU farm ministers adopted a fundamental reform of the Common Agricultural Policy (CAP). The vast majority of subsidies are now paid independently from the volume of production. These new "single farm payments" are linked to the respect of environmental, food safety and animal welfare standards ("cross-compliance"). The reformed CAP aims at a strengthened rural development policy with more EU money, new measures to promote the environment, quality and animal welfare and to help farmers to meet EU production standards starting in 2005.

2.1.3. Directive 91/414/EEC

In the European Union, the regulatory framework concerning Plant Protection Products comprises Directive 91/414/EEC on the placing on the market of plant protection products, and several Directives on residues in food and feedstuffs. These regulations focus particularly on the beginning and the end-of-life stages of such products. However, the actual phase in the life-cycle of plant protection products, which is a central key element for the determination of the risks they pose, is not sufficiently addressed by the existing regulatory framework.

With respect to the quality of surface water and ground water, respectively Directive 75/440/EEC and, Directive 80/68/EEC outline the strategy and regulatory framework.

2.1.4. The Belgian regulatory framework

To implement the Directive 91/414/EEG at the Belgian level, the following decrees were put in place (see www. phytoweb.fgov.be for a more detailed description):

- RD 28/02/1994 with reference to Plant Protection Products;
- MD 07/04/1995 with reference to Plant Protection Products, amended in 2002;
- RD 08/11/1998 with reference to Protection Certificates;

- RD 13/03/2000 on Maximum Residues

More recently, the RD 22/02/2005 has been approved, outlining the first Belgian reduction programme for plant protection products in agriculture and the use of biocides. The federal reduction programme aims at achieving a more sustainable use of pesticides and a significant general decrease in the risks associated with the use of pesticides, in balance with the necessary plant protection. The programme wants to reduce the negative impact of pesticide use in agriculture with 25% at 2010. To this end several measures are proposed, such as legislative reform, total traceability, improvement of technical measures and additional measures to reduce the presence of pesticide residues.

2.1.5. Future legislative options

The Belgian policy makers can pursue two options to further regulate the use of plant protection products, whether they further restrict the current regulatory framework or they opt for an adaptation of the current measures. Both options are discussed below.

More stringent regulatory framework
Additional constraints can be imposed to producers based on type of pesticides, equipment, time of application and regional zones. Adherence should than be checked using an efficient and effective control system. In theory, two types of additional standards can be imposed: those which measure performance and those which measure the design. Performance standards regulate the output. The producer can, in function of his personal preferences, individually determine how he remains below the prescribed output. Design standards prescribe the path the producers have to take. These standards are more easily controllable for the official bodies, but flexibility is lost for the individual producers. Uniform design standards impose high costs to producers due to differences in farm structure.

To regulate the availability of chemical pesticides, several options can be pointed out:

1. Pesticides could be obtained on prescription. This system is considered fairly bureaucratic and too time-consuming for the producer (hence costly).
2. Pesticide input quotas. At national level, an upper boundary on each group of active ingredients could be imposed. Based upon current and historical data, farmers obtain a quota per active ingredient group: restrictions can be posed on company or field level.
3. Transferable quotas (although this can be considered as a market mechanism) from year to year and between different farmers are an option, because application of pesticide doses is function of the climate, the pest population etc. In sales centres, farmers' purchases have to be administered.
4. Credit system: farmers receive a total of for example 10 credits per crop. When using a pesticide classified as dangerous, some points are deducted. Fewer points are lost when using less harmful pesticides. A negative score is permitted, as long as the farmer remains below the prescribed level of active ingredients. Corrective measures, such as an extended buffer zone, the use of green electricity and habitat management should then be integrated. This system is considered as rather complex due to the compensation measures.

Adaptation of legislation
The system currently used, starts from approval and registration. However, the formulation of standards is dominated by eco-scientists, who focus on risk minimization. The economic consequences are largely neglected and a danger exists of overuse of the approved pesticides, leading to pest resistance.

A more stringent legislation as such is considered as rather harmful for the agricultural sector, which is already under high pressure. A combination of a more restrict legislation with a legislation more adapted to producers' wishes and possibilities could be a better solution, taking into account the technical production process restrictions they already experience during daily practice. Government should issue legislation more in line with the producer's daily reality. Hence, intensive communication between policy makers and farmers' representatives when adapting legislation is a prerequisite.

2.2 KNOW HOW AND INFORMATION DISSEMINATION

The stimulation of research and the dissemination of knowledge can be regarded as one of the most promising and feasible solutions for the increased use of sustainable practices, both from economic and social point of view, the former because the community as a whole bears the costs, the latter because no

(visible) enforcement mechanisms are applied. The strategy can increase the use of sustainable practices significantly, at a relatively low cost for society. The most important condition should however be that the newly introduced methods and techniques imply a significant (economic) improvement for the implementers.

2.2.1. Advice and training

The advice and training instrument is very useful for farm managers in case of lack of information or misperception. The starting point should be to get farm managers acquainted with alternative production methods. The strategy could or could not be compulsory, with non-compulsory implicating that only a selective (interested) public will be reached. Another problem arises because alternative production methods, in most cases, impose higher costs to the producers. Hence, implementation will only be achieved when the alternative becomes compulsory or financially attractive. Some examples of alternative methods with a lower environmental pressure do exist. The use of bumblebees for fertilisation purposes is very cost-effective compared to use of man labour, but some pesticides are extremely harmful for the bee population, hence alternative, less environmentally harmful strategies are introduced in horticulture. By financially supporting demonstration projects and after school education (courses, presentations and traineeships), the government tries to fill in the current knowledge gap.

2.2.2. Creating consumer awareness

Consumer awareness campaigns can be an appropriate tool to alter consumption patterns in the long run. The problem is that Belgian consumers, unlike German consumers for example, are fairly uninterested in making these kinds of choices. Belgian consumers prefer other bodies to take the appropriate measures. Hence, awareness campaigns will demand an elaborated financial (government) investment plan and a long term vision.

2.2.3. Stimulation of research and development

New pesticides should be developed with a low level of (harmful) active ingredients and suitable for spot application and new machinery should co-evolve with the pesticide types. To this end, some governmental efforts are essential. Because of the concentration in the pesticide industry, only a few multinational companies are important players in the field. For approval of new kinds of pesticides in the EU member states, the products of these companies have to be evaluated and approved in every country, which makes the process extremely costly. These companies hence don't invest in economically less important crops, leading to limited options for the farmers. The farmers associations propose an approval system on EU level, based upon climate zones, instead of the country-specific approach.

Extra budget should also be released for research concerning alternative production methods (for example new type of crops etc.).

2.3 ECONOMIC INSTRUMENTS FOR PUBLIC POLICY MAKERS

Up to now, the negative external effects of agriculture are hardly incorporated in the product prices. In the case of environmental goods, government intervention could influence market actors' behaviour. Different policy measures influencing market mechanisms, both compulsory and non compulsory, can be appointed.

At producers' level, **subsidies** can be used to correct for the economic loss caused by measures aimed at increasing environmental sustainability. Agri-environmental measures (EU's sixth environment action programme) for example offer support for commitments on keeping records of actual use of pesticides, lower use of pesticides to protect soil, water, air and biodiversity, the use of integrated pest management techniques and conversion to organic farming. The problem with this kind of subsidies is that those who participate are not the biggest polluters.

Craincross (2000) argues that subsidies in agriculture, while increasing production of a limited number of crops, decrease biodiversity and can become harmful for the environment. An environmental policy for sustainable development could therefore better aim at reducing the subsidies which endanger the environment. This would reduce incentives to overuse natural resources, as well as increase the efficiency

of the economy because the market would not be distorted anymore and market prices would reflect the true value of goods and services.

At sector level, the State can try to reduce the price difference between environmentally sound products and conventional products, by subsidizing the sales of the environmentally sound products. These subsidies can be appointed to the processors of these products, because this is easily administrable (due to the relatively small number of processors). The problem in this case is whether and to what extent the decrease in prices will be visible at consumers' level. Another possibility is a direct cut in consumer prices at retail level. A financially and administratively less demanding option is the sponsoring of advertisement campaigns.

Permits, property rights and user rights aim at creating a price for negative effects. The government can administer property rights or user rights to the environment. Hence, a purely collective good becomes a purely individual good. The market actor obtains the exclusive right to use the environment. The government determines the price for the external effect and market actors enter into a contract to regulate the external effects. They are held responsible for the pollution.

Permits are to a certain extent comparable with quotas. Permits primarily focus on the output, while the quota system measures the level of active ingredient input. Users of the environment (farmers) are given the possibility to reach a certain level of pollution (confer Manure Action Plan, MAP). A maximum pollution level is determined for the sector as a whole. These permits can also be made transferable.

Defining property rights can be a powerful strategy for SD because of the following two reasons: first, people will take more care of an asset which he or she owns compared to one which is communally owned. Communal property can easily lead to a tragedy of the commons. The concept was introduced by Hardin (1986) and is defined as the process where the *"sink capacity is tampered by human contributors without having to pay for such a destruction"* (in Rao, 2000). And second, property rights can be enforced by courts, so that polluters can be imposed a cost for their pollution.

Taxes and charges aim at forcing the polluters to pay, and thereby overcoming externalities. Polluters are charged for the use of natural resources. The Belgian Federal Plan for Sustainable Development includes a number of tax measures taken to reduce the environmental burden of some industries, i.e. (1) taxes on unwanted social or ecological ways of producing and consuming and/or tax reductions on desirable production and consumption patterns; and (2) shifting the base on which taxes are calculated from labour to the level of use of environmental resources. The government should thereby take the impact of the taxes on the poor into consideration. Furthermore while greening its tax regime, the governments should look after a strict budget control.

Inversely, the government can issue tax reductions for "green" goods and services. The Belgian government is still debating on the possibility for a positive incentive for consumers to buy goods and beverages in a recyclable packaging material. However the "Ecoboni" policy has not passed the political discussion yet. After being introduced in January 2005, the measure has been abolished again in July 2005.

These measures aim at a change in the behaviour of farmers. They also confirm to the 'polluter pays' principle. Regulating taxes can be based upon the number of pollution units per hectare or farm (for example quantity of pesticides in water). The underlying idea is that external effects are valorised and integrated in the company costs (i.e. Pigouvian tax, stating that the negative externalities caused by pollution would be internalized by the market if polluters paid a tax equal to the marginal social cost of polluting emissions, Pigou (1920) in Nimubona and Sinclair-Desgagné, 2005). Farmers who can easily adapt their production process, will do so by investing in pollution reduction measures, to reduce the tax amount they have to pay. The rest will pay the full tax amount. This system offers the farmers a choice between changing the production process and paying the tax, hence each farmer can make his personally preferred choice. This system also stimulates innovation. One of the main difficulties with the regulating tax is the correct definition of the relationship between tax level and pollution level.

When it is too difficult to calculate the exact amount of pollution units per farm, the inputs (pesticides), the production process (conventional versus integrated versus organic) or the output (f.e. number of

conventionally produced potatoes) can be taxed. These measures aim at generating tax incomes, which can be refunded to the market.

Producers are risk averse; hence they might exaggerate their use of pesticides to reduce the risk on crop failure. **Crop insurance** could be the solution to this. The insurance premium should be lower than the cost for a standard pesticide application. This system is rather difficult because damage levels (as well as the causes) are difficult to estimate.

Vat-differentiation is another policy option influencing market behaviour. According to the degree of ecologic efforts, the different production process strategies (f.e. conventional versus integrated versus organic farming) could be administered a different VAT-level. This strategy causes a major shift in the administration procedures.

Mandatory labeling as a tool is mainly used when a political consensus is absent concerning the negative effects of a strategy. Good examples are genetically modified crops. The government asks for mandatory labeling in case of asymmetric information (when one party is more informed than another), because consumers have the right to be informed of the product's content. The information on the label should be clear and increase food (or environmental) safety. All steps in the labeling process (such as standards, testing, certification, enforcement), should be clearly described. This tool is very efficient in case of a difference in consumer preferences. The message on the product steers consumers towards a more environmentally sound consumption pattern, hence externalities (i.e. difference between actual situation and situation the government aims at) will be reduced. Due to a shift in consumption preference, the market will follow by a change in production strategies. In Germany, a system with ladybirds exists (voluntary). The more ladybirds on the product package (with a maximum of five), the more environmentally sound the production process is.

2.4 PRIVATE VOLUNTARY MECHANISMS

Despite the variety of their types and subtypes, all voluntary approaches contain a common element: they are nonlegislative commitments to undertake additional efforts in pollution abatement. In essence, a polluting firm is not required by law to develop or adhere to a voluntary approach. As a consequence, in contrast to other instruments, voluntary approaches do not apply to all firms belonging to the same industry, contributing to the same adverse effect, or submitted to the same jurisdiction.

This definition of the legal aspects of voluntary approaches does not imply that these instruments are developed without external pressure on polluting firms, including pressure from public authorities. Typically, voluntary approaches are initiated in response to consumer and community pressure; competitive pressure; and a threat of a new regulation or tax (Börkey et al. 1999). Moreover, there are various ways in which these approaches are interlinked with the legal system.

2.4.1. Types of voluntary mechanisms

Four main types of voluntary approaches can be distinguished depending on the parties involved (Börkey et al. 1999):
1. unilateral commitments made by polluters;
2. agreements achieved through direct bargaining between polluters and pollutees;
3. environmental agreements negotiated between industry and public authorities;
4. voluntary programmes developed by public authorities (e.g., environmental agencies) to which individual firms are invited to participate.

The latter two imply an important role played by public authorities, the former two fully reside in the private sphere (private voluntary mechanisms).

Unilateral commitments consist of environmental improvement programmes set up by firms and communicated to their stakeholders (employees, shareholders, clients, etc.). The definition of the environmental targets as well as of the provisions governing compliance, are determined by the firms themselves. Nevertheless, firms may delegate monitoring and dispute resolution to a third party in order to strengthen the credibility and the environmental effectiveness of their commitments (Croci & Pesaro, 1996).

Private agreements are contracts between a firm (or sometimes a group of firms) and those who are harmed by its emissions (workers, local inhabitants, neighbouring firms, etc.) or their representatives (community organizations, environmental associations, trade unions, business associations). The contract stipulates the undertaking of an environmental management programme and/or the setting of a pollution abatement device.

Contracts between the public (local, national, federal or regional) authorities and industry are known as **negotiated agreements**. They contain a target (i.e., a pollution abatement objective) and a time schedule to achieve it. The public authority commitment generally consists of not introducing a new piece of legislation (e.g., a compulsory environmental standard or an environmental tax) unless the voluntary action fails to meet the agreed target.

Within **public voluntary programmes,** participating firms agree to standards (related to their performance, their technology or their management) which have been developed by public bodies such as environmental agencies. The scheme defines the conditions of individual membership, the provisions to be complied with by the firms, the monitoring criteria and the evaluation of the results. Economic benefits in the form of R&D subsidies, technical assistance, and reputation (for example by being permitted to use an environmental logo) can be provided by the public body.

The focus in this research, certification and labeling, principally concerns the first and the last type of these mechanisms.

2.4.2. Key features of voluntary approaches

Some key features can be identified that make voluntary approaches differ one from another.

Individual or collective voluntary approaches
Voluntary approaches may be developed by single firms or by coalitions of firms. Unilateral commitments have been developed by a number of firms, for example in the case of waste production and recycling, and energy and material consumption. Similarly, sector based programmes to improve firms' environmental performance have been undertaken. Whether voluntary approaches are collective or individual is a key distinction, for the former involve inter firm cooperation whereas the latter do not. This directly influences the costs of voluntary approaches, in particular the costs of monitoring and sanctioning non compliance to limit free riding (free riding occurs when it is in the interest of economic agents not to contribute to an action because they will benefit from it without paying its costs).

Local/global voluntary approaches
Voluntary approaches cover the whole spectrum of geographic delimitations. They may take place at a local, national, federal or regional level.

Binding/nonbinding agreement
The legal form of voluntary approaches is an important element of their success. Agreements are binding for both parties when they include sanctions in the case of non compliance and are enforceable through a court's decision. Binding agreements, as opposed to nonbinding agreements, or gentlemen's agreements, are more likely to be effective.

Open/closed access to third parties
As they operate outside the regular legislative process, voluntary approaches are not necessarily transparent and open to all vested interests. However, the involvement of additional parties is possible. Third parties, like community organizations and green groups, play an increasing role in unilateral commitments as well as in negotiated agreements.

Target based and implementation based voluntary approaches
Voluntary approaches may concern setting pollution abatement objectives and/or the implementation of measures to achieve them (EEA, 1997). Where the environmental objective is set by the party(ies) involved in the voluntary approach, the voluntary approach is called target based. Where the target is set within the framework of the regular legislative process by government, and the voluntary approach only

consists of selecting and implementing the measures to achieve it, the voluntary approach is termed implementation based.

2.4.3. Motives for participation in voluntary approaches

Going beyond compliance is counterintuitive because a firm is supposed to make money and abating pollution is costly: its costs include capital resources to change processes or to buy end of the pipe technologies, and human resources in research and environmental management. These expenditures will increase the production cost and as a result there will be either a decrease in demand due to increasing product prices, or a decrease in profit if the firm decides not to raise its product price. However, different incentives for adoption of voluntary strategies can be identified, as outlined below.

Regulatory gains
A commonly expected gain associated with voluntary abatement is avoiding the costs of public regulations. The government may plan to introduce a new standard or a new tax. In behaving proactively and deciding to reduce its emissions, a firm may expect to pre-empt public regulation (Maxwell et al., 1998).

Saving inputs, increasing sales and enhancing reputation
Benefits from voluntary abatement are not limited to regulatory gains. An additional pollution abatement may result in a better use of, and access to, inputs. Such a case is called 'no regret action' and the classic example is that of energy savings. Environmental improvement of a process may be associated with a lower consumption of fuel or gas, and, therefore, may result in a reduction of energy costs.

Another expected gain for firms' voluntarily abating pollution is provided by product differentiation on environmental performances and their signalling to consumers via advertisement and labeling. Once the environmental performances are known, green consumers can express their willingness to pay for the environment in purchasing goods. High quality products will then be sold at higher prices. Even if consumers do not want to pay more for greener products, there may still be an advantage of differentiation. At the same price consumers opt for greener products and therefore the greener firm is rewarded by an increase in its market share. Finally, as a rule, product differentiation relaxes price competition.

A third benefit which may outweigh the abatement costs is reputation gains vis-à-vis stakeholders (its employees and local communities).

2.4.4. Some important extensions

Minimum Quality Standard at sector level
In some cases, the number of participants in a private voluntary initiative can encompass a full sector, when the players jointly propose a Minimum Quality Standard (MQS) surpassing the legal requirements. Main reasons are retaining consumer trust and avoiding an impact on the sector due to an isolated crisis. The sector can also impose measures on the sector players to avoid governmental interference, when considered less optimal. This tool is typically used for products difficult to diversify in the market place (such as vegetables and fruits).

The MQS in the fruit and vegetable sector is faced with difficulties concerning definition and control (Giraud-Heraud et al., 2003). The risks are only visible in the long run and difficult to identify. Government policy induced a ban on dangerous active ingredients and homologated this at EU-level. Secondly, they imposed Maximum Residue Levels (MRLs). Due to the intensification in crop production, globalisation and the decrease of consumer trust, government control is considered insufficient. Therefore, they prefer private standards with independent control bodies (integrated in Good Agriculture Practises, GAPs). In the fruit and vegetable sector, the GAPs are privately initiated.

Certification
Sector players 'impose' extra product characteristics and standards on their suppliers or jointly agree on extra standards, aiming at a diversification in the market place or as a safety measure. These measures are integrated in certification books and in most cases monitored by a third party. After a positive evaluation, producers receive a certificate, which enables them to sell their produce under the specific conditions of

the certification initiative (whether this is market access to previously closed sales channels, higher prices or something else). When the certification strategy is accompanied with a label, we speak of Business to Consumer (BtoC) communication, if not, the certification standard is meant for Business to Business (BtoB) communication purposes. A more in depth description of the general objectives of certification is given in Chapter 6.

Other voluntary strategies at retail level
Possible strategies at retail level could be:

- internal cross subsidies on sustainable products in combination with higher margins on non sustainable products;
- saving and rewarding systems mainly focussing on sustainably produced goods;
- extra shelf space for sustainable goods (creating a positive retail image);
- advertisement for sustainably produced goods, financed through a 'tax' on food;
- no price stunting, except for commodities produced in a sustainable manner.

3. Labeling

A label should provide the consumers with information based upon which they can differentiate labelled products from otherwise similar products. In case of a lack of information, consumers can not make an optimal choice, and might buy a product that does not match their preferences. As a result, resources are less efficiently used than in a perfect market (Golan et al., 2000). The label provides missing market information on the production process or attributes certifying that the product complies to a set of criteria (Bougherara and Grolleau, 2002). These criteria can be minimum requirements for social, economic and environmental development. A consumer of labelled products is prepared to pay a premium for the extra attributes of these products. Labeling then increases economic efficiency by helping consumers to target expenditures towards products they most want (Golan et al., 2000).

For voluntary labels, developed by an individual or group of firms, it is imperative that the benefits from increased sales of a labelled product outweigh the costs. Issued by the government, mandatory labels will have a social goal, trying to alter people's economic behaviour. Yet both try to target the consumers' behaviour by attracting attention to certain product attributes. A consumer buys a product after clearly evaluating all attributes including search, experience and credence attributes. Search attributes are considered before the actual purchase of the product and are e.g. colour, price, size. Experience attributes are those which consumers perceive after the purchase and use of the product. Consumers attach experience attributes to the product after purchase, while credence attributes are not accurately evaluated. They are better known by the producers than by the consumers, as is the case for environmental or ethical attributes. A third-party assessment is commonly put in place to add to the credibility. The label would form a proxy, while the consumer does not need to search a more direct contact with the producer (Golan, Kuchler et al. 2000; Bougherara and Grolleau, 2002).

From the producer-firm or government side, the labeling decision is not an easy one because many attributes can be labelled, and it is not easy to know what the many and very different consumers find important. The effectiveness will depend on the type of information involved and the level of distribution of the costs and benefits of proving that information (Golan, Kuchler et al. 2000).

4. Sector players' attitude towards labeling versus alternative strategies for enhanced ecologic sustainability

During focus groups organised with different sector players, some of the strategies outlined above were discussed with the participants. In addition, sector players were asked to formulate missing strategies and to scale the strategies based upon their contribution towards ecological sustainability. In the mean time, sector players were asked whether the strategies are economically viable for the sector.
The different sector players questioned are: promoters of a labeling initiative and representatives of the Administration, the producers, the distribution, the consumers and the auctions. Figure 2.3 shows the perceived contribution of each initiative towards ecologic sustainability and the economic viability according to the participants. This figure should be interpreted as indicative, given the complexity of this

subject. This figure is based upon qualitative information, hence the distance and level of contribution are questionable.

A general remark has to be made: because of time lack, the participants were not asked to express their opinion concerning the contribution of the different strategies towards social sustainability. It is clear that this is an important drawback for an assessment of the strategies' contribution towards overall sustainability.

4.1 ADDITIONAL STRATEGIES PROPOSED BY SECTOR PLAYERS

The focus groups participants were asked to identify additional strategies above those presented by the researchers. The following were commonly agreed upon:
- Short supply chain projects with direct communication between producers and consumers;
- The enhancement of farmers' awareness, resulting in more compliance with the laws;
- Adapted legislation instead of more restrictive legislation: extra restrictions aren't necessary, the legislation should be more in line with the reality in the field, improving compliance.
- Regional labels;
- More follow up from government (i.e. more and more appropriate controls)

4.2 CONTRIBUTION TOWARDS ECOLOGIC SUSTAINABILITY

4.2.1. Labels and certification books

Labels (f.e. Flandria) and certification books (f.e. EurepGAP) are both an equally interesting tool for stimulating ecologic sustainability. Within the different labeling initiatives, the sector players do identify major differences in contribution towards sustainability. Organic labeling for example is perceived as highly favourable for ecologic sustainability. On the other hand, the scale of the initiative is also important. Some labeling initiatives are less restrictive compared to organic production, but their number of members widely exceed the organic label membership, hence their overall contribution towards sustainability may be larger. Measures such as 'observe and alert' and more controlled soil disinfection among others are important, but it will always remain a battle between production and the application of resources.

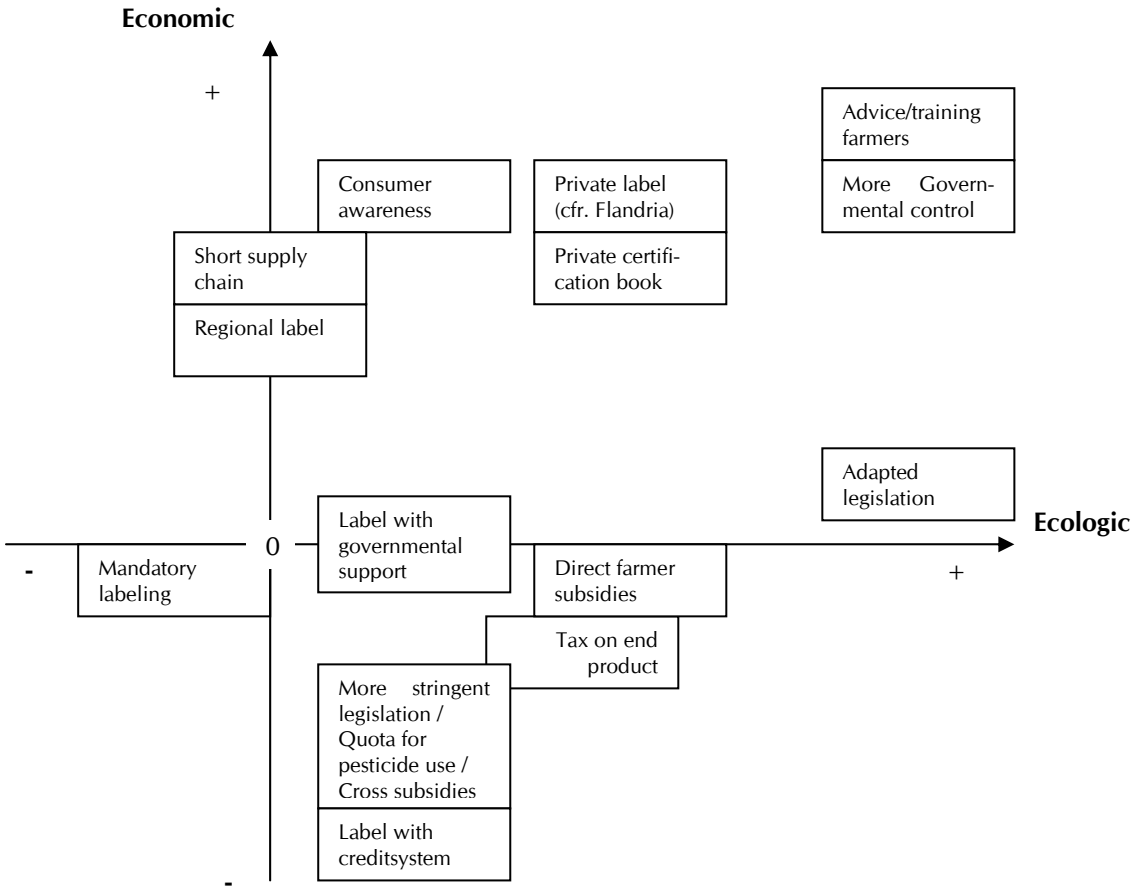

Figure 2.3: Contribution of different strategies towards ecologic and economic sustainability

4.2.2. Label with credit system

In general, this system is perceived far too complex to be workable in practice. To adapt this system (to make it more stringent each year) seems very laborious. Because of the need for continuous adaptation, it cannot be used in practice. The advantage is the fact that farmers can position themselves versus other farmers, because they have an exact measure of their contribution versus sustainability. This system allows them to evolve in a more sustainable direction. From the perspective of excess usage reduction, this system clearly seems ecologically advantageous, because farmers' excessive use of harmful products is punished. The problem could be that farmers use more compared to the past, when they did not yet reach their upper boundary.

4.2.3. More stringent or adapted legislation

Both systems have a positive impact. When the legislation becomes too severe, agriculture will disappear, hence adapted legislation is a better tool. The legislation should not be restricted further, to give market initiatives the possibility 'to breath'. A more stringent legislation can only work when it is applied all over the world. Another problem associated with this is an increased possibility of non-compliance and shifting away towards uncovered areas. Adapted legislation means taking the production circumstances into account. An example to elucidate this: nowadays there is a fertilization stop starting from August 31st. When September is very rainy, all fertilizers leach out in the groundwater. In that case, spreading the application of fertilizers is more effective and less harmful. However, in case of dry weather, this law is very effective.

4.2.4. Subsidies, taxes and VAT-differentiation

The ecologic effect of these measures is clear and more direct compared to labeling initiatives, because a rise in price reduces the demand. The problem with taxes is that, if they are not imposed on every product, they will always be evaded. They should also be imposed at the European level; otherwise

farmers purchase the products in our neighbouring countries. In case of a VAT-differentiation, it is very difficult to quantify the exact height of the levy. Another problem could be the building up of stocks when the tax is announced.

4.2.5. Creating consumer awareness

This is successful when it leads to a change in purchasing behaviour. The impact is considered rather small because alerting consumers is very difficult. The consumer does not want to make this decision; other people should perform this task (f.e. by imposing a more restrictive legislation). The effect will only be measurable in the long run. A circular reasoning can be made: labels are not successful because the consumer is uninterested, and the consumer is uninterested because labels are not well communicated.

4.2.6. Increasing farmers' awareness

Because farmers are the prime actors affected by strategies aiming at a change in pesticides use, all participants perceive this tool as essential for enhanced sustainability. The measure does not affect the target group financially, hence acceptance and success will be more than reasonable. New developments should be demonstrated by means of effective field tests. An example is a control field with calendar spraying versus a field sprayed only after monitoring. Farmers will believe the effectiveness of a measure when proof is delivered in practice.

4.2.7. Short chain supply

Because of the decrease in transportation distances, the contribution to ecologic sustainability is reasonable. In many cases, product packaging is also diminished, also decreasing the environmental burden. This system is only suited for a part of the producers and chain members, hence its impact will remain rather small.

4.2.8. Regional label

This type of labeling does not directly affect ecologic sustainability regarding pesticide use. It can motivate consumers to purchase locally produced food, reducing the transportation burden. A lot depends on the prescriptions in the 'cahier de charge'.

4.2.9. Quota on pesticides/active ingredients

Some participants do not perceive this as ecologically sustainable, because farmers will always try to use their full quota. Concerning the amount of pesticides allowed, the legal norm is probably the reference, hence the contribution of this system can be considered equal to the legal situation.

4.2.10. Direct subsidies for farmers

This system will have ecological benefits in the short run. If it results in changing the attitude of the participants, the long run effect can also be positive. The system 'observe and alert' is a good example.

4.2.11. Cross subsidies

In theory, this system seems very suitable and promising for shifting consumption in a more environmentally sound direction. In practice however, this system is regarded as not applicable. Retailers fear difficult negotiations with suppliers and non cooperation of competitors.

4.2.12. More stringent government action

With more stringent government action, participants mean more controls, and more effective controls, predominantly aimed at the group of 'free riding farmers'. The contribution towards sustainability seems important, because it will eradicate current misuses effectively. The polluters will be punished, instead of the farmer community as a whole or the consumers. The measure is also less visible (compared to a change in price f.e.), hence acceptance will be larger. Problems are the time consuming controls, the administrative burden for the farmers, and the financing of the system. A penalty system could solve this last problem.

4.3 CONTRIBUTION TOWARDS ECONOMIC SUSTAINABILITY

4.3.1. Label

The Flandria-label is clearly an improvement in the field of economic sustainability, because it adds surplus value to the product, it covers an extensive product range, it is well accepted in the domestic and export market and it groups the major part of Flemish vegetable growers among other things. Quality of EurepGAP products is lower compared to FlandriaGAP products, but market certainty is equal for both labels. Flandria is perceived as economically more sustainable than EurepGAP. Farmers perceive a private cahier de charge as an obligation, while participating in a label is considered as an honour, it stresses the distinctive features. A cahier de charge without label is also interesting for farmers when it is widely accepted in the market place and when it offers new marketing opportunities.

4.3.2. Label with governmental support

This option is not giving enough market impulses to be viable in the long run. It is not because of governmental support that a label will be more economically viable. In the early stage, governmental support can be defendable to cover initiation costs. For example, the governmental support for communication is larger for organic products compared to Flandria (in percentage of the total private budget for communication). Whether this will result in continuation of organic farming will depend on the quality of the support provided.
This initiative is difficult to place on the economic axis, because the effect can be either positive or negative. The preconditions for support are also a key factor in the success of the initiative.
Players do agree that a label with governmental support has more chances. A lot of labels result from private initiatives, but their growth rates largely depend on the reception of governmental support.
Another option is a governmental label, with clear governmental prescriptions for the label, comparable with an 'appellation of controlled origin'. In such an initiative, a cahier de charge is imposed to producers without additional support.

4.3.3. Label with credit system

Because this system is too difficult to explain, to implement and to monitor, it is perceived as not viable. It is also technically not workable. The administrative burden is quite large for the farmer and the controlling body. It is also too flexible, creating uncertainty for the farmers. Moreover, the system is too specific, too detailed. Every instruction book works per definition with one or another coding system, which is a mixture between workability and accurateness. This strategy is also very difficult to explain to the consumer. Because of the multitude of variables in food systems, the points system is not feasible. In the extreme case, a farmer has to choose between loosing his crop and being punished.

4.3.4. Adapting/restricting legislation

A more stringent legislation will have an adverse effect. With the level of severity, adherence becomes more difficult and sheeting more common. The only advantage is that measures for enhanced ecologic sustainability are expanded to every farmer, resulting in a more equal distribution of the burden. This situation is comparable with the Flemish environmental policy. This policy is too extensive, resulting in a contra productive effect. Market actors reason: *'To be able to drive 60 on average, one must accelerate to 70 from time to time'*.
Climatologic circumstances should also be given proper attention.
A product that cannot be produced in Belgium, due to a stringent legislation, will be imported, resulting in a worse off situation for ecologic sustainability (due to transportation). The consumer wants to dispose of everything, at any time.
Adapted legislation is more neutral, it is more giving and taking. Administration, for example, is labour intensive, but in the end it is time and cost saving. Another example is the necessity for a unified pesticide regulation per climate zone at the EU level. The European and international legislative prescriptions should be taken into account before imposing a more restrictive policy. Adaptation of legislation will result in lower investment costs. The fuel oil policies, for example, are alleviated because benefits did not outweigh the costs.

4.3.5. Quota

For MeBr a kind of quota existed in Belgium (however, since 1/01/2006 it has been prohibited in Belgium). Because no alternative pesticides exist, the economic effects are disadvantageous, but the ecologic consequences are very positive. One should distinguish quota on resources (pesticides) from quota on production quantity. In the latter case, a black market for the product will be created. Another distinction should be made between quota and managing the quota in a sustainable manner. If, for example, a farmer spills his complete quota in the creek at the border of his production area, ecologic sustainability will be worse off. Typically, every farmer will have used the full amount of his quota each year. Players regard this strategy as economically neutral. An international quota on the resources will result in an ecologic advantage, but a quota per ha (f.e. for the management of Phytophtora) will create an economically unviable situation at micro level.

4.3.6. Taxes/VAT-differentiation

In concreto, this means a VAT-differentiation (VAT = Value Added Tax) on sustainable products. For organic products, price is a determining factor in the purchase decision, so for these products this system would be favourable. Some participants have doubts whether organic sales will increase significantly due to a (relative) decrease in price. They argue that organic consumers are conscious consumers, indifferent to the price difference. Others argue that, as demonstrated in numerous quantitative studies, price is considered as a key determining factor for the 'average' consumer, therefore economic viability of the more ecologically inspired initiatives will most likely improve. In this case, Flandria will probably be positioned between organic and conventional farming. Because of the unstable political environment (changing ministers every 4 years), the tax levels will change continuously.
Another option is levying taxes on the production resources (f.e. on pesticides). The influence on farmers' economic situation will be negative, because the surplus prices at factor level will probably not result in higher prices downstream.

4.3.7. Creating consumer awareness

This process is considered very slow, hence the effects will only be visible in the long run. Integration of certain topics, such as reading labels, in the education program of pupils could be a means. Normally, awareness should be created mainly through the product label, but consumers are generally uninterested in the extra information on the package. Two questions are at stake: do consumers understand the extra information and aren't they frightened by it? A good example are the E-numbers, the consumer does not comprehend these. Another problem associated with the strategy, is the lack of confidence in scientific research. Legislation is based upon solid scientific research (for example in case of M.R.L.'s), if extra labeling is necessary the impression is created that policy makers fail in their duties (the creation of reliable standards). Creating awareness concerning production methods seems economically interesting, because a more informed consumer is prepared to pay more. Communication with the consumers should be as clear as possible.

4.3.8. Creating producers' awareness

Initially, this strategy creates costs for the informing and receiving parties, but the optimizations will result into beneficial economic effects in the longer run. The important role of meetings between farmers is also stressed. All participants do agree that this strategy is a must for increased sustainability.

4.3.9. Short chain supply

In the case of short supply chains, the producer (seller) acts as a label. This system is considered no better or worse than the auction system. It is a system that will probably remain a niche in the market place. A farmer has to opt for a sales system suitable for his company and his personality. One should not forget that this market form is time consuming, relatively uncertain and more demanding from the farmer (selling skills). It is more direct than the regional label system, resulting in a more stable cooperation between market actors; therefore its economic viability may be higher in the long run.

The project 'Instruments and institutions to develop local food systems (LFS)' financed by the Federal Science Policy (SPSD 2, CP/59), focused on how LFS can enhance sustainable patterns of production and consumption in Flanders. LFS are systems where consumers prefer to buy their food locally, both for

social and environmental reasons. Entrepreneurship, reflection (self evaluation) and trust were found to be key elements and competences necessary for success in these channels.

4.3.10. Regional label

A regional label is less structured, less coherent, because the composition of market actors is more subject to change (each time other industries cooperate together). In the short run it is economically viable, but the question is whether the fragile alliances will last in the long run, resulting in a weak sustainability. Because a private label is more structured, it is probably more sustainable compared to regional labels and alliances. A regional label is more vulnerable (f.e. concerning quality). The quality difference between products in the same label can be substantial, because the only binding factor is the regional origin. Participants consider the basis too small to be successful.

4.3.11. Subsidies

The environment is one of the four pillars to receive GMO-support (support for Common Market Order for fruit and vegetables, mainly given to farmers unions). Environmental criteria are also of major importance for receiving farm level support from the VLIF (Flemish Agriculture Investment Fund). Supporting systems are nowadays usually linked to environmental measures. Participants are convinced of the economic stimulus given by subsidies. They perceive it as comparable to the strategy 'labels with governmental support'. When governmental support for the auctions would be substantially reduced, the sector would be confronted with a serious economic viability problem (which may raise the question whether the auction system is viable in the long run).

4.3.12. Cross subsidies

The retail sector does not consider this strategy as economically feasible, because the competition pressure is too high. In smaller retail shops as well, this strategy is not workable, because they also face intensive competition and their product range is too small. Similarly, producers will not accept the shift in money.

4.3.13. More stringent governmental control

Governmental control is considered too lax. A good and fair control is advantageous for the honest producers and for the community as a whole. It can also reduce risk occurrence (a good example: pre harvest control in lettuce is currently done by the government). The fine level should also be considerable, otherwise abuse is stimulated.

It should however be noted (as will be indicated later) that farmers are generally not very keen on increasing number of controls, whether performed externally or internally. Nowadays, the Food Agency (FA) makes no distinction between producers participating in private schemes and those not. Besides this, the former are privately controlled (mostly by a third party), the latter not, implying that the latter are far less submitted to controls. Typically, the share of subversive elements is larger in the latter group, because the need for compliance with the private scheme regulations hampers abusive behaviour. The farmers participating in private schemes hence argue for more governmental control within the group of non participants, given that an isolated crisis can influence the sector as a whole.

5. Conclusion

Nowadays, different mechanisms operate in the market place to reduce the ecologic burden from excessive pesticide use. These mechanisms can be subdivided into 4 distinguishable groups;
1. Know how and information dissemination;
2. Regulatory instruments (e.g. emission standards, product bans), whereby public authorities mandate the environmental performance to be achieved, or the technologies to be used, by firms;
3. Economic instruments (e.g. taxes, tradable permits, refund systems), whereby firms or consumers are given financial incentives to reduce environmental damage;
4. and Voluntary instruments, (e.g. voluntary codes, ecolabeling schemes) whereby firms make commitments to improve their environmental performance beyond what the law demands.

Each of these mechanisms has an impact on both ecologic and economic sustainability. Private voluntary mechanisms are perceived as the new tool for a more market oriented restriction of the resource use. Several changes in the public and private institutional settings have promulgated the introduction and acceptance of these voluntary mechanisms. They play on the moral responsibility of the actors involved and on the social sanctions to which the latter will be exposed in case of non compliance. Different types of voluntary mechanisms can be identified, among which unilateral commitments by private firms and public voluntary programmes can be regarded as the most important for this study. Some key features can be identified based upon which voluntary approaches can differ one from another, such as their individual or collective nature, the differences in scope, legal form and accessibility. Principal motives for the participation in voluntary approaches are regulatory gains, saving inputs, increasing sales and enhancing reputation.

In the opinion of the focus group participants, the contribution of a particular measure to ecologic and economic sustainability seems strongly correlated. Some measures with a poor chance of economic survival, receive a comparably low score for ecologic sustainability (f.e. cross subsidies or more stringent legislation), although the strategy in practice could prove beneficial for ecology.

The three ecologically most advantageous systems (training and advice for farmers, more governmental control and adapted legislation) can be positioned in the policy sphere, aiming at an **optimisation of the current policies**. The two economically and ecologically most beneficial systems (training and control) do not require major (financial) adaptations from the market players, instead, the government has to bear the extra costs. The implementation process for both strategies is also quite uncomplicated, and they result into a direct pay-off.

The other strategies can be considered as **'new' tools**, possibilities in the market place, to shift current practices away from unsustainable behaviour (hence they do not optimize current measures).

Private initiatives (such as certification and labels) are perceived as beneficial for sustainability because they are voluntarily initiated by the private sector, hence their market support may be considerably higher compared to governmental initiatives. Private initiatives have an economic purpose, aiming at gaining or keeping a certain market share. When the diversification strategy is based on ecologic features of the product or production process, the contribution towards overall sustainability seems guaranteed.

Chapter 3 Do Belgian Greenlabels attribute to environmental sustainability?

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Introduction to the chapter

To respond to **society's demand for a more sustainable agriculture** the mass market, some professional organizations, and even producer groups have proposed guidelines or standards concerning the management of farming systems. Facing this proliferation of guidelines, the consumer is confused. Which is the most sustainable? What are the impacts of the different types of agriculture (integrated, organic, etc.) How can one rate them? In this chapter a methodology is described to answer these questions. The proposed method is based on the Girardin method, which was developed to compare standards for arable farming systems (Girardin, 2002).

1. Pre selection of the studied greenlabels

Because the project is focused on pesticide use, only labels used in the domain of arable crops and fruit and vegetables were chosen. In these domains, labels pertaining to different levels in the food chain were selected. The labels with the highest spread and impact in the Flemish and Walloon regions were chosen.

The following label/certification systems were selected:

- EUREPGAP: *EUREPGAP General Regulations, Fruit and Vegetables. Version 2.1-Jan04. Valid from: 12th September 2003*.
- Organic farming: *COUNCIL REGULATION (EEC) No 2092/91 of 24 June 1991 on organic production of agricultural products and indications referring thereto on agricultural products and foodstuffs (OJ L 198, 22.7.1991, p. 1).*
- Flandria/FlandriaGAP: *Lastenboek Flandria/FlandriaGAP - versie 2004 - LAVA*
- Charte PERFECT: *Charte P.E.R.F.E.C.T. (version 2004) ou audit commun industrie-production* and *Filière PERFECT-EUREPGAP/Grille d'audit Perfect version 2004/GAP.Perfect04 001.1*
- Terra Nostra: *Cahier des charges : Pommes de terre culture raisonnée sous certification de conformité. Récolte 2004-2005*.
- Fruitnet: *Lastenboek 'Fruitnet' voor geïntegreerde productie van pitfruit. Versie 17/03/2003.*
- Geïntegreerd Pitfruit: 'Lastenboek Geïntegreerde Productie van Pitfruit - MBT: wettelijke tekst overeenkomstig met bijlage 1 van de ministeriële besluiten van 1 maart 1996, 26 maart 1997, 19 juni 1998, 4 mei 1999 en 20 mei 2000.

1.1 BIOGARANTIE (ORGANIC FARMING): THREE DIFFERENT LEVELS: FARMERS, PROCESSORS AND DISTRIBUTORS

The Biogarantie label was developed in Belgium for the inspection and auditing of organic products at different levels. Farmers, processors and distributors have to follow the specifications. Organic farming as it exists today is a cultivation method with strong agro-ecological foundations, exercised in a highly professional manner and refusing all chemical pesticides and nutrients. The European Commission has developed specific regulations for this environmentally friendly form of agriculture and stock-rearing (Council Regulation (EEC) no. 2092/91 24 June 1991 on organic production of agricultural products and indications referring thereto on agricultural products and foodstuffs). The Biogarantie quality label is only awarded after a positive control by an independent control body.

1.2 FLANDRIA/FLANDRIAGAP: FARM LEVEL

In 1995 the first tomatoes and chicory were sold in the auctions under the Flandria quality label. This comprises a guarantee of a high quality product, cultivated in an environmentally friendly way and perfectly traceable. Today there are more than thirty Flandria products being offered at Belgian auctions. To cultivate in an environmentally friendly manner implies that for each type of cultivation particular specifications are to be respected. For example, the use of organic resources is preferred and observation and warning messages must form the basis of crop protection. The use of fertilisers must be based on the results of soil analyses and considerable attention has to be paid to hygiene aspects. Strict requirements are also imposed to residue monitoring.

In order to meet the requirements of the people in the trade and of the government, the auctions "Mechelse Veilingen" and "Veiling Hoogstraten" decided to extend the content of the quality label Flandria by adding the FlandriaGAP Specifications. As a result of these specifications, the strict standards applying to Flandria for hygiene, planet-friendly planting and sustainable horticulture are now set even higher. Extra attention was paid to food safety, care for the environment and the work force. The auctions "Mechelse Veilingen" and "Veiling Hoogstraten" switched over completely to the FlandriaGAP Specifications in 2004. The first control of the products takes place at the auctions. An external control body is responsible for second-line control: it monitors the automatic control system within LAVA (Logistic and Administrative Auction association) and is responsible for the control of alien substances. This method guarantees foolproof control.

1.3 CHARTE PERFECT: FARM LEVEL

Charte P.E.R.F.E.C.T. is an initiative of a number of companies (Hesbaye Frost s.a., Ets. Jean Robert et Coopérative de l'Yerne s.c.r.l.) and is supported by the Walloon region. It is managed by the Centre Maraîcher de Hesbaye. Charte P.E.R.F.E.C.T stands for a chain quality system for the vegetable production and was inspired by the I.C.M.S. (Integrated Crop Management System) concept. Charte P.E.R.F.E.C.T. strives for sustainable vegetable production by the rational use of production resources, careful use of energy and non-renewable raw materials, limiting waste and stimulating recycling. Cultivation files and technical files form the basis of this system. It covers all the links in the food chain from the agricultural producer through storage and transport to the processors of vegetable production. Producers using this quality mark are audited by an independent body.

1.4 TERRA NOSTRA: FARM LEVEL

In 1998 the first Terra Nostra potatoes were put on the market. Terra Nostra is a generic quality label being increasingly used by Walloon potato growers. The label aims to give consumers guarantees concerning quality, traceability and respect for the environment. In order to be sold under the Terra Nostra mark potatoes must be grown in Wallonia and the grower must respect the particular specifications based on good agricultural practice, traceability and respect for the environment. Moreover he must have this controlled by an independent body. This cultivation technique also enables a reduction by 30 % to 40% in the quantity of fertilisers and pesticides used.

1.5 IFP (INTEGRATED FRUIT PRODUCTION) & FRUITNET: FARM LEVEL

The integrated production of pipfruit is an environmentally friendly cultivation method that became regulated by the Belgian government in 1996 (Royal Decree of 26.01.1996 and Ministerial Decrees of 01.03.1996 and 25.03.1996). This legislation determines the specific content of this production method, as well as the conditions under which reference can be made to the term "integrated production". It is the economical production of high quality fruit giving priority to ecologically safer methods, minimising undesirable side effects and use of agrochemicals, in order to enhance the safeguards to the environment and human health.

In 1990 the member producers of GAWI (Groupement des Arboriculteurs pratiquant en Wallonie les techniques Intégrées – Group of tree cultivators applying the integrated techniques in the Walloon Region) created the FRUITNET specifications. These specifications contain all the guidelines of the IOBC (International Organization for Biological and Integrated Control of Noxious Animals and Plants) for the integrated production of pipfruit, together with additional guidelines, which encourage environmental

measures (nesting boxes, hedges, introduction of auxiliaries, etc.) and give priority to the use of organic pesticides rather than chemical pesticides. The GAWI producers adapted their cultivation techniques and chose to fight harmful insects (greenfly, caterpillars, etc.) by using natural enemies (ladybirds, etc.) and traps. In this way the use of pesticides is kept to a minimum. When pesticides do have to be used, selective products are applied which have no noxious effect on useful organisms. In addition, the Fruitnet system (founded in 1990 by GAWI) guarantees traceability from producer to the point of sale. In addition to the internal control by Gawi Fruitnet asbl, external control is applied by independent accredited control bodies. Thus, fruit origin and quality control measures are emphasised.

1.6 EUREPGAP: RETAIL LEVEL AND FARM LEVEL

EurepGAP was launched in 1997 as an initiative of retailers - the so-called Euro-Retailer Produce Working Group (Eurep). EurepGAP is a quality system used in the agricultural sector by this group of retailers for reference purposes. The first EurepGAP specifications were established for fresh fruit and vegetables, followed by working documents for other sectors of agriculture. The document was drafted in cooperation with producer organizations on the basis of practical field experience and of the experience of certification bodies. EurepGAP was developed to become a complete accredited certification system. The intention is to continue to develop this system into a world standard for different sectors of agricultural production to be used by the retailers.

2. Definition of the focused environmental sustainability

An environmentally sustainable agriculture implies compatibility with the following criteria (Hill, 1992):

- meeting the basic needs of all people, and giving this priority over meeting the greed of a few
- keeping population densities, if possible, below the carrying capacity of the region
- adjusting consumption patterns and the design and management of systems to permit the renewal of renewable resources
- conserving, recycling, and establishing priorities for the use of non-renewable resources
- keeping environmental impact below the level required to allow the systems affected to recover and continue to evolve.

3. Sustainability assessment of the selected greenlabels: method based on the Standards analysis

Originally it was postulated to assess the sustainability of greenlabels by developing algebraic equations. An example of such an equation is the POCER-indicator which can be used to evaluate the pesticide risk for man and environment. An attempt was made to approach the technical evaluation of labels in a quantitative way, but because of the lack of data representative for the labelled/certified farming systems, it was impossible to use this methodology. Therefore a semi-quantitative method was developed to evaluate ecologic sustainability of the different labels. The method was based on the checklist method of Girardin (Girardin and Sardet 2002). This method is based on a detailed assessment of the impact on sustainability of each particular rule written in the different certification books and was selected based on an extensive literature review.

Detailed description of the technical-scientific methodology

The applied methodology consists of three phases. In the ***first*** phase different aspects of sustainability are defined. Environmental as well as human health aspects are emphasised. In total eleven aspects of sustainability were selected to evaluate the labels/certification schemes, namely Air Quality, Biodiversity & Landscape, Climate Conservation, Food Safety, Water Quality, Noise Quantity Reduction, Pest Pressure Reduction, Rare Resource Spillage, Soil Fertility, Waste Importance and Worker Safety. The selection of the sustainability aspects was based on a literature review concerning similar researches (Doom, R. 2001). For each of these aspects a checklist was made. All the rules that were thought to have an impact on the sustainability aspect under study were taken up in the list. The rules were translated into English to facilitate the communication between the Flemish and Walloon experts.

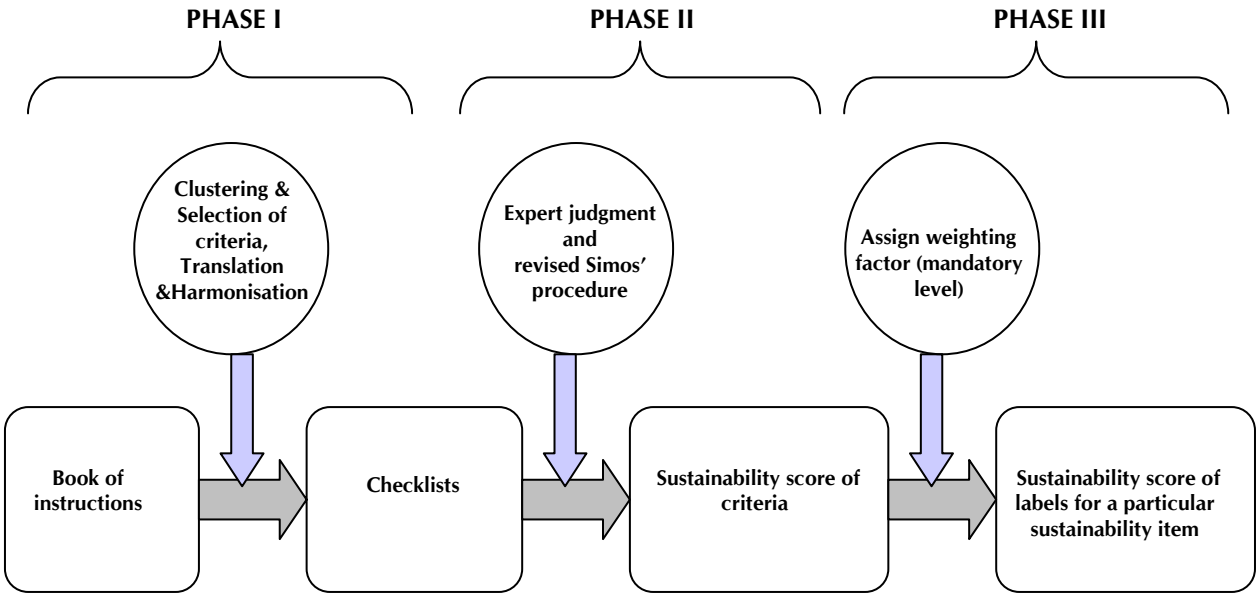

Figure 3.1: Overview of the technical-scientific methodology

In the ***second*** phase the checklists were submitted to experts in the different disciplines. The experts were selected on the basis of their experience and knowledge relating to the chosen sustainability items. The majority of the contacted experts were professors at the University of Ghent and Leuven. Furthermore, a number of experts were experienced researchers of scientific institutions or employees of governmental organizations. The experts were asked to rank the rules from the least important to the most important, starting with the rule that has the lowest positive impact on the sustainability item under study. On the basis of the rankings made by the experts in the different disciplines, weights could be determined for all of the rules mentioned in the checklists. Therefore the revised Simos' procedure was used (Figueira & Roy, 2002).This same procedure was also applied to attribute weights to the selected items of sustainability. This step was necessary to determine the contribution of each item of sustainability to overall ecologic sustainability. In the ***third*** phase the weights of the rules obtained with the revised Simos' procedure were multiplied with a factor which reflects the mandatory level of the rule. In this way a score was obtained for each rule, specific for a particular certification book. A total score for each sustainability item was achieved by adding the individual criterion scores.

Figure 3.1 gives an overview of the described procedure. The proposed method allows us to clarify the standards for users, to rank them according to one or all of the environmental components, to improve the current standards and help in writing new ones. The following paragraphs discuss the methodology in detail.

3.1 CLUSTERING AND SELECTION OF RULES RELATED TO ENVIRONMENTAL SUSTAINABILITY

The books of instructions of the seven label/certification standards under study were analysed in detail. Every rule related to any environmental or human health aspect was registered in a database and translated into English. The rules were registered in a field, named Text Item. The source references (i.e. label/certification book, paragraph number, chapter and paragraph name) were also registered in specific fields. Another field of the database is dedicated to the mandatory level of the rules (e.g. "major must", "minor must" or "recommended").

As the full database consists of 741 rules, it became difficult to analyse all of the rules without a previous grouping of comparable rules. Therefore it was necessary to group the related criteria according to their contribution to the concept of sustainable development. A clustering system was used in order to compile the numerous rules. Therefore several fields were added to the database. Eleven fields with environmental and human health impact items, relevant for an ecologic sustainability assessment were added. The following impact items were found relevant: Air Quality, Biodiversity, Landscape, Climate, Food safety, Water Quality, Soil Fertility, Waste Reduction and Management, Worker Safety, Pest Pressure Reduction,

Noise Quantity and Rare Resource Spillage. The clustering of the rules was based on their membership to general topics (chapters) as presented in the label/certification standards. Every possible impact of a rule on one or more of the considered sustainability items was indicated with "1" in the database. Rules that were supposed to have a negligible impact on one or more of the considered items were indicated with "0". This clustering of rules did not take into consideration the importance of the impact of the rules. Experts estimated for each rule the importance of the impact on a particular sustainability item. By allowing the experts access to all of the rules, the risk of underestimating some impacts was minimised.

The selection procedure of the rules related to environmental sustainability consisted of three phases. In the ***first*** phase the rules that are obligatory according to the law were eliminated. Thus only rules that give a surplus to legislation were included in the further analysis. ***Secondly*** all the rules that absolutely had no impact on any sustainability impact item were eliminated by the researchers of this study. In the ***third*** phase each of the rules was submitted to experts. They selected only those criteria that had a positive impact on a specific environmental sustainability item. The number of the rules selected for each item is indicated in Table 1.

Table 3.1: Number of selected rules having potentially an impact on environment or human health

Environment and human health Impacts	Abundance of related rules
Food Safety	308
Pest Pressure Reduction	120
Waste Importance and management	29
Water Quality	254
Biodiversity	216
Climate	63
Worker Safety	168
Air Quality	89
Soil Fertility	63
Rare Resource Spillage	81
Landscape	20
Noise Quantity	22

3.2 TRANSLATION AND HARMONISATION OF THE SELECTED RULES

When composing the database, the rules of the selected certification books were translated into English to facilitate communication between the experts. The rules of Terra Nostra and Charte Perfect were translated from French into English, while the rules of Fruitnet, IFP and Flandria/FlandriaGAP were translated from Dutch into English. The EurepGAP specifications were copied from the English version of the certification book. The translated rules were sent to the administrators of the standards to assure that the translations were correct and that no misinterpretations could occur.

3.3 RANKING THE RULES BY A GROUP OF EXPERTS: EXPERT JUDGMENT

Experts in the domain for which the impact is supposed to exist rated each rule's impact. They ranked the rules by order of impact (*ex-equo* ranks were allowed) following the Simos's method (Simos, 1990 a,b). This technique, proposed by Simos and revised by Figueira and Roy, allows any decision maker (not necessarily familiarized with multi-criteria decision aiding) to think about and express the way in which he wishes to hierarchise different criteria in a given context. It is a very simple procedure using a set of cards, allowing one to determine indirectly numerical values for weights. This method has been applied to different real-life cases, such as public transportation problems, water resource problems, environmental problems, etc. and proved to be successful (Figueira & Roy, 2002). The algorithm used to calculate the weights of the criteria is described in detail in the article 'Determining the weights of criteria in the Electre type methods with a revised Simos' procedure', written by Figueira & Roy (2001). Annex 3.1 presents one of the checklists established for the landscape sustainability item. The other checklists can be requested. In these checklists the weights of the criteria, obtained with the revised Simos' procedure, are noted.

3.4 COMPARISON OF GREENLABELS FROM VARIOUS POINTS OF VIEW

Then, following the Girardin method, the eight label/certification standards are compared by determining the distance to the ideal point. This ideal point is represented by an ideal certification book that was composed on the basis of the certification books of the selected standards. The composition of this ideal standard depends on the number of certification standards under study. In this project the ideal standard was composed on the basis of the guidelines of the eight selected certification schemes. This ideal checklist is presented in Annex 3.2. The rules from the various standards are presented, accompanied by their weights and their mandatory level. This ideal point represents the solution where all objectives achieve their optimum value. This implicates a score of 100 for each environmental sustainability item. The label that contributes the most to environmental sustainability can be found by minimizing the distance to this ideal point. By using the L_p metrics, the distance to the ideal point can be determined as follows (Van Huylenbroeck, 1997):

$$L_p(W) = \left[\left(\sum_{j=1}^{n} W_j \bullet d_j \right)^p \right]^{\frac{1}{p}}$$

With:

- Wj being the weight of criterion j which measures the relative importance of the attributes
- n being the number of criteria
- $d_j = \dfrac{\left| Z_j^* - Z_j(x) \right|}{\left| Z_j^* - Z_{*,j} \right|}$

  In this formula Z_j^* and $Z_{*,j}$ are, respectively, the ideal and anti-ideal solutions for criterion j.
- p being a parameter that acts as a weight attached to the magnitude of the deviations

By changing the W and the p parameters, different solutions are obtained reflecting different preference structures.

4. Results of the sustainability assessment of the selected greenlabels

The next paragraphs discuss the performance of the various certification standards under study concerning the selected items of sustainability. For each item of sustainability a maximum score was calculated based on the weights of the criteria taken up in the ideal checklist. In this respect a mandatory level of 100% was attributed to all of the rules. The label scores were calculated by multiplying the mandatory level coefficient with the weight attributed to each criterion by the experts in the different disciplines. By adding the scores of the individual criteria a total score for each sustainability item was obtained. In using the sum it is assumed that among the different technical actions compensation exists (Girardin, 2002). While calculating the label sustainability scores, several corrections had to be made. ***First of all*** a label, for example Organic farming can comply with criteria that are not explicitly mentioned in its certification book, but are taken up in one or several of the other standards. Thus Organic farming should receive an appropriate quotation for these criteria, although they cannot be found in the standard. To illustrate this, the following example can be given. In the Organic farming standard it is not explicitly mentioned that plates or pheromone traps are used to catch insects, while this technique is commonly applied in organic farming production systems. The Organic Farming label received the maximum score for this criterion, since the use of synthetic pesticides is forbidden and since only alternative pest suppression techniques are allowed. ***Secondly*** criteria can contain only one or several elements. In the different standards the same elements can be mentioned in a single rule or in several rules. This had to be taken into account while calculating the label scores. The latter can be illustrated with the following example. The EurepGAP certification book contains two rules regarding the competence of those who choose the pesticides. This standard makes a distinction between decisions made by farmers and decisions made by advisors. The other certification books combine these two rules into one by demanding that the person who chooses the pesticides has to be competent. In this case it was decided to retain the latter. By carefully analysing the rules, the risk of under- or overestimating the label scores was underpinned.

The graphs shown in the following paragraphs reflect the scores of the different certification standards for the various sustainability items in terms of percentage. These percentages were then multiplied with a weight factor to give a visual representation of the impact of each sustainability item with respect to overall ecologic sustainability. Table 3.2 gives an overview of the weights attributed by the experts to the various sustainability items.

Table 3.2: Attributed weights for the selected items of ecologic sustainability

Sustainability item	Attributed Weight
Noise Quantity Reduction	2,54
Food Safety	8,88
Water Quality	14,04
Pest Pressure Reduction	6,24
Air Quality	13,81
Climate	11,82
Biodiversity	8,95
Landscape	8,95
Soil Fertility	9,48
Worker Safety	6,24
Waste Reduction and Management	7,87
Rare Resource Spillage	10,13

The weight factors that were attributed to the selected items were determined by applying the revised Simos' procedure. Thereto a ranking of the environmental sustainability items had to be made. This was achieved by expert judgment. These weights can be questioned. Subjectivity plays an important role in determining these weights.

4.1 SUSTAINABILITY IMPACT OF CHARTE PERFECT

Figure 3.2 gives an overview of the performance of the certification standard Charte Perfect. Table 3.3 reflects the scores in terms of percentage for each item. On five of the eleven considered sustainability items, namely Climate Conservation, Air Quality, Food Safety, Water Quality and Rare Resource Spillage, Charte Perfect obtained the highest score of all the certification standards under study. These high scores can partly be explained by the high degree of detail of the Charte Perfect standard. A larger number of criteria originating from Charte Perfect was taken up in the checklists.

The high score for the item ***Food Safety*** is due to the fact that Charte Perfect is complementary with the HACCP (Hazard Analysis Critical Control Point) –system; which is obligatorily for each transformer of food products. Following the same structure as HACCP, Charte Perfect describes the risks, the critical control points, the correspondent limits and the manners of surveillance in order to identify the most suited corrective actions in case a problem should occur. The implementation of a good hygiene procedure is very important. This hygiene code has to be adapted to each type of harvest (mechanical or manual harvest) and has to be respected by every worker. Yearly a collective instruction session for the workers is organised where they are informed about the requirements of the hygiene code. Other elements relevant for food safety are the maintenance of the harvest machinery, the storage and packaging of the harvested products under the appropriate conditions, the yearly analysis of the rinsing water, etc. Charte Perfect also pays reasonable attention to the aspect of ***Worker Safety***. It is specified that pesticide applicators must take off and clean their clothes on returning to the farm, workers have to attend an annual collective instruction session about hygiene and the emergency facilities have to be accessible and close by.

The score for the item ***Water Quality*** is comparable to that of Fruitnet and FlandriaGAP. Rules relating to the appropriate storage of pesticides and fertilisers (for example, storage of animal liquid manure in a water tight reservoir), the correct calculation of the application rates, taking into account label instructions, application speed and application pressure, and rules concerning the registration of crop protection products are considered to have a major positive impact on the item Water Quality. Registration of the amounts of pesticides used is considered important, because through registration

farmers are stimulated to develop methods aiming at reducing the applied amounts. However, the administrative burden caused by certification books is a major source of complaints by farmers. Therefore, the auctions developed an easy to use computer format to facilitate crop registration. Also the purchase of computers is subsidized. Considering ***Waste Reduction and Management***, Charte Perfect incorporated a few specifications. It is for example recommended to sell off the production wastes to other markets, or devote them to animal feeding instead of destroying them. It is also specified to reduce the waste volume to a minimum, to manage it in a responsible and non-polluting matter, to promote recycling, to participate in a neutral substrate recycling program, and to perform an environmental audit.

Table 3.1: Scores in terms of percentage for the selected items of ecologic sustainability for Charte Perfect

Charte Perfect	Percent Scores (%)
Noise Quantity Reduction	57,50
Food Safety	71,03
Water Quality	56,66
Pest Pressure Reduction	53,57
Air Quality	62,36
Climate	63,68
Biodiversity	42,71
Landscape	33,64
Soil Fertility	45,91
Worker Safety	57,33
Waste Reduction and Management	65,25
Rare Resource Spillage	54,97

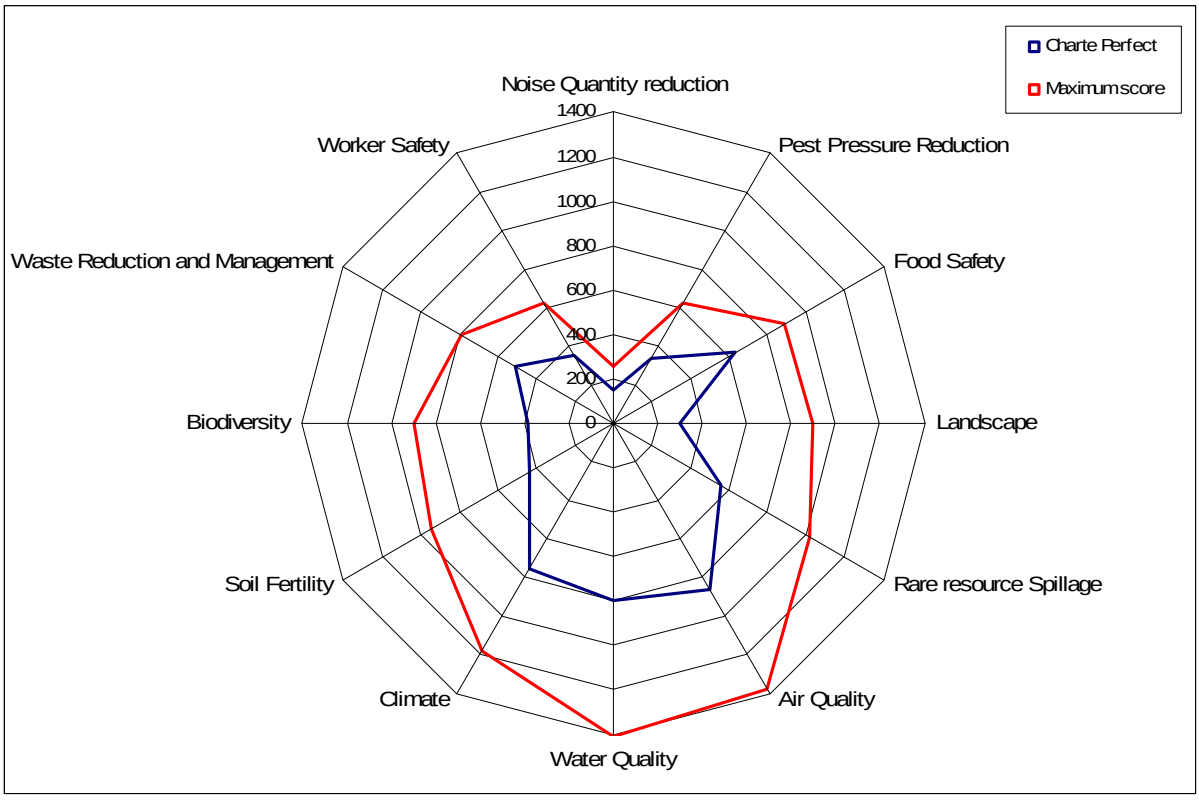

Figure 3.2: Performance of the Charte Perfect standard concerning ecologic sustainability

Regarding ***Rare Resource Spillage*** the best score of all the standards was obtained, mainly because of the numerous rules relating to restrictions regarding application of fertilisers. For the item ***Noise Quantity Reduction*** Charte Perfect scored second best. According to this standard the heaters have to be protected

meaning that any noise produced is limited. Other relevant rules which reduce noise are the proper adjustment of the harvest machinery, the cleaning of the transportation engines and the preference to stop motor engines within warehouses. Compared to the other standards, Charte Perfect pays a lot of attention to the closely linked items ***Climate Conservation*** and ***Air Quality***. A number of Charte Perfect specifications have a positive impact on these themes of sustainability. Among them is the rule prohibiting the use of soil disinfectants, which contribute to the depletion of the ozone layer. Also the rules concerning reduction of fertiliser quantities and those related to fertiliser storage can be mentioned. These rules result in a smaller emission of greenhouse gases such as N_2O and CH_4. Charte Perfect also specifies its preference to disinfect crop substrates by using steam. Though this rule was ranked very high by the experts, a lower rank might have suited better. On one hand it is positive that no classic disinfection products are used; on the other hand energy is required to produce steam. This leads to the production of carbon dioxide, contributing to the greenhouse effect. Rules concerning the application of pesticides and fertilisers, such as the rules about mixture volume calculation, assistance to implement integrated pest management systems, only applying pesticides under suitable weather conditions, all contribute to a better air quality. For ***Landscape*** and ***Biodiversity*** Charte Perfect scored relatively well. Amongst others agro-environmental measures should be adopted, a conservation management plan should be established and non-productive areas should be converted into natural fauna and flora conservation infrastructures. The last two sustainability items are ***Pest Pressure Reduction*** and ***Soil Fertility***. For both items an average score was obtained, relative to the maximum score. But compared to the other standards Charte Perfect again performed well. The pest management plan promotes the principle of alternation of products and seed quality is visually checked. The adoption of crop rotations is considered important for the reduction of pest pressure as for the conservation of soil fertility. The follow-up of fertilisation advices on the basis of plant requirements and soil contributions and the establishment of a fertilisation management plan were rated very high by the experts according to their contribution to soil fertility.

4.2 SUSTAINABILITY IMPACT OF TERRA NOSTRA

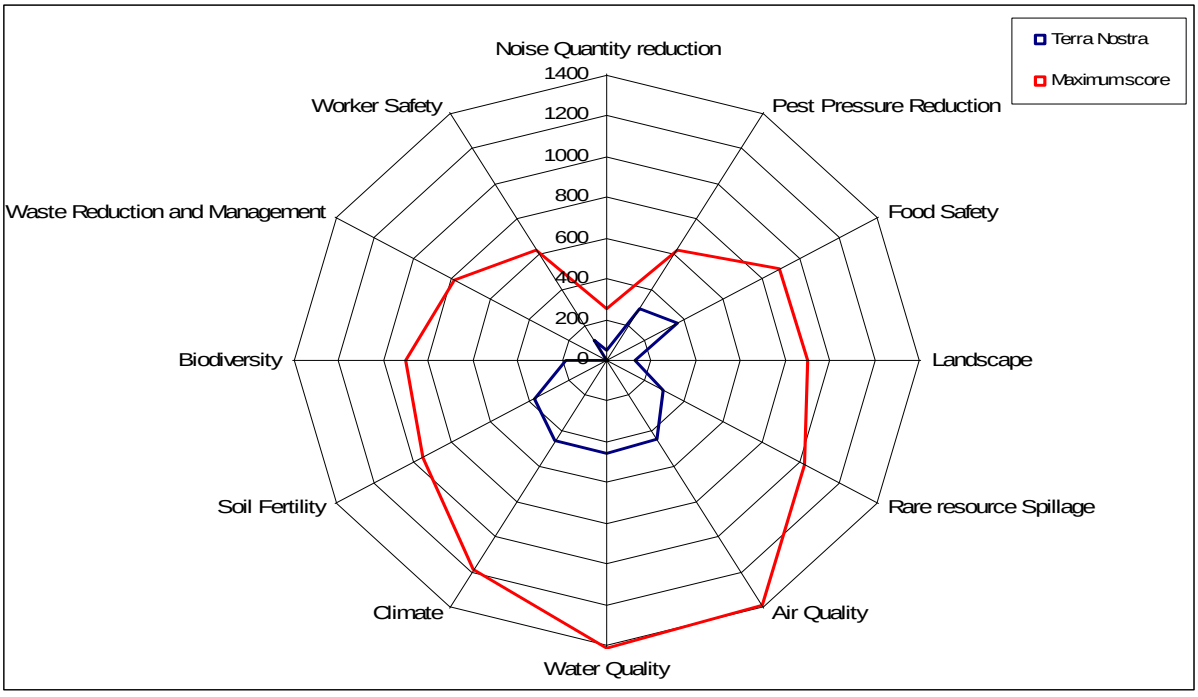

Figure 3.3: Performance of Terra Nostra concerning ecologic sustainability

The overall performance of Terra Nostra on the different items of sustainability is not very good (Figure 3.3, Table 3.4). The most important explanation is that only specifications relating to the cultivation of fresh tubers are incorporated in the certification book, since Terra Nostra is a generic quality label for potatoes. The other standards are established for several kinds of crops, not only potatoes, and contain therefore a larger number of criteria.

For the items ***Soil Fertility*** and ***Pest Pressure Reduction*** Terra Nostra obtained an average score. The following Terra Nostra specifications contribute to maintain the fertility of the soil: an obligatory analysis of compost before use, the prohibition of human and industrial sludge on the whole farm and an obligatory analysis of the soil for potassium and phosphorous every three years. Moreover fertilisation has to be based on the advice of the GET (Groupe d'Encadrement Technique Terra Nostra). Pest pressure reduction is achieved by using certified seed, subscribing in an epidemiologic forecast service and respecting the minimum intercrop period of three years, among other things. Regarding ***Climate Conservation*** and ***Air Quality*** Terra Nostra obtained respectively an average and a low score. The prohibition of soil disinfection and fertilisation based on advice of competent institutions result in smaller emissions of methane and N_2O, and thus contribute to the mentioned items of sustainability. The low score for the air quality aspect can also be explained by the fact that few specifications are proposed to guarantee safe pesticide storage and no competence of the applicator of pesticides is required.

Table 3.4: Scores in terms of percentage for the selected items of ecologic sustainability for Terra Nostra

Item of sustainability	Scores in terms of percentage (%)
Noise Quantity Reduction	20,00
Food Safetyis	40,58
Water Quality	32,18
Pest Pressure Reduction	46,71
Air Quality	32,26
Climate	38,33
Biodiversity	20,71
Landscape	14,29
Soil Fertility	39,07
Worker Safety	18,26
Waste Reduction and Management	0,00
Rare Resource Spillage	28,16

Not many criteria aiming to improve **W*ater Quality*** can be found in the Terra Nostra certification book. But the rules concerning the limitation of nitrogen residues in the soil and the obligatory analysis of composted matter do contribute to the improvement of water quality. These rules result in less leaching of nutrients into the ground water and thus limit eutrofication. Concerning the items ***Landscape*** and ***Biodiversity*** a great deal of improvement is still possible. This is also the case for the item ***Noise Quantity Reduction***. Although Terra Nostra does promote the application of agri-environmental measures, the adoption of crop rotations and the regularly cleaning of transportation engines. No rule regarding ***Waste Reduction and Management*** is mentioned in the standard. This results in a score of zero for this aspect. The score obtained for ***Rare Resource Spillage*** and ***Worker Safety*** is also rather low. In these fields much improvement is still possible. As for the aspect of ***Food safety***, Terra Nostra scored average. The label scored slightly less than Organic Farming and Flandria and a little better than IFP. To guarantee food safety, Terra Nostra requires that the nitrate content of fresh tubers must be lower than 200 mg per kg.

4.3 SUSTAINABILITY IMPACT OF EUREPGAP

The scores obtained by EurepGAP are comparable to those of FlandriaGAP for most of the items. But for Noise Quantity Reduction, Climate and Rare Resource Spillage FlandriaGAP does score much higher. For the item Worker Safety EurepGAP scores slightly better compared to FlandriaGAP. An overview of the obtained scores is given in Table 3.5 and Figure 3.4.

Table 3.5: Scores in terms of percentage for the selected items of ecologic sustainability for EurepGAP

Item of sustainability	Scores in terms of percentage (%)
Noise Quantity Reduction	36,90
Food Safety	52,60
Water Quality	44.29
Pest Pressure Reduction	55,23
Air Quality	45,38
Climate	27,90
Biodiversity	38,48
Landscape	21,46
Soil Fertility	33,53
Worker Safety	60,98
Waste Reduction and Management	25.33
Rare Resource Spillage	29,21

In the fields of ***Biodiversity*** and ***Landscape*** EurepGAP obtained a low score. The standard should pay more attention to the integration of nature on the farm. A positive aspect however is the obligation to establish a conservation management plan. Moreover, the farmer must understand the implications of the farming practices on nature and biodiversity and must take action to reduce these to a minimum. For the items of ***Climate Conservation*** and ***Air Quality*** a rather low score was obtained.

Most of the rules that have a positive impact on these items relate to the condition of the fertiliser application equipment (clean, good calibration, etc.), the registration of fertiliser use and the competence of the applicator of fertilisers and pesticides. The fact that chemical soil disinfections have to be justified also has a positive impact on these themes of sustainability.

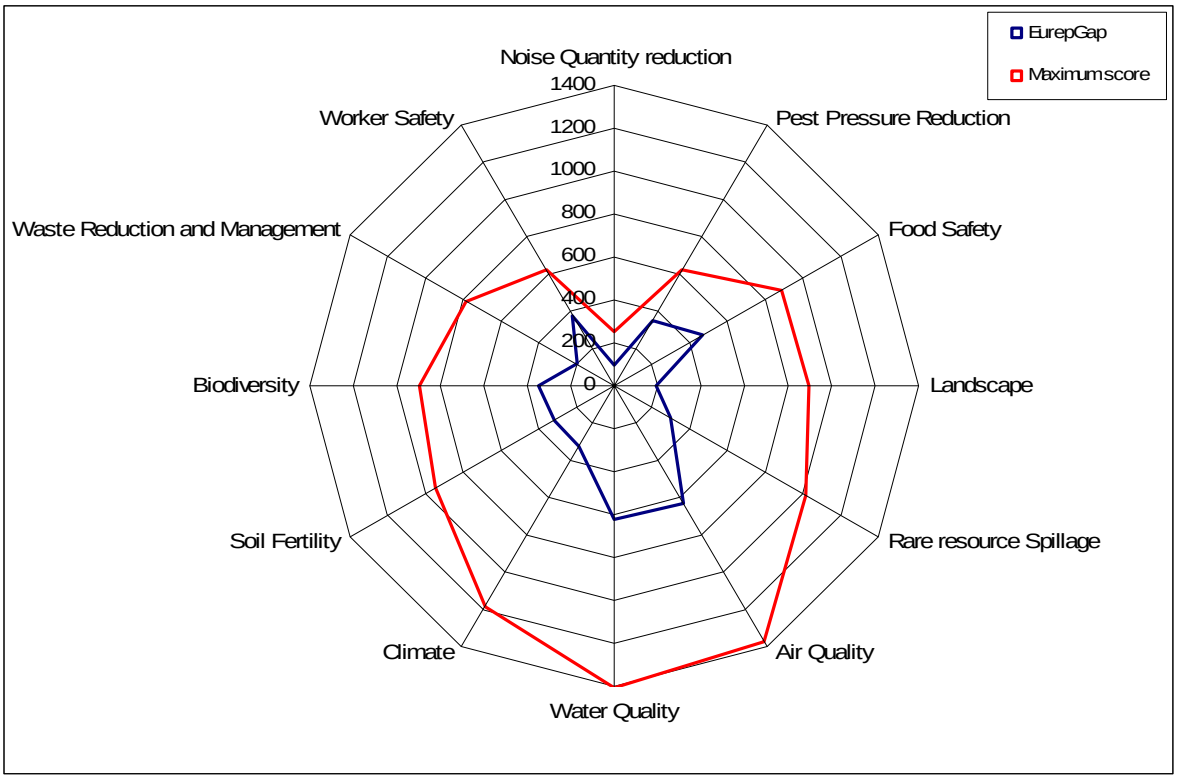

Figure 3.4: Performance of EurepGAP concerning ecologic sustainability

Regarding ***Water Quality*** EurepGAP scored average, scoring higher than both Flandria and IFP. Relevant criteria for this aspect of ecologic sustainability are the use of cultivation techniques minimising soil erosion, suitable storage of fertilisers, following the correct handling and filling procedures when mixing crop protection products, keeping the application equipment in good condition and testing it yearly. With

respect to ***Waste Reduction and Management*** a rather low score was obtained. Relevant measures taken up in the certification book are the identification and secure storage of obsolete crop protection products and the disposal of them by authorised or approved channels. EurepGAP is characterized by an average performance in the fields of ***Soil Fertility***, ***Pest Pressure Reduction***, ***Noise Quantity Reduction*** and ***Rare Resource Spillage***, but performs well regarding ***Food safety*** (encourages the use of HACCP and supports the principles) and ***Worker Safety***. In case an accident occurs, a safety procedure must be present and must be understood by all employees. Every worker must be aware of the specifications laid down in the hygiene code and must respect them at all times. The issues that have gained importance recently are the testing of pesticide residues and hygiene during harvesting and produce handling.

The most obvious explanation for this focus on food safety and hygiene is the high priority for food safety issues at the EU and the national governmental level and the need for retailers to cope with their new regulatory environment (the EU food law) (van der Grijp, 2005). Strikingly, the Eurep membership has strongly increased since the food safety focus has been strengthened. This suggests that food safety is a better vehicle for generating industry-wide support than environment.

4.4 SUSTAINABILITY IMPACT OF FLANDRIA AND FLANDRIAGAP

The scores for Flandria and FlandriaGAP for the different items of sustainability are reflected in the figure below (Figure 3.5).

It is clear that Flandria does not perform well and that the new specifications added in the FlandriaGAP certification book were necessary in order to meet the requirements of people in the trade and of the government. In particular additional rules relating to food safety and traceability had to be added. For Flandria, none of the eleven sustainability items reaches a score higher than fifty percent of the maximum attainable score, but compared to the other standards relative good scores were obtained for the items ***Noise Quantity Reduction***, ***Food Safety*** and ***Air Quality***. Average results can be seen for the items ***Pest Pressure Reduction***, ***Worker Safety***, ***Rare Resource Spillage***, ***Climate*** and ***Biodiversity***. Less attention was given to the aspects ***Waste Reduction and Management***, ***Soil Fertility*** and ***Landscape***.

Through the introduction of FlandriaGAP, Flandria with its Green Bow was hosted to a higher level. Most progress was made on the aspects of ***Worker Safety***, ***Waste Reduction and Management*** and ***Pest Pressure Reduction*** as reflected by Table 3.6. More stringent specifications for hygiene, environmentally-friendly production methods and sustainable horticulture were set. Extra attention was paid to food safety and traceability, but also to the care for the environment and the workforce (e.g. accident procedures and safety protocols). The FlandriaGAP specifications apply to all the different crops, with separate appendices for each product stipulating the quality and selection requirements. In the past, the specifications applied to only one particular type of crop. A major advantage of FlandriaGAP is the flexibility of the system, making it possible to respond quickly to any new developments which may occur. For example in the case of EurepGAP it takes years before adjustments actually take place. In the case of FlandriaGAP, the adjustment is achieved in a matter of weeks. FlandriaGAP obtained the second-highest score for the item ***Food Safety***. This is due to the large number of rules relating to hygiene. Approximately 70 of the 148 inspection points within FlandriaGAP relate to this topic. Under Flandria the grower had to achieve only 80% on the hygiene inspection points, regardless of the type of directive, whereas FlandriaGAP comprises a number of compulsory hygiene directives. Here lies the main difference between EurepGAP and FlandriaGAP.

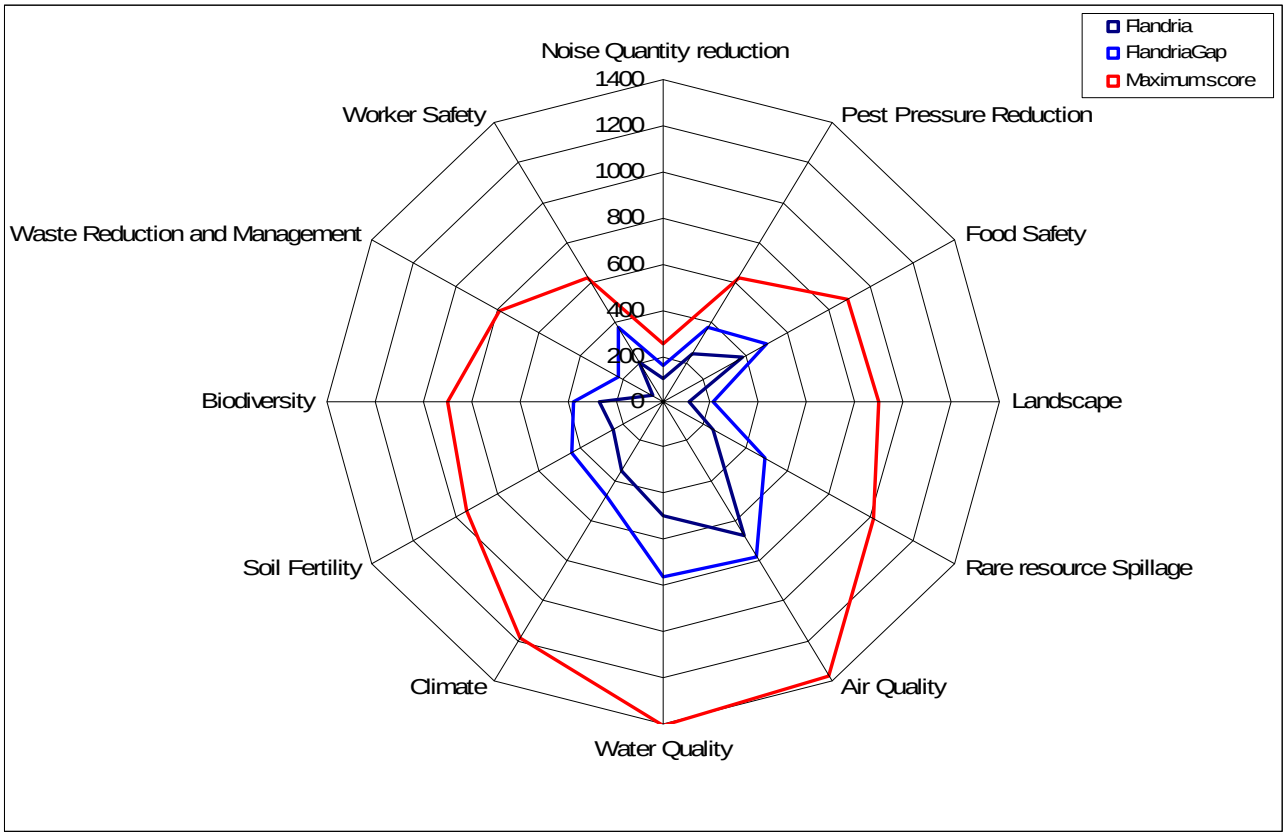

Figure 3.5: Performance of Flandria and FlandriaGAP concerning ecologic sustainability

Table 3.6: Flandria and FlandriaGAP scores in terms of percentage for the selected items of ecologic sustainability

Ecologic Sustainability Item	Flandria scores in terms of percentage	FlandriaGAP scores in terms of percentage
Noise Quantity Reduction	40,10	61,10
Food Safety	42,53	55,53
Water Quality	35,04	54,14
Pest Pressure Reduction	38,60	60,22
Air Quality	49,01	55,97
Climate	29,00	40,38
Biodiversity	29,52	41,50
Landscape	12,31	23,04
Soil Fertility	25,70	46,05
Worker Safety	32,64	59,70
Waste Reduction and Management	6,67	27,54
Rare Resource Spillage	23,88	48,35

Regarding hygiene the FlandriaGAP specifications are stricter and more numerous. Moreover a strong point of FlandriaGAP is that the emphasis is on verifying whether the inspection points are effective in order to comply with the directives, whereas the emphasis of EurepGAP tends to be on registration. FlandriaGAP also puts a strong emphasis on the content of the specifications, which other certification schemes, such as Organic Farming and integrated Farming sometimes overlook. Given the fact that the auctions Mechelse Veilingen and Veiling Hoogstraten are certified for various systems (ISO, HACCP, BRC,...), the standards are set quite high as far as the raw materials coming into the auctions are concerned. The grower, therefore, has to act as an extension of the quality label. That is why the ideology of the ISO and HACCP systems are incorporated into the FlandriaGAP system. FlandriaGAP's real asset is its residue monitoring programme. Every year, some 14.000 mostly carefully directed samples are taken at

the LAVA auctions, and this at the most critical points. In the case of most other specifications, this sampling is not carefully directed.

As reflected by Table 3.6 extra specifications regarding ***Worker Safety*** had to be taken. The score of FlandriaGAP for this item reflects the progress. Also regarding the items ***Landscape*** and ***Biodiversity*** improvement is noticed. A policy of nature management is required to be established and the farmer has to choose at least three policy measures regarding nature. Concerning the aspects ***Air Quality*** and ***Climate Conservation***, Flandria has a lot of improving to do. As a positive note, the regular control of the greenhouses can be mentioned. In this way solar energy can be used more efficiently and less energy is needed to heat the greenhouses. FlandriaGAP scored a lot better, although still average, mainly because of the larger number of criteria relating to the application and storage of fertilisers. The item ***Noise Quantity Reduction*** is given more importance in both the Flandria and FlandriaGAP certification books in comparison to the other certification schemes. FlandriaGAP even obtained the highest score of all the standards. Rules which contribute to the reduction of noise quantity are the protection of the heaters and the requirement to carry out a risk evaluation if new production locations are brought into use. Regarding ***Water Quality***, Flandria did not perform well, but FlandriaGAP did. Only Fruitnet and Charte Perfect scored better, however only slightly. In the field of ***Pest Pressure Reduction***, Flandria scored poorly, FlandriaGAP scored well. Specific to these standards is the use of the SRC cards. It is advised to only use the crop protection products mentioned on these cards. These products are considered safe for use by the POCER indicator. This indicator takes into account human, environmental and toxicity aspects. Both standards also advise to use biological pesticides in the first instance before switching to chemical alternatives. It is understandable that Fruitnet, Organic farming and IFP score better on the aspect of Pest Pressure Reduction, since even less pesticides are allowed. Flandria and FlandriaGAP stimulate the farmers to use less pesticides; EurepGAP does not demand a reduction in quantity, but registration is obligatory. This registration results in a higher awareness of the farmers. Flandria scored low on the aspect of ***Waste Reduction and Management*** and average for ***Rare Resource Spillage***. In FlandriaGAP the progress in these fields is noticeable. Waste streams have to be located at a secure distance from water catchment areas and vegetable raw materials, below the product shelves collecting tanks have to be installed, and empty crop protection products have to be adequately stored, labelled and handled. The lowest score for the item ***Soil Fertility*** was obtained by Flandria. Regarding this aspect FlandriaGAP did score well compared to the other standards. Fertilisation has to be based on advices, preferably given by authorised and competent institutions. But as reflected by Figure 3.5 a great deal of improvement is still possible.

4.5 SUSTAINABILITY IMPACT OF INTEGRATED FARMING: FRUITNET & IFP (INTEGRATED FARMING PRODUCTION)

Observing the scores of both the Integrated Farming Standards, one can conclude that Fruitnet certainly imposes more stringent specifications than the IFP standard. Only the result for the item ***Pest Pressure Reduction*** is comparable. The comparable scores for this item can easily be explained since the main goal of integrated farming is to reduce the quantities of pesticides applied. Integrated farmers make use of the regulating force of nature, only intervening when really necessary. Observation systems in the orchard are used to detect the presence of pests, especially to determine the extent of their population. To this end the farmer has several means at his disposal, such as visual control, pheromone and mechanical traps, glue traps, etc. Fruitnet obtained the highest score for the item ***Landscape*** and a high score for ***Biodiversity***. The Fruitnet specifications namely contain all the guidelines of the IOBC (International Organization for Biological and Integrated Control of Noxious Animals and Plants) for the integrated production of pipfruit together with additional guidelines, which encourage environmental measures (nesting boxes, hedges, introduction of auxiliaries, etc.), give priority to the use of organic pesticides to the detriment of chemical pesticides and emphasise fruit origin and quality control measures. Moreover a policy of nature management is to be established on an individual or regional basis. IFP also performs well on these aspects, because for these items the certification book contains the same criteria as the ones mentioned in Fruitnet. One thing missing though is the requirement to establish a nature management plan.

Table 3.7: Scores in terms of percentage for the selected sustainability items for the Integrated Farming and Fruitnet Standard

Item of Sustainability	Scores in terms of percentage for IFP (%)	Scores in terms of percentage for Fruitnet (%)
Noise Quantity Reduction	11,60	41,10
Food Safety	39,59	54,13
Water Quality	36,92	56,01
Pest Pressure Reduction	62,74	67,67
Air Quality	54,71	61,50
Climate	40,24	50,38
Biodiversity	41,07	59,26
Landscape	43,87	64,39
Soil Fertility	25,70	44,48
Worker Safety	33,27	59,86
Waste Reduction and Management	20,00	60,92
Rare Resource Spillage	27,78	41,53

Regarding the ***Climate Conservation*** sustainability item Fruitnet performs relatively well, IFP slightly less. The same can be said for the item ***Air Quality***. Especially the use of integrated production techniques (use of plates to catch insects, use of pheromone traps, mechanical weed treatments), the requirement of competence of the fertiliser and pesticide applicator and the participation to an epidemiological forecast service contribute to the improvement of air quality. The performance of IFP regarding ***Noise Quantity Reduction*** is rather low. Fruitnet scored considerably better. This is due to the fact that compliance with the EurepGAP specifications is required to obtain the Fruitnet certificate. Moreover existing natural elements are well taken care of and new green elements are introduced. The vegetation can subdue noise by absorbing certain frequencies of sounds. Fruitnet was ranked at first place for the item ***Water Quality***. Important to mention is that all the rules relating to this topic have a mandatory level of 100 percent. This is also the case for the IFP certification scheme. Rules considered important by the experts are the correct calculation of the pesticide dose, the application of pesticides in suitable weather conditions (reducing drift to watercourses), the planting of hedges along waterways to capture drift and the treatment of rinsing water after use on the farm. Rules specific to Fruitnet are the drawing up of a water management plan and the chemical and microbial analysis of irrigation water. IFP scores average on this aspect, obtaining a score comparable to that of Flandria. Improvement can be processed concerning pesticide storage. All the other certification books, with the exception of Terra Nostra and Organic farming go beyond what is legally required for pesticide storage.

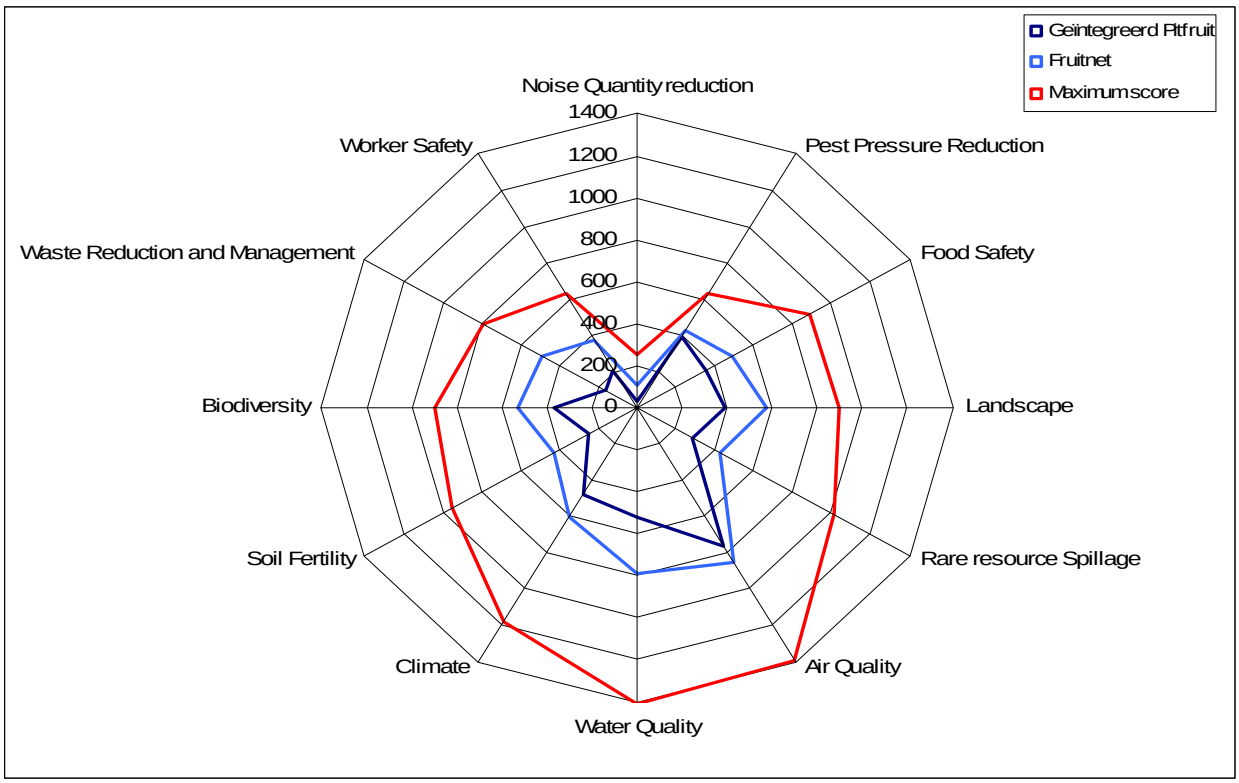

Figure 3.6: Performance of Integrated Farming and Fruitnet concerning ecologic sustainability

Next to Charte Perfect, Fruitnet scored the best on the aspect of ***Waste Reduction and Management***. Rules specific to Fruitnet are the establishment of an inventory of all waste products and sources of pollution, the drawing up and implementation of an action plan in order to reduce waste production and the promoting of recycling. Also required is the use of spraying systems, supplied with a system for rinsing the packages of pesticides. In comparison to Fruitnet, IFP performed less well. Only rules related to the reduction of pesticide mixture excesses are mentioned. For the item ***Soil Fertility*** Fruitnet scored slightly less compared to FlandriaGAP. Reasons for the relative good score are that fertilisation is coordinated based on fertilisation advice, agro-environmental measures and field cultivation techniques reducing soil erosion are adopted. Vegetation bands are mowed regularly and the greenery is left in place to favour beneficial fauna. IFP does not score very well in this field, mainly because of the lack of criteria related to fertiliser applications. Criteria specific to the IFP label are the recommendation to perform a leaf analysis once a year in case of symptoms of deficiency and the preference to use crop protection products that are less persistent.

The high score of Fruitnet for the items ***Food Safety*** and ***Worker Safety*** opposed to the scores of the Integrated Farming Standard can be explained by the fact that EurepGAP approval is a mandatory obligation required of each fruit grower wishing to market his fruit under the "Fruitnet" trademark. Moreover a team of skilled technicians train and supervise fruit growers in the implementation of this production system. Technical advisers give aid by means of group sessions, individual visits and warning bulletins. The nature and the philosophy of Fruitnet imply that all the safety standards (with regard to the fruit grower and his personnel as well as consumers) and respect for the environment are fully contained in the "Fruitnet" specifications. Fruitnet employs the most appropriate techniques for the preservation of the environment, prohibiting the most toxic pesticides to the environment and nature and classifying products in a green, yellow and orange list in function of their degree of toxicity with respect to the environment, humans and beneficial fauna. In case of a risk of major economic damage (treatment threshold was exceeded) the grower must choose a control method. Naturally, priority must be given to natural enemies of the pest in question, but when these are insufficient the grower will have to opt for a more appropriate biological or chemical treatment. The most selective, least toxic, least persistent product, which is as safe as possible to humans and the environment, must be selected.

4.6 SUSTAINABILITY IMPACT OF ORGANIC FARMING

Figure 3.7 reflects the research results for the Organic Farming Standard. This standard obtained the best result for the item ***Soil Fertility***, closely followed by FlandriaGAP, Fruitnet and Charte Perfect. Good scores were obtained for the items ***Pest Pressure Reduction***, ***Biodiversity***, ***Landscape***, ***Water Quality*** and ***Waste Reduction and Management***, compared to the other certification standards. Table 3.8 gives an overview of the scores in terms of percentage for each theme of sustainability.

Organic Farming obtained the second best result for ***Pest Pressure Reduction***. It was expected that Biogarantie would score better on this aspect than the other standards because of the zero tolerance towards chemical pesticides. But this was not the case. The higher score of Fruitnet can be explained by the larger number of criteria relating to storage of pesticides and registration. Biogarantie only requires what is legally mandated. Fruitnet set more stringent specifications, for example the shelves have to be covered with absorbing material and the storage room of pesticides cannot be situated near the harvested products. Fruitnet also requires that the farmers follow courses about integrated pest management. This is not required by the Organic Farming standard. It has to be mentioned that the environmental impact of biological pesticides is not assessed. The high score obtained for the item ***Soil Fertility*** can be explained by the use of organic fertilizers, the use of leguminous and nitrogen fixating crops and the cultivation of legumes, green manures and deep rooting plants in an appropriate multi-annual rotation program. Moreover special attention is paid to the living soil in order to improve its biological activity. Also fertilisation is based on the advice of competent institutions. Concerning ***Noise Quantity Reduction***, Organic Farming does not mention a single criterion. But indirectly organic agriculture does contribute to the reduction of noise quantity (absorbing vegetation). Much attention is paid to the integration of nature on the farm. This is reflected in the relative high score obtained for the ***Landscape*** item. The score for Biogarantie is comparable with that of IFP. It may seem odd that Organic Farming performs less well than Fruitnet and IFP, but this can be explained by the non-detailed nature of the Organic Farming certification standard.

Table 3.8: Scores in terms of percentage for the selected sustainability items for the Organic Farming standard

Item of Sustainability	Scores in terms of percentage (%)
Noise Quantity Reduction	28,00
Food Safety	42,69
Water Quality	52,65
Pest Pressure Reduction	63,68
Air Quality	55,63
Climate	51,48
Biodiversity	59,84
Landscape	43,19
Soil Fertility	48,67
Worker Safety	30,95
Waste Reduction and Management	61,67
Rare Resource Spillage	37,07

On the aspect of ***Biodiversity*** Biogarantie scored very well as to be expected. By using a system of crop rotation, in time (over several years rotation) or in space (through intercropping or growing several crops in the same season in several fields), the build-up of harmful pests and diseases can be reduced and biodiversity increased. Organic agriculture also encourages variety. Plant breeding has been concentrated on producing varieties that grow well in farming systems reliant on chemical inputs. Organic producers by contrast look for varieties that are adapted to local climatic and soil conditions and are not susceptible to disease and pest attack. Organic systems encourage the expansion of varieties grown and the preservation of older, locally bred varieties and breeds. Good care is taken of farm landscapes and existing natural hiding places for beneficial organisms. Sometimes new artificial hiding places are created. Organic systems feature a higher arthropod diversity and abundance, mainly related to the organic plant protection management, low input organic fertilisation, more diversified crop rotations and more structured landscapes with semi-natural habitats and field margins. Organic Farming has a positive impact on ***Climate Conservation*** and ***Air Quality***. For instance, the reduced pesticide use implies less production of pesticides and thus lower emissions of carbon dioxide. For these items Organic farming was ranked

respectively at the second and third place. An average score was obtained for the ***Rare Resource Spillage*** aspect. Organic systems largely rely on locally available resources and are dependent upon maintaining ecological balances and developing biological processes to their optimum. Organic systems dramatically reduce external inputs by refraining from the use of synthetic chemical fertilizers and pesticides.

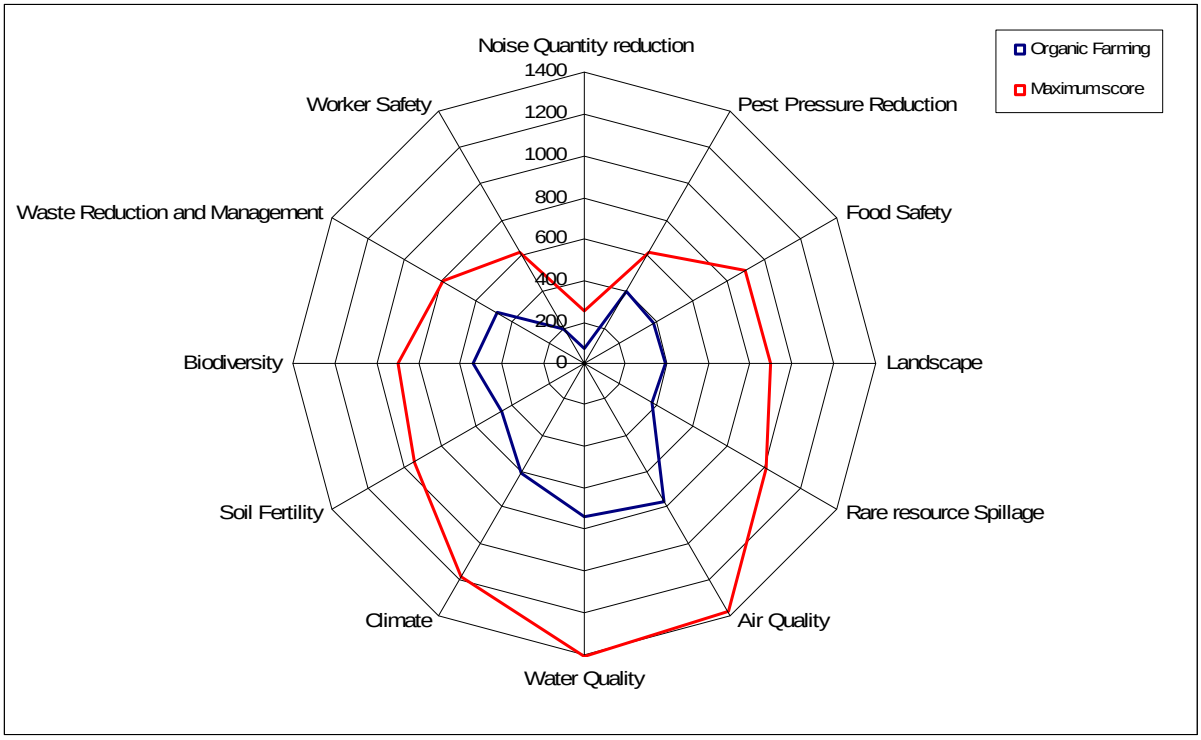

Figure 3.7: Performance of the Organic Farming standard concerning ecologic sustainability

4.7 COMPARISON OF THE VARIOUS GREENLABELS

Table 3.9 gives an overview of the scores calculated for the different certification schemes for the various items of sustainability.

Table 3.9: Overview of the scores of the different labels for the selected items of environmental sustainability

Item of sustainability	Labels							
	Charte Perfect	Terra Nostra	EurepGAP	Flandria	FlandriaGAP	IFP	Fruitnet	Organic Farming
Noise Quantity Reduction	57,5	20	36,9	40,1	61,1	11,6	41,1	28
Food Safety	71,03	40,58	52,6	42,53	55,53	39,59	54,13	42,69
Water Quality	56,66	32,18	44.29	35,04	54,14	36,92	56,01	52,65
Pest Pressure Reduction	53,57	46,71	55,23	38,6	60,22	62,74	67,67	63,68
Air Quality	62,36	32,26	45,38	49,01	55,97	54,71	61,5	55,63
Climate	63,68	38,33	27,9	29	40,38	40,24	50,38	51,48
Biodiversity	42,71	20,71	38,48	29,52	41,5	41,07	59,26	59,84
Landscape	33,64	14,29	21,46	12,31	23,04	43,87	64,39	43,19
Soil Fertility	45,91	39,07	33,53	25,7	46,05	25,7	44,48	48,67
Worker Safety	57,33	18,26	60,98	32,64	59,7	33,27	59,86	30,95
Waste reduction and Management	65,25	0	25.33	6,67	27,54	20	60,92	61,67
Rare Resource Spillage	54,97	28,16	29,21	23,88	48,35	27,78	41,53	37,07

The following general conclusions can be drawn from Table 3.9. Charte Perfect has a substantial asset in guaranteeing food safety, and contributes to preserving the environment by making sure that waste is managed in an appropriate manner and reduced where possible. Compared with the other labeling initiatives Charte Perfect scores better in preserving air and water quality. EurepGAP's real assets lie in the domains of food safety and worker welfare, hereby giving a lot of attention to the hygiene aspect. The organic production mainly enhances environmental sustainability by managing the soil in this way that the natural fertility is maintained, by taking care of landscape and biodiversity and by using alternative pest pressure techniques. The latter is also a great trump of the IFP, the Fruitnet and the FlandriaGAP certification standard. FlandriaGAP guarantees a good protection of water quality and assures worker safety and welfare. With respect to Fruitnet, the efforts provided to preserve biodiversity and landscape can also be mentioned. On the whole, Terra Nostra scores rather low. This is due to the fact that this standard was composed specifically for potatoes and thus only contains rules concerning the production of this crop.

Using the formulas outlined earlier, the relative distance from the ideal point is calculated for the different certification standards. The obtained results are presented in Table 3.10 for different values of p and for different weights. In case one it is supposed that all the environmental evaluation criteria are equally important. In case two the weights given by the experts for the different items of sustainability were taken into account.

Table 3.10: Relative distance of each label opposed to the ideal standard

Weight	p	Lp of labels							
		Charte Perfect	Terra Nostra	EurepGAP	Flandria	FlandriaGAP	IFP	Fruitnet	Organic Farming
Case 1	p=1	**535,39**	869,45	728,71	835	626,48	762,51	538,77	624,48
	p=2	158,38	254,85	214,47	244,42	185,65	225,09	**158,32**	184,46
	p=3	107,24	171,02	144,22	163,80	125,10	151,80	**106,48**	124,62
Case 2	p=1	**4828,05**	7759,22	6681,22	7547,03	5767,38	6722,68	4854,53	5494,06
	p=2	474,30	753,73	651,08	733,40	565,07	655,68	**472,11**	535,52
	p=3	222,54	349,87	302,56	340,32	264,57	304,98	**219,28**	249,28

Table 3.11 presents the relative environmental sustainability scores in terms of percentage opposed to a minimum limit (= the legislation, equals zero percentage) and a maximum limit (= the ideal certification book, equals hundred percentage). The scores were calculated for the two cases, outlined above.

Table 3.11: Scores in terms of percentage for the overall environmental sustainability and this for the selected standards

Label	Scores in terms of percentage (%) *	Scores in terms of percentage (%) **
Charte Perfect	55,38	55,69
Terra Nostra	27,55	28,78
EurepGAP	39,27	38,68
Flandria	30,42	30,73
FlandriaGAP	47,79	47,06
Integrated Fruit Production	36,46	38,30
Fruitnet	55,10	55,44
Organic Farming	47,96	49,57

* With respect to the weights, it is supposed that all the environmental sustainability criteria are equally important.
** The weights determined by the experts were attributed to the different items of sustainability.

As can be concluded from Table 3.11 and Figure 3.8, the different certification standards offer a clear surplus opposed to legislation. But evolution is still possible. That is, if the producers receive premium prices when meeting additional requirements. Otherwise additional investments are not feasible. Also, measures have to be taken to further facilitate administration.

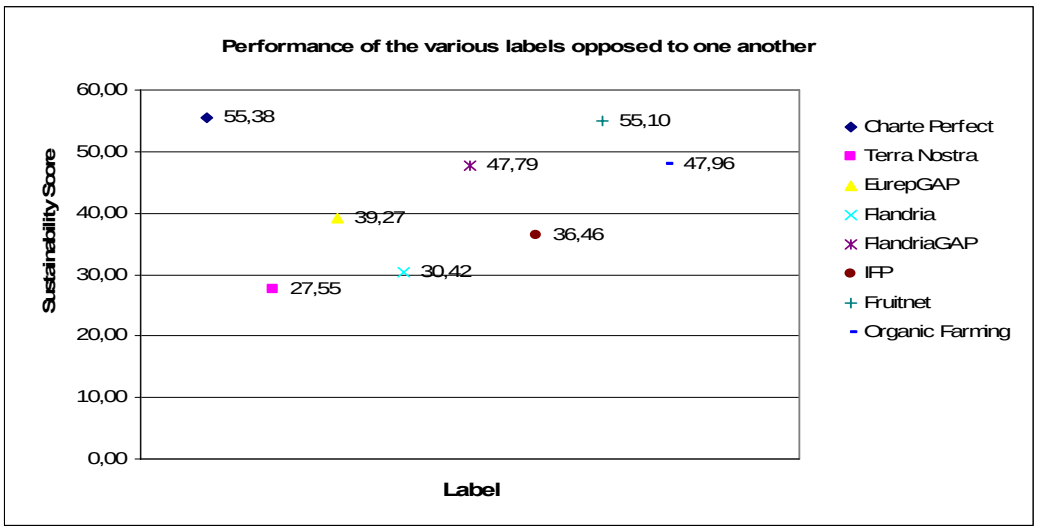

Figure 3.8: The overall environmental sustainability score opposed to the ideal standard and the legislation

Figure 3.8 clearly shows the relative position of the labels compared with the limits set. The sustainability score of 100 equals the score of the ideal standard and the zero score equals the level of legislation. It can be concluded that the performance of the various standards does not diverge too much. Terra Nostra and Flandria perform less than the other standards with respect to environmental sustainability. The lower score for Terra Nostra can be explained by the fact that this certification scheme mentions specific rules for the production of potatoes. Flandria also scored lower than the other standards, but the new rules introduced in the FlandriaGAP certification scheme show that progress is being made. IFP and EurepGAP scored slightly better. Organic Farming and FlandriaGAP obtained a similar score as did Charte Perfect and Fruitnet.

5. Relation between theoretic analysis of books of instructions and output of focus groups

The participants of the focus groups had the opinion that there was no significant difference between EurepGAP and FlandriaGAP regarding to their contribution to ecologic sustainability. This research showed otherwise. FlandriaGAP was considered to contribute more to ecologic sustainability; a higher score was obtained for several of the selected sustainability items. Organic Farming was considered to have a large impact on ecologic sustainability by the focus group participants as well as by this research. During the focus group discussions Flandria producers showed great interest in the organic farming practices. The Flandria farmers seemed to acquire more new insights from the organic farmers than the other way around. One could conclude that the biologic farmers have a clearer picture of conventional agriculture opposed to organic agriculture. The producers particularly assessed the EurepGAP certification book as too theoretic. For each farmer perhaps ten percent of the rules could be considered as superfluous. But this ten percent varies from farmer to farmer.

Biogarantie farmers are considered to have a strong ideological conviction to protect nature, biodiversity, consumer health and regional character. These aspects are reflected by the high scores for several ecologic topics. Integrated farmers pay more attention to soil quality and fertility, crop rotation and prevention opposed to conventional farmers. This focus group outcome is reflected by the high number of rules relating to the mentioned topics. The Flandria and FlandriaGAP farmers are producers with a positive feeling towards the sustainability of their production process and with a strong need towards personnel fulfilment and content, although, some producers consider farming as an economic activity driven by financial stimuli.

Contradictory opinions existed among the participants concerning various topics. For example some said that the certification books reflect the wishes of the customer and others considered them as a protection mechanism for retailers. Some participants believed that the standards do stimulate farmers in reducing

pesticide use. Others believed that the reduction of pesticide use is the merit of the legislation that has become stricter.

During the seminars, held to obtain the rankings for the different items of sustainability, the specifications of the certification books were not always clear to the experts. The focus group discussions revealed that for the producers this is not at all a problem. The specifications are evident to the farmers concerning clarity and intention. An exception is the Biogarantie standard. Also the producers found the specifications of this standard too vague.

Concerning the evolution of the certification standards, the following results were obtained by the means of focus groups. The retailers' belief was that evolution is still possible in all the standards on several fields. Extra elements that could be incorporated in the certification books are specifications relating to taste and health promoting substances. But conducting tests regarding taste of fruit and vegetables gives little outcome, which results in little or none economic surplus. New specifications relating to the microbiological quality of fruit and vegetables can also be added, since continuing smaller amounts of substances can be detected. This has a large impact on the aspect of food safety. Also more strict specifications can be added concerning rest-water and recycling of water. In The West of Flanders such rules could have a large impact since the use of groundwater there has to be reduced with 75%.Though when new specifications are added, one has to keep in mind that they have to be practically attainable and payable. For example the Organic farming standard should set specifications that are less vague and practically better attainable. This opinion concerning the evolution of certification standards was contradictory with the judgment of the producers who believe that the limits have already been reached, certainly regarding registration and quality. They believe that recently elements have been added that have no significant impact. Some focus group participants made the remark that adaptations to certification books are always inspired by an underlying economic advantage. For example the use of bumble bees as pollinators, which results in less labour efforts and contributes to the environment as a side-effect. Regarding this topic a spontaneous discussion arose. Producers will only be prepared to meet these additional requirements if they receive price premiums for their products.

6. Discussion of the output in the light of other similar researches

The methodology applied in this research was based on the study performed by Girardin and Sardet (2002). In this chapter it was attempted to perform a more precise evaluation of the technical actions compared to the analysis conducted by Girardin (2002), by differentiating the impact for each environmental component. The weights attributed to these environmental themes were determined using the same procedure applied to calculate the individual criterion weights, namely the revised Simos' procedure. In this way one of the limitations of the Girardin method was eliminated. The contribution of each item to the overall concept of ecologic sustainability is visually represented in the graphs presented above (Figure 3.2-3.8).

Several similar studies were conducted regarding ecologic sustainability assessment of labels. Research performed by de Snoo & van de Ven (1999) postulated the conclusion that eco-labeling could give an impetus to the development of sustainable agriculture, albeit a rather slow and unstructured one. This research was limited to a qualitative analysis, revealing gaps in environmental protection that need attention. The themes studied were those identified in Dutch environmental policy plans, with the added proviso that they should be significantly affected by agricultural activity. The research led to the development of a matrix which contained qualitative designations (mostly covered, not covered). From the matrix it was easy to derive which environmental topics were covered and which neglected. It was not analysed whether the set of criteria listed for each topic guaranteed adequate environmental quality. The approach adopted in this research was merely an initial step. The only conclusions that could be drawn relate to the degree to which the various labels investigated, cover the different themes of Dutch environmental policy. Two questions remain: what are the actual added environmental gains of farming according to the labels compared with conventional cultivation methods? And how close do these come to truly environmentally benign farming? The last question can be solved using the scientific framework for analysing environmental issues proposed earlier in this chapter. In this way the effectiveness of the criteria can properly be evaluated. The results of the study performed by de Snoo (1999) show that the themes of acidification, eutrofication, climate change and ecotoxicity are covered by most market-oriented

approaches. In contrast, the themes of hydrological changes and of habitat loss and fragmentation are scarcely covered in the certification schemes. The theoretic analysis of the standards studied in this research showed that more or less the same topics of sustainability were discussed. In accordance with the results of De Snoo & van de Ven (1999) a lot of attention was given to acidification and eutrofication and less attention was paid to habitat loss and fragmentation in all of the studied standards.

Research performed by Morris and Winter (1999) showed the environmental relevance of organic agriculture and integrated production (Swiss IP, Ofag, 1999 and IOBC, Böller et al., 1997). This was also shown in the study performed by Girardin (2002). For consumers, organic and integrated farming systems appear as the best solutions to promote a more ecologic sustainable agriculture. Girardin and Sardet (2002) questioned if the official prescriptions really were in harmony with this positive image. In their research it was analysed that 58% of the technical actions included in the OA standard (European standards for organic agriculture, Le Guillou and Scharpé, 2000) had a high impact on the environment. Organic Faming imposes fewer constraints than the other standards, but the rules usually have a stronger positive impact on the environment. Nevertheless some improvements could be proposed regarding irrigation management, quantitative management of N fertilisation and soil cover. These results are also reflected in our research. Girardin (2002) also concluded that some parts of the Integrated Production standards could be included in the Organic Farming standard, since most parts of the certification books are complementary. The same can be concluded on the basis of the results of our research. But not all standards can be considered compatible. The focus group discussions showed that Organic Farming is not compatible with FlandriaGAP, since 20% of the specifications are totally different.

The environmental impacts presented here are only potential impacts. Very likely, the farmers' practices go beyond what they need to do according to the standards they agree to follow. This is particularly true in organic agriculture, where farmers are obliged to use rotations, cover crops and other beneficial techniques even if that is not explicitly stated in the standards (Bourdais, 1998). The analysis performed in this study is primarily based on the technical specifications mentioned in the standards. But where possible it was attempted to include the underlying principles.

Regarding the applied methodology several limitations can be mentioned. The ***first*** restriction relates to the ranking of different rules according to their contribution to an item of ecologic sustainability. The ranking procedure cannot be underestimated. Repeatedly the experts mentioned their difficulty in assessing the impact of certain rules. Moreover a lot of rules had to be judged and since the seminars occupied several hours the fatigue effect played a role. Sometimes the experts shared different points of view with long discussions as a result. Finally a consensus for the ranking was achieved which had the approval of all the experts. Concerning the ranking of the sustainability items a ***second*** restriction can be mentioned. Subjectivity played a major role in the establishment of this ranking. ***Thirdly*** one can wonder to what extent experts are able to assess the impact of the rules in field situations. The interpretation of the final figures can also be a bottleneck. One must be aware of misinterpretation of the obtained results.

A big advantage of the applied methodology as described in Figuiera & Roy (2002) is that a motivated ranking is obtained. During the first consultation round of the organised seminars the experts made the ranking individually which allowed them to form an opinion of their own that could divert from what they were expected to think as an expert in a certain field. In the second consultation round the rules were discussed and opinions could be revised based on the input of others. In this way a well thought-out level of consensus was reached. This methodology also allows identifying the rules that can be restricted further. The analysis method proposed here is one of many. In the literature several analysis methods to assess ecologic sustainability can be found. Environmental sustainability can be evaluated by applying an indicator based approach (van der Werf, H., 2002) or by using Life Cycle Analysis (Helias, 1997; Mazijn, B., 2004).

Another aspect that should be taken into account in the sustainability assessment is the number of participants taking part in the labeling initiatives. The more participants a labeling initiative has, the greater the impact on environmental sustainability. The Charte Perfect and Fruitnet standard both scored well on the various items of ecologic sustainability. However, these certification schemes are followed by few producers. The estimated number of participants taking part in the Fruitnet and Charte Perfect labeling initiative respectively equals 125 and 75. The Terra Nostra standard is only followed by approximately 25 producers. Together with the low score for several ecologic sustainability items resulting from the above

assessment, it can be concluded that the impact of this label on environmental sustainability is rather low. The Organic farming label scored rather well for most of the selected environmental sustainability items and taking into account the 140 Flemish and 12 Walloon farmers which produce according to the Biogarantie standard, a medium impact on ecologic sustainability can be assumed. The number of Belgian farms which produce according to the Integrated Fruit Production standard is estimated at 353. Considering the rather low scores for this label a medium impact on environmental sustainability is assumed. The remaining standards Flandria, FlandriaGAP and EurepGAP have a larger impact on society since a lot of farmers produce according to the guidelines written in the certification books of these labeling initiatives. The EurepGAP certification scheme counts 2000 Belgian farmers and approximately 3500 farmers produce according to the Flandria standard. Since the introduction of the new guidelines, approximately 1056 farmers have switched over to the FlandriaGAP standard.

7. Conclusion

This research argues that the present certification standards indeed provide an impetus for farmers to change their production methods towards a more environmental sustainable agriculture. The improvement with respect to environmental sustainability resulting from the introduction of additional guidelines is clearly indicated (cfr. Flandria versus FlandriaGAP). Each labeling initiative chooses a certain level of environmental sustainability and defines its regulations accordingly. Moreover the competition between the certification programmes may give an impetus to raise their ambition level in terms of content and good governance (van der Grijp, 2005).

The proposed scientific analytical methodology allowed us to evaluate the rules in an objective manner and provides us with an appropriate tool to assess the evolution of certification standards on several environmental sustainability aspects. This methodology can also be used to assess the environmental effect of the evolution in mandatory level of the rules. However, this methodology is not able to evaluate the way the rules are interpreted and does not take the organizational framework, provided by the labeling initiatives, into account.

The following general conclusions can be drawn from the results of the performed comparative analysis. Charte Perfect has a substantial asset in guaranteeing food safety, and contributes to preserving the environment by making sure that waste is managed in an appropriate manner and reduced where possible. Compared with the other labeling initiatives Charte Perfect scores better in preserving air and water quality. EurepGAP's real assets lie in the domains of food safety and worker welfare, hereby giving a lot of attention to the hygiene aspect. This certification book was considered too theoretic by the focus group participants. The organic production mainly enhances environmental sustainability by managing the soil in this way that the natural fertility is maintained, by taking care of landscape and biodiversity and by using alternative pest pressure techniques. Both, farmers and experts found the specifications given in the Organic farming standard too vague. Improvement is desired in this respect. The use of alternative pest suppression techniques is also a great trump of the IFP, the Fruitnet and the FlandriaGAP certification standard. With respect to Fruitnet, the efforts provided to preserve biodiversity and landscape can also be mentioned. On the whole, Terra Nostra scores rather low. This is due to the fact that this standard was composed specifically for potatoes and thus only contains rules concerning the production of this crop. One has to keep in mind that also the scale of the initiative is important regarding sustainability.

Part 2: Producers, chain actors and consumers versus labeling strategies

Comprising of:

Chapter 4: Certifications: strategies for controlling pesticide use

Chapter 5: A consumer test of a framework assessing certification systems for fruit and vegetables: pesticide use and sustainability

Chapter 6: Certification systems as equilibria of stakes

Chapter 4 Certifications: strategies for controlling the use of pesticides

Laurence Roussel and Marc Mormont

SEED, FUL

Introduction

As part of the broader aim of evaluating the contribution made by labels to pesticide regulation, the specific aim of this part of our research is to evaluate the extent to which producers and consumers (see Chapter 5) regard labels as a pertinent strategy. This aim has been broken down into several different aims, each corresponding to a different method.

Labels are an indication of quality. In theory, they are designed to help the end consumer choose what he buys. But these indications of quality only have any meaning if they reflect a real difference in the practices used by producers and, more generally speaking, by actors involved in the sector. This is translated into specifications, which imply forms of organization and coordination between actors in the sector. The main aim will be to ascertain what changes actors in this sector and, especially, producers must make in order to comply with the label criteria. That said, labels are not just technical instruments. Labels modify competition on the market and even compete with each other. We have thus observed a commercial dynamic in labels. Labels also create a hierarchy of relations within the sector insofar as the definition of quality criteria in no way stems from market mechanisms, but rather from an initiative taken by some actors, which in turn implies the establishment of power relationships within the sector: having the power to define these criteria is a very important factor. In order to gain insights in these issues we carried out a series of interviews with actors from the sectors concerned so as to ascertain the content of the specifications, the forms of organization and competition and the power relationships that they create.

1. From labels to certifications

Our research has been guided by an initial observation: the fruit and vegetable sector is characterised by the diversity of its production procedures, ranging from quality trademarks to certification procedures that are not communicated to the public. In particular, the EurepGAP certification has been set up, which, whilst not directly designed to help the consumer, nonetheless plays an important role. A European initiative launched by large distribution companies, this certification aspires to be universal, as it is used on other continents, and has tended to replace other quality guarantees in the fruit and vegetable sector. In the case of the sustainable management of pesticides, which we are dealing with here, we thought it was important not to restrict our research to labelled products, but rather to focus on certified products, i.e. where the production processes include a pesticide strategy, which is reflected in the specifications as well as in other instruments, as we will see later.

This decision to focus on certifications rather than on labels is borne out by the results of our surveys. The use of the term “labeling” was sometimes not appreciated by certification bodies, which associate labeling with marketing, whereas the term “certification” denotes the existence of specifications. These bodies believe the term “labeling” does not do justice to their work, which is to devise specifications and monitor compliance with them. This sets certification apart from the purely promotional side of marketing products.

This distinction reflects another made by many of those interviewed, namely between production-related issues and production rules (the specifications, the way the sector is organised) and promotional issues, i.e. trademarks, labels. The public authorities in the Walloon Region deal with these two areas separately.

EurepGAP is not involved in promotion, but is merely a certification, whereas some more general labels, such as Eqwalis or Delhaize’s “Contrôle et Qualité” are visible to the consumer, but do not guarantee a specific type of product or production method. Our study focuses on fruit and vegetable certifications and, especially, on certifications that aim to reduce pesticide use.

In the rest of the text, the word “certification” refers to an approach and to actors involved in devising specifications.

2. Different definitions of quality and economic dynamics

Quality is a response to uncertainty in the agri-food sector, as is highlighted by a number of authors: "*quality is uncertainty about the definition and evaluation of the characteristics of foodstuffs by the partners in a transaction*" (Sylvander 1994). Similarly, the proponents of the convention theory state that "*in a commercial contact, agreement among individuals is not possible without a constitutive convention*" (Becker, 1982, quoted by Busch, 2000). "*They note that conventions make it possible to leave contracts incomplete*" (Busch, 2000). Certifications can therefore be seen as standards governing a foodstuff, which may be temporary and incomplete, but which give precedence to certain aspects over others.

An analysis of the structure and aims of these certifications shows that the term quality refers to different concepts. An analysis of interviews and public documents has led us to distinguish three different types of relationship to the final foodstuff and, therefore, three different types of certification:

- The first type of certification aims to guarantee vegetable food that complies with commercial requirements and this certification therefore contains an obligation to achieve certain **results**;
- The second type of certification creates a link between quality and the means of production: **production methods** are therefore all important;
- The third type of certification has no link with the vegetable food, but instead establishes a link between quality and compliance with **rules and procedures**.

Type 1. The Flandria, Charte Perfect and Terra Nostra certifications focus on the final product. This means that a given product must exhibit certain characteristics relating mainly to the appearance of the fruit or vegetable, as well as regarding their preservation and compliance with legal standards. This enables the certifiers to guarantee a higher level of quality for consumers or intermediaries compared to standard products. It is therefore a product-oriented certification that requires compliance with verifiable characteristics. But this also means that if the product does not respect these criteria, it is excluded from the market. This type of certification therefore implies two parallel certifications: certification of the producer and certification of the product.
How are these criteria defined? In the Flandria certification, launched by wholesale markets in Belgium, commercial quality criteria are given precedence. Various European directives set marketing standards for fruit and vegetables according to three quality categories: Extra, 1 and 2. For the Flandria certification, a vegetable food that does not comply with the Extra-category criteria is automatically excluded. These criteria relate mainly to the appearance of the vegetable (visible signs of spoilage, colour, compliance with the characteristics of the variety being cultivated), as well as to the size and homogeneity of the size of the product. The pesticides used are traced back to the producer, which enables wholesale markets to decide whether the product is to be exported or not depending on the potential presence or absence of pesticides.
For the Terra Nostra certification, criteria such as washability and the levels of dry matter and nitrogen are extremely important. Some years, when the weather has been bad, only half the produce from certified producers can be sold under the Terra Nostra certification.
Similarly, under the Charte Perfect certification, the product is delivered to a freezing factory which takes charge of part of the cultivation process and which expects a product of a certain size. They are also involved in the monitoring and control of certain aspects of the specifications such as measuring pesticide residue levels. These requirements include the traceability of measurements, the obligation to take measurements if there is a health risk, the setting up of procedures in the event that the MRL is exceeded and accreditation of the laboratory that carries out the controls. These factors show how much importance is attached to the final product.

Type 2. This type of certification gives precedence to the production method. The main difference between this type of certification and the previous one is the actual definition of the certification. For example, "integrated production" and "organic farming" labels attach importance to more environmentally friendly production methods. In terms of organic farming, this means that synthetic fertilisers and pesticides are not used and no chemicals are added to the product. Similarly, for integrated production the aim is to reduce the amounts of pesticides used through orchard management and especially by looking at how certain insects can prevent diseases naturally. Integrated production uses a strategy based on crop protection products in conjunction with other methods, and bases its use of them on the level of damage that could potentially be caused to the crops.

The non-guarantee of the quality of the final food product is set out in European legislation on organic production: "*No claim may be made on the label or advertising material that suggests to the purchaser that the indication shown in Annex V constitutes a guarantee of superior organoleptic, nutritional or salubrious quality*"[1] but also in literature published by bodies involved in organic production: "*Farmers are not obliged to produce high quality foodstuffs, but should cultivate the soil in accordance with strict rules for protecting the environment*"[2].
A producer is awarded a certification if he has complied with a series of fundamental rules. This does not mean that the final products under this type of certification are not subject to controls. They, like all other products, are subject to a series of standards. For the Fruitnet certification, pesticide residue levels are measured twice, sometimes using stricter criteria than those imposed by the law.
Similarly, "commercial" qualities (taste, appearance) are not left out, but are defined differently, sometimes in quite the opposite way to conventional products. For the Fruitnet certification, two aspects of the harvest are measured: sugar content and firmness, and if the fruit is not in conformity, it can be withdrawn from sale. These "commercial" criteria define products using a different scale of values, i.e. one that respects nature.

Regarding organic production, once again a number of non-measurable elements contribute to developing a different product: taste, as well as mineral content, or even the appearance of the products, which differs from that of standard products, are seen as positive aspects of the products "*Fresh organic fruit and vegetables often look different to what we are used to seeing. Their shape and colour are less uniform. The reason for this is simple: these products have had time to grow and nourish themselves in the soil, without being treated with any additional 'feed concentrates', such as chemical fertilisers that are quickly absorbed.*[3]". Pesticides are absent from this type of production, as they are considered to run contrary to the logic of organic production.

Type 3. The EurepGAP certification, however, is awarded without taking into consideration the final product and is based mainly on compliance with national legislation and a number of procedures (traceability, hygiene, identification of plots, for example). There is no link between the certification and the commercial quality of the product or a production philosophy. No matter how it looks and tastes, the product will be sold under the EurepGAP certification under one of the three categories (extra, 2 or 3). This certification aims to guarantee, above all else, traceability and compliance with legislation, rather than to promote a type of product or quality. The EurepGAP certification is therefore starting to become a basic standard, the aim of which is to enable the movement of products across international markets: it creates a uniform European (and increasingly world) standard based essentially on respect for food safety.
Despite these different definitions of quality, a degree of convergence has been created due to pressure from distribution channels.

Convergence 1: Type 1 or type 2 certifications converge within mass distribution networks due to an alignment of the commercial criteria relating to the appearance and size of the products. The organic certification has, in this respect, been forced to look at the issue of the final product. An organic producer explains the situation in the 1980s when organic products first entered mass distribution networks: "*Several hundred analyses were carried out and the whole of the organic sector was forced to consider the results. Products were analysed and there were some nasty surprises. Recurrent problems appeared: not cases of fraud, but a failure to get to grips with serious problems*".
The arrival of these certifications on mass distribution networks has therefore led to their transformation and has also led distributors to accept a number of the characteristics of these products. For example, in the case of organic production, taste has become an additional aspect of the label or certification and is also important for distributors "*Taste is still important. The mass distribution sector attaches importance to this in order to satisfy its clients. If a product is tasteless, it won't sell. After all, why pay more for a product that is tasteless?*" (an organic producer).
Therefore, we believe that in practice, and due to the influence of distributors, there is overlapping of quality-based certification with classical commercial standards-based certification.

[1] (Council Regulation (EEC) No 2092/91 of 24 June 1991 on organic production of agricultural products and indications referring thereto on agricultural products and foodstuffs, chapter 10)
[2] http://www.ateliersante.ch/bio.htm
[3] http://www.bioforum.be/fr/nav_sup/faq21.htm

Convergence 2: The type 3 certification, EurepGAP, is not at all visible, either through a label or the website of distributors. We believe that this certification should be looked at in our study of pesticides because it is one of the strategies open to distributors and the biggest Belgian distributors impose this certification on producers more or less officially. It is therefore extremely important to producers in terms of their access to the mass distribution market. Not only is this practice supported by the public authorities which finance farmers' training bodies, but it has also transformed already existing certifications which incorporate this certification in their specifications, with producers having to comply in order to gain access to the mass distribution sector. Most producers therefore have to have a double certification (at least for the time being, as other certifications are trying to gain equivalence with the EurepGAP certification). It is also a very recent certification and, in the case of the Flandria or Terra Nostra certifications, consumers were only informed of their existence some time after their creation, and therefore it is not unlikely that the consumer might be informed of the EurepGAP certification some years from now.
When we take a look at the certifications, we also see the need to respond to situations of uncertainty and particularly, in the case we are dealing with, to the use of pesticides. Integrated production certifications ensure residue levels are checked, but we also see that the EurepGAP certification is imposed on other certifications as a condition for market access: all type 1 sectors have to get EurepGAP certification. And this certification – structurally speaking – is increasingly taking over from government-imposed standards and is trying to achieve standardisation across the European and even the international market.

We have therefore noted both a tendency towards differentiation and a tendency towards standardisation, the latter being based mainly on security criteria and pushed for by mass distribution companies.

3. Who guarantees quality?

Not all of these certifications carry a clearly visible label on their packaging. The indications of quality, which are described by Valceschini as "*succinct, credible information given concrete expression through the displaying of a logo, an acronym, a name or an endorsement on the product* " are not the only ones that structure a relationship with the consumer. The three types of certifications described above have three different relationships with the consumer.

Type 1 certifications are visible through a logo. These products are sold unpacked (Flandria) and the name of the certification is displayed on the crates, or are sold in packages that are similar to other equivalent products (Hesbaye carrots, Terra Nostra), but are hardly advertised at all. Promotion of these products is integrated into the general quality promotion activities of the distributor. These certifications promote themselves partly through the food product and its characteristics, as well as by providing information on the websites of the certification bodies or those of the distributors that sell their products.

What do these three certifications offer the consumer?: a standardised, predictable product that has been subject to controls and which can be traced. These certifications use a procedure that guarantees a certain type of product. Both the EurepGAP certification and the type 1 certifications use these procedures to manage pesticides with the aim of reassuring consumers who can be described as being "concerned" about these questions, a concern which has increased as a result of various food crises. These are certifications that are primarily aimed at distributors that are interested in guaranteeing food safety. But these certifications do not make direct references to pesticides. In this respect, the communication activities of both certification bodies and distributors focus on good agricultural practice (EurepGAP), traceability, as shown by the Delhaize "contrôle et origine" label, and the concept of quality, which is highlighted by Flandria on its label: "*the quality seal labels the product as the result of many years of careful efforts on the part of the growers and identifies the efficient quality assurance policy of the auctions. Each and every link in the chain is being inspected: the product, the produce, the growers, and the auction.*" or as can be seen on Charte Perfect's website: "*The CHARTE PERFECT is a guide for vegetable production that aims at achieving total quality in order to guarantee product safety and consumer health as well as safeguard the environment*".

These are therefore certifications under which distributors – and fairly large groups of producers – make a commitment to the consumer to produce a higher quality or a specific product, but where the issue of pesticides is only dealt with implicitly through the promise of a high-quality, traceable product.

Type 2 certifications, on the other hand, have a stronger identity not only due to the reputation of their labels, but also because they have a more legitimate definition of the difference in quality of their products. The Biogarantie certification has a very good reputation among consumers, as shown by a study indicating that it is the best-known certification, with 61% of consumers aware of it (CRIOC study[4]). This usually means that the products are not sold loose, but in packages, since the label must be visible. This type of certification, which is used in integrated production and organic farming, requires strong recognition of its approach in order to protect it from fraud and preserve its originality. One of the ways of guaranteeing this is to write its specifications into legislation. For example, there is both a Royal Decree governing the "integrated production of pome fruit" and a private label based on this legislation: "Fruitnet". Some producers can be accredited with only one of the two. Similarly, the Biogarantie specifications are also found in European legislation that stipulates the minimum standards for national specifications. In these two cases, the specifications for the private labels (in this case Fruitnet and Biogarantie) must at least comply with the minimum legal requirements and exist in parallel to these. Support through legislation goes hand in hand with the presence of an inscription that is visible to consumers: a label that enables consumers to associate a label with an approach, which is explained elsewhere (internet, leaflets, visits to orchards).
In these two cases, the relationship with the consumer is also established using more direct means. Producer/consumer relations can develop through direct sales to the consumer. Under the organic certification, there are also many small-scale sellers who can answer questions, and markets or fairs are also organised. The Fruitnet certification is also promoted by organising visits to orchards or by selling directly from the farm. We can see that these certifications take the opportunity to communicate directly with the consumer without going through mass distribution channels. This communication consists of information about the production method and some of the specific characteristics of the vegetables products. The legitimacy of these certifications stems not only from legislation, but also from producers and consumers espousing a series of common beliefs and values.
They are also the only certifications that give information on pesticides. A ladybird, representing the biological control of disease, appears as a logo on Fruitnet packaging and organic farming is defined by the non-use of synthetic products. These two certifications are thus the only ones that make specific reference to pesticides and establish a clear difference between themselves and 'conventional' farming.

The question of pesticides is linked to food quality and the quality of the environment. It is difficult to give information about pesticide reduction because doing so would be admitting that pesticides were already being used, which could lead to the product loosing its certification (Valceschini, 1999).

What types of consumers are these certifications designed for? Type 1 and 3 certifications are mainly designed for mass distribution and consumers who are anxious in the wake of food safety crises. They respond to their concern through traceability and controls.
These certifications do not make specific reference to pesticides, as consumers could be extremely sensitive to this issue. During an advertising campaign in France, the international union for plant protection (association of pesticide producers) attempted to show that pesticides in food were harmless. Initially it tried to show that its products were no more harmful than organic products and was taken to court by nature protection organizations. Although they did not win their case, it showed how dangerous it is to talk about pesticides when advertising a product. Thus, the main message conveyed to consumers by these certifications is that there is a link between quality and the notion of controls.
Type 2 certifications, however, do take a stance on pesticides; organic farming labels ban their use, while integrated production focuses on the biological control of diseases. These certifications put agricultural practices to the fore. For example, Fruitnet was created in response to the agronomic problem of the resistance of a certain red spider to a particular pesticide. Producers have attempted to tackle their problems by using other cultivation methods and have sought to inform consumers about this in an attempt to offer them an alternative. Without going into organic farming in great depth, there is also a link between the production philosophy and the raising awareness among consumers. Organic and integrated production labels are also characterised by another important dimension: a more or less explicit reference to the environment, rather than just to food quality. These certifications are not designed for concerned consumers, but rather for responsible consumers who are being called on to make a choice.
Our analysis of relations with the consumer is backed up by our qualitative studies (part 2).

[4] http://www.oivo-crioc.org/textes/pdf/1035.pps

4. Transformation of relations within certifications

4.1 RELATIONSHIP TO WORK

How do these different methods of managing uncertainty have a bearing on the work of producers? What do producers try to teach consumers and how? In order to answer these questions, we can first of all ascertain the extent to which producers are involved in defining specifications. We may be tempted to think that producers play an important role in the certification process, as is the case with the development of networks based on labels of geographic origin. However, we shall see that the role played by the producer in drawing up specifications differs according to the type of certification.

4.2 THE ROLE OF FARMERS IN DEFINING SPECIFICATIONS

The rules laid down in specifications have different backgrounds. Some specifications, especially those of type 2 certifications, are defined by producer associations (organic, integrated production). In most other certifications, but also when organic and integrated production specifications are modified, the farmer is present as a representative. For most certifications, modifications to the specifications are decided upon by a committee that brings together the different partners, including producers.
When it comes to drafting the specifications, an important role is played by the technical committee, which is usually a supervisory body: the FIWAP (Walloon Potato Federation) for Terra Nostra, the CMH (Hesbaye Market Gardening Centre) for Charte Perfect, the GAWI for Fruitnet. In the case of Fruitnet, a specific body has been set up to monitor and make modifications to specifications – this structure is distinct from the producers' group that originally devised the project. At the other end of the scale, however, are the Flanders auction houses, which have a number of different responsibilities: they are producer organizations, intermediaries dealing with producers and technical supervisors. The procedure used by these different certifications is to propose a set of specifications to the different partners involved in the certification process and discuss them. Within this framework, producers can make changes or adjustments. In this case, the presence of supervisors who are in touch with producers and familiar with the specifications is crucial to bringing about these negotiations. The diverse nature of these bodies prevents us from getting a clear idea about the role played by producers in defining the specifications. Although some of them somewhat resemble producer associations, this does not mean that producers created the certification. These supervisory bodies act as an interface between producers and clients of the certification body in very different ways and, at the end of the day, most specifications are jointly devised by producers, distributors and the various different intermediaries, such as auction houses or wholesalers in the case of potatoes.

In the case of EurepGAP, producers have only limited input when it comes to modifying specifications, although they have a fifty percent representation in both the Technical and Steering Committee of the certification book. This is a special case because their specifications are drawn up at European level and afterwards adjusted to different national laws. There seems to be little scope for both producers and other certified members (distributors or processors are also certified) to contribute to defining specifications. In Belgium, for example, requests for modifications were made in writing to the management body (FoodPLUS), but were not taken on board when the parties met. We can therefore say that, generally speaking, producers have little opportunity to contribute to defining specifications, which is especially true when it comes to certifications that are negotiated with the mass distribution sector.

Although producers cannot necessarily negotiate the specifications, the aim of the certifications is for the specifications to be applied fairly progressively by many producers. In fact, either 'stable' specifications (EurepGAP) have been implemented progressively or specifications have evolved over time and requirements have been introduced progressively (Charte Perfect, Flandria).
The progressive manner in which requirements have been brought in is made possible by the presence of supervisors who work closely with farmers. These supervisors can negotiate the deadlines for complying with certifications with mass distribution companies. This was the case with EurepGAP. They can adopt a flexible approach to the requirements imposed on farmers, dealing first of all with certain requirements and then bringing in others in subsequent years. For example, the initial focus of Charte Perfect's specifications was to ensure compliance with specific standards for storage facilities for crop protection products (the "crop protection room"), and then progressively the specifications moved away from loosely binding requirements (of the type "producers should") towards binding requirements (of the type "producers must"). The phyto clauset was already a legal obligation, but there was very little compliance:

it was the supervision set up by the different certifications that enabled this legislation to be enforced by providing farmers with the various different tools and helping them to meet the requirements (stickers, analysis, proposal to bring facilities into conformity), which in turn enabled concrete actions to be taken.

The work of producers has thus been transformed by the emergence of certifications. How can we assess this transformation? It should be pointed out that merely referring to the specifications is not sufficient. The more these certifications develop, particularly with the ever-increasing influence of EurepGAP, the more the specifications resemble each other. If we look at the structure of these certifications, there appear to be two decisive factors when it comes to defining relations between producers and the certification body:

- Human supervision
- The technical requirements, which, in some cases, are reiterated in the crop sheets.

4.3 THE ROLE OF SUPERVISION IN THE DIFFERENT CERTIFICATIONS

The link between the definition/modification of specifications and technical supervision must be emphasised. Supervision is an integral part of the Fruitnet certification. Producers pay a percentage of the cost of this. This does not apply to EurepGAP, where supervision is carried out by external bodies, i.e. by already existing structures in each country, especially agricultural development associations. The supervisory/control bodies are funded by state subsidies (regional subsidies when it comes to product promotion or European subsidies when it comes to common organization of markets, COMs) or by the farmers themselves, as is the case with Fruitnet. European funding of producer organizations (POs) under the "fruit and vegetables" COM allows for the funding of supervision for certain certifications (Flandria, Charte Perfect) and is likely to be extended to others.

Some supervisors stated during our interviews with them that human supervision is essential: "*a farmer cannot receive the EurepGAP certification without supervision*" while others thought that the farmers are sometimes more knowledgeable than they are: "*Supervision was proposed… some of the first producers to receive supervision were more knowledgeable than we were. They already had experience of table potato production, they had been irrigating for years. They were starting to invest in fridges or crates. Nothing beats practical experience. Some of them are still more knowledgeable than we are. That's quite plain to see*" (Terra Nostra supervisors). Some farmers specialise in a specific product and therefore learn little about how to cultivate their produce: "*I didn't learn much from Flandria because I had already seen everything in my earlier work*" (chicory producer). The role of certification is therefore to allow supervisors to pass on their knowledge to producers and vice versa and, in the case of some certifications, for producers to exchange knowledge amongst each other.

In terms of the **"timing" of the supervision**, there are differences between the certifications. This is an important consideration, which allows us to anticipate the type of instruction needed and the changes that farmers can make to their practices. For example, EurepGAP supervision is very different to that of Fruitnet in terms of their philosophies. In the case of EurepGAP, the supervision takes place upstream and is designed to help the producer gain certification, and then there is little further supervision. However, in the case of Fruitnet and, to a lesser extent, other certifications, the supervision consists of regular inspections of the farmer's work, with the introduction of new requirements and new instruction throughout the time the farmer holds the certification. In short, we could say that supervision allows for access to the EurepGAP certification whereas, with other certifications, certification gives access to more stringent supervision, which in turn enables requirements to be modified or implemented on the ground. The example of pesticide management will enable us to show what new instruction this supervision can provide throughout the period of certification and how it contributes to sustainable pesticide management. As we shall see in the next chapter, the role of supervision is representative of the importance of instruction and of the scope for innovation in and changes to cultivation methods.

4.4 THE CHOICE OF PESTICIDE

In terms of pesticides, farmers have two decisions to make: the first relates to the timing of the pesticide treatment and the second the choice of pesticide.
The question of *when to treat with pesticides* is linked to the development of the disease and how advisable it is to use a pesticide to fight the disease. The question of *which product* to use obviously

depends on the effectiveness of the pesticide in tackling the disease in question, as well as the repercussions for health and the environment (depicted on the product label in the form of a pictogram) and its regulatory status (Is it authorised? For which crops?). Additionally, there is the question of "how long before harvesting should the pesticide be used" - a deadline that must be respected so as to avoid the presence of residues in the food.

4.4.1. The situation outside the framework of certifications

Apart from the certification bodies, various types of assistance and advice are available in order to help producers make their choices. A recent poll (2002-2003) of Belgian farmers highlighted three main sources of information for farmers, in the following order of importance: crop protection adviser, the agricultural press, crop bulletins (Marot, Godfriaux *et al.* 2004).
The most common form of assistance comes from crop protection advisers (sellers). The poll shows that "*whatever the crop, by far the most regularly consulted source of information is the phytopharmacy delegate*". According to the poll, this answer was given by 64% of arable farmers.
The crop protection delegate is most often called upon by the farmer in the event of an outbreak of disease and he advises the farmer on which type of product to use and in what quantities. In some cases, producers may subcontract out the spraying operations, implying that the farmer does not come into contact with the pesticide, and does not have to stock it or dispose of the remaining pesticide after spraying.
The role of representatives has one major drawback, which is denounced in particular by nature conservation groups, which is the suspicion that crop protection representatives always want to sell the largest quantities of pesticides possible, thereby preventing reductions in the use of these products. This special relationship between producers and the crop protection adviser has also been described in England where, even though most farmers think that this consultancy is not impartial, their advice continues to be applied to the letter. This research has revealed that the advisers manage to convince producers that they are acting in the same interest (Ward, 1995). According to one of the Belgian farmers interviewed for the purposes of this study (strawberry and potato producer): "*the representative does not prescribe excessive quantities of pesticides because he knows that if he oversteps the mark we can switch from adviser*".

The second fact to emerge from the aforementioned poll is the role of the agricultural press. This is mentioned by 30% of arable farmers. However, the poll does not specify what information they get from this press. These newspapers contain advertisements for crop protection products, as well as crop bulletins and advice from the CADCO (the Agricultural Centre for the Development of Cereals and Protein Crops).
The third source of information comes from crop bulletins. Supervisory bodies have had bulletin systems for a number of years already and producers are already subscribed to them. Crop bulletins are a form of assistance provided in specific circumstances (in the event of an outbreak of disease, or bad weather) in order to enable farmers to decide whether to spray their crops or not. Bulletins are put out every one (in the case of potatoes and cereals) to two weeks (fresh market garden produce). These different services are geared to specific crops and, for each crop, information relates only to epidemic diseases, i.e. those which can be prevented from reaching alarming levels by using appropriate pesticide products. These services do not, therefore, cover all crops or all diseases. This information can be found in the specialist newspapers or over the Internet. However, according to the results of the poll, "*farmers do not systematically follow the advice put out by these services. Advice given by the company rep takes precedence over the advice of these services*" (Marot, Godfriaux *et al.* 2004).

4.4.2. The role of certifications

Farmers can avail themselves of a number of services in order to help them make decisions. They are free to compare the different services, to choose which service they like, and even to change their adviser if they desire so. The certification bodies systematically use these services, as well as other additional tools.

Which products?
In terms of the choice of a pesticide product, the certification bodies have two strategies, one of which is common to all certifications and consists of clarifying legislation, the other consisting of limiting the list of products that may be used. The fact that some certifications have their own crop sheets enables them to highlight the legal requirements and incorporate them into the question of "*when to treat*" with pesticides.

Information requirements and tools: knowledge of the law

All certification bodies emphasize the need to inform farmers about the crop protection products that are authorised and those that are not. This list can be consulted directly over the Internet (http://www.fytoweb.fgov.be). Certification bodies provide producers with the list in paper form, with updates sent out by post when necessary.

This information is directly accessible and can, for example, enable producers to check whether the advice given to them by their reps is in compliance with legislation. The information covers which products are authorised and how long before harvesting pesticides should be used, so as to guarantee that the harvested food products will contain no traces of crop protection products, as well as the maximum doses for each product. These are therefore procedures that ensure that producers are aware of the legislation in force and take responsibility for the crop protection products they use and the way they use them.

This procedure puts farmers on a more equal footing with the reps who, in theory, can no longer sell them unauthorised products, or recommend excessive doses (EurepGAP supervisor, personal comment).

Under the certification system, the number of products is limited on the basis of two other decision-making tools:

- A toxicity list for products in relation to beneficial insects has been drawn up following research carried out by the Gembloux Research Centre[5]. This research has led to a three-tier list being drawn up: red, green and amber depending on the toxicity of the product for so-called beneficial insects, i.e. those that can combat diseases themselves. The effectiveness of the crop protection product is also mentioned. This list is used in various specifications (Terra Nostra, Flandria, Fruitnet) as a means of helping producers to choose which products to use.
- Use of the POCER software is an explicit stipulation in Flandria and FlandriaGAP's specifications (chapter 2.1.1). This software, which was developed in order to enable evaluation of the different risks of pesticide products for different environmental and human health compartments (water, health, bees, etc.), helps producers to decide which product to use on the basis of these criteria.

Technical tools: crop sheets

Type 1 certifications also provide **crop sheets**, which give details about which products should be used, in what quantities and the conditions for using them throughout the cultivation process whilst always taking into account the edaphic and climatological conditions. These sheets contain lists of the pesticides authorised under that particular certification (Charte Perfect, Terra Nostra, Flandria) with an indication of their toxicity. The list of authorised pesticides under the Flandria classification is divided into three categories: those that are authorised, those that are tolerated but must be declared if used, and those that are banned and for which farmers must apply for an exemption if they want to use them (otherwise they may lose their certification for that particular crop). These crop sheets enable the monitoring of the production of the end food product. They enable producers to ensure that their practices (in terms of quantities and types of pesticide products used and cultivation methods applied) guarantee the type of end product required under the certification. These sheets are compiled under precise edaphic and climatological conditions and, therefore, constitute a sort of manufacturing process, which means that they are specific to each certification and are even confidential. These crop sheets are therefore not available to the general public, whereas the specifications are usually readily available. These sheets are used solely by type 1 certifications, but the Bioforum association, which is an umbrella organization for the whole of the organic farming sector, is considering setting up a similar system.

When to treat with pesticides?

All certifications use crop bulletins, and either provide additional tools or make affiliation compulsory for producers. For example, under Charte Perfect's supervision procedures, trapping is carried out in order to find out about the arrival of predators and notify certified producers. Terra Nostra's specifications, for

[5] Drawing up of pesticide selectivity lists in relation to beneficial insects within the framework of the development of specifications for the integrated production of arable crops and vegetable crops. Agricultural Research Centre of Gembloux Department of Biological Control and Plant Genetic Resources. Scientific manager: J-P Jansen. Main external partner: SPF public health, food chain security and the environment – Raw Materials Budgetary Fund. In conjunction with the Analytical Chemistry and Phytopharmacology Unit (FUSA)

example, use bulletins on a more systematic basis:
Terra Nostra (2004-2005 season) Chap. V, Art. 21: "In order to protect their crops from parasites and especially from mildew, producers sign up to at least one of GET's bulletin services. The bulletins are conserved and made available to the certification body".

For Fruitnet, having to sign up as well to a bulletin service, producers may carry out their own trapping of parasites. For example, in the case of worms in potatoes and pears, its specifications require farmers to lay one pheromone trap per 4 hectares. These traps attract butterflies in the vicinity and thus enable their density to be calculated. Under Fruitnet specifications, a threshold of 7 butterflies per week is tolerated, which means that crops can only be treated with pesticides when weekly densities are higher than this. Producers can therefore monitor the presence of butterflies themselves and treat with pesticides only in the event of a real risk. Similarly, under the FlandriaGAP certification, use of insect traps is strongly recommended (1.1.1).

As we have seen, certifications, when they are created, use already existing services, but make their use more systematic (use of bulletins, compliance with legislation) and add trapping requirements. The crop sheets of some certifications group together all the different kinds of information and guide farmers in their choices. Sometimes they impose choices on them.
Producers have a certain amount of leeway when it comes to meeting these requirements *"Few producers stick to the letter of the requirements. It would be a mistake to apply the rules to the letter without first assessing the situation on the ground"* (Terra Nostra supervisor). However, as we saw in the case of Flandria, producers must apply to derogate from the requirements of a certification and must obviously remain within the confines of the relevant legislation. In some cases, failure to comply with the requirements can lead to certification being refused for that particular year.

The increase in record-keeping
Keeping records of actions taken relates to farmers' activities involving the use of pesticides (this is the case we are dealing with, but fertilisers are also covered). A Decree of 14 November 2003 made record-keeping compulsory for all pesticide use on a farm holding. Record-keeping must be completed at all the different stages in the food chain and is carried out at two levels: firstly, for products entering the firm (in products), including details of the purchase, date, quantity and identification of the product and, secondly, outbound products, including the date and quantity of the product, and, for producers, the dose and location (the administrative identification number of the plot). Registration was already in force under a number of certifications, but only for certified crops, and therefore the legislation has brought record-keeping into general use throughout the food chain and for the whole farm holding.
In addition, some certification bodies require producers to keep documentary evidence showing why they decided to spray their crops with pesticides: results of trapping, details of bulletins. Under the Fruitnet certification, when producers spray their crops, their records must not only contain evidence of how they arrived at their decision, but also details of all the actions undertaken on their holding (especially, as we shall see subsequently, information on the protection of organisms that combat diseases naturally) designed to avoid having to resort to spraying.

These different requirements highlight the importance of the role played by certification bodies in both enforcing the regulations and guaranteeing the traceability of all crop practices, especially pesticide use. This is made possible by setting up a supervision procedure that provides farmers with technical solutions. This procedure is made up both of human resources and technical tools, such as the crop sheets, which standardise the work of each producer, which in turn allows controls to be carried out more easily and provides for a more predictable end product. As we shall see, it is the presence of supervisors that enables certification bodies to go beyond merely enforcing the law and to move towards reducing spraying activities.

4.5 TAKING ACCOUNT OF NATURE CONSERVATION ISSUES: SUPERVISION TO INCREASE PREVENTION

Nature conservation issues will enable us to explore the different types of instruction that can be developed for each certification. We can see from the various specifications that there are three main types of requirements: the maintenance of conservation strips, incorporating farm holdings into legislation or local nature development programmes, and taking account of the requirements of integrated

production. All the certifications dealt with in this report, with the exception of EurepGAP, claim to espouse *integrated production*. Integrated production is defined by its use of integrated controls and aims to incorporate nature and nature's regulatory mechanisms into farming activities in order to limit, as far as possible, the use of external products[6].

Maintaining conservation strips can have two objectives. The first is to stimulate natural disease defence mechanisms (either by making the crops more resistant or by assisting organisms that fight these diseases). This is the integrated production approach.
The second objective relates to the need for farmers to protect areas surrounding their holdings from pesticides, especially rivers, which are protected by planting grass strips. This is compulsory in the specifications of integrated production, and also guided the measures taken in France to ensure good environmental and agricultural conditions under eco-conditionality legislation, which requires 5% of the land to be kept fallow.

- Integrated production approach

This is an important factor and one that is included in various specifications, without the objectives necessarily being explicitly specified, as in the case of Charte Perfect, or where only a general conservation objective is set, as in the case of EurepGAP.
Below are some excerpts from specifications:

Biogarantie: Annex I §3: Pests, diseases and weeds shall be controlled by a combination of the following measures: choice of appropriate species and varieties, appropriate rotation programme, mechanical cultivation procedures, protection of natural enemies of pests through provisions favourable to them (e.g. hedges, nesting sites, release of predators), flame weeding.

Fruitnet: 4.6.4: Is an ecological surface of at least 5% of the farm surface preserved?
4.3.5-4.6.3: Is taken care of the existing natural hiding-places for beneficial organisms and are extra natural hiding-places created?
8.2: Are the vegetation bands regularly mowed and is the greenery left on the spot to favour the beneficial fauna?

Charte Perfect.11.5: Farm landscapes and surroundings are to be protected

EurepGAP: 13.3.1: Has consideration been given to the conversion of unproductive sites into conservation areas?

We can see that the specifications of Biogarantie and Fruitnet set up procedures that ensure the protection of the natural enemies of pests, which should enable the use of pesticides to be eradicated (Biogarantie) or reduced (Fruitnet), whereas with other certifications nature conservation is not linked in with pesticide reduction, but rather with the achievement of best agricultural practice.

- The second type of requirements relates to the obligation to comply with legislation to protect biodiversity.

Requirements stemming from the specifications:

Fruitnet: 4.2: Is a policy of nature management set out on an individual or regional basis?

FlandriaGAP: 4.2.1: There is a policy to manage nature on the farm. The cultivator chooses at least 3 policy measures regarding nature

EurepGAP: 13.2.3: Is the management of wildlife and conservation policy compatible with sustainable commercial agricultural production and does it minimise environmental impact?
13.2.6: Does the wildlife and conservation plan contemplate the creation of an action plan to enhance habitats and increase biodiversity on the farm?
13.2.5: Does the wildlife and conservation plan contemplate taking action to avoid damage and deterioration of habitats on the farm?
13.2.4: Does the plan contemplate the undertaking of a baseline audit to understand existing animal and plant diversity on the farm?
13.2.2: Does the farmer have a management of wildlife and conservation policy plan for his/her property?

[6] Anonymous (1999). Integrated production: principles and technical guidelines. 2nd Edition. IOBA/WPRS Bulletin 22(4), 1999.

13.2.1: Has a conservation management plan been established (either individually or on a regional basis)?
13.1.2: Has the farmer considered how he/she can enhance the environment for the benefit of the local community and flora and fauna?
13.1.1: Does the farmer understand and assess the impact his/her farming activities have on the environment?

These types of requirements pertain to the application of both compulsory and non-binding legislation, including providing information about existing local agri-environmental measures or nature development plans (EurepGAP supervision by CIM, Flandria). The choice of agro-environmental measures (AEM) can be based on production-related requirements. For example, technical inspectors stated that for a number of holdings some AEMs are detrimental to certain quality requirements: for example, this is true of tree hedges bordering spinach plantations, because during the picking season the tree leaves get mixed up with the spinach leaves. Conversely, some AEMs can reinforce certain precautions linked to production, such as the planting of grass strips along roadsides so as to create buffer zones that keep waste from the roads away from the production.

- A third reference is made with respect to the requirements of integrated crop management, ICM, or integrated crops, or of integrated pest management, IPM or integrated production.

FlandriaGAP: 1.1.1: Basis concepts of ICM are respected
EurepGAP: 8.1.2: Do farmers apply recognised IPM techniques?
8.1.3: Have anti-resistance recommendations been followed to maintain the effectiveness of available crop protection products?
8.1.1: Has the protection of crops against pests, diseases and weeds been achieved with the appropriate minimum crop protection product input?
8.1.4: Has assistance with implementation of IPM systems been obtained through training or advice?

These references to integrated production in the various certifications must be viewed with care. Various authors have shown that although integrated production is referred to by many certification bodies (especially in France, where "rational agriculture" is referred to), it is usually limited to a more narrow methodology. These methodologies, which can be described as rational rather than integrated, do not take natural enemies of diseases into account and the need to encourage them through appropriate measures, nor attempt to manage orchards, which would allow for a reduction in the use of chemical pesticides. We can therefore discern two approaches to pesticide management, one focused on the rational use of pesticides, the other on integrated production. The first approach seeks to distance itself from the systematic use of chemical products and use complementary methods: physical and biological controls, as well as genetic modifications. This approach is the new standard for pesticide use, and is promoted on all the websites of pesticide manufacturers (for example, the website of the European Crop Protection Association: www.ecpa.be). The integrated production approach, in its strictest sense, adds to this dimension a whole raft of actions designed to avoid using chemical products: protection of populations of organisms that are natural enemies of diseases, keeping records of all these pesticide reduction measures, precedence given to tackling problems through biological means, adapting the anti-disease measures to the prevailing situation at the time and the infestation levels, but also taking into account potential damage. Additionally, its objectives include the management of non-renewable natural resources, the production of high quality foods using safe and environmentally-friendly technology, ensuring a sustainable income for farmers, pollution reduction, and support for the different roles played by agriculture. This approach is based on both scientific research and supervision of farmers.

These analyses of the specifications in terms of their impact on nature protection have produced similar results compared to the other research teams taking part in this project. A resource protection league table drawn up by an expert (version dated 18 November 2005) gives a priority rating of 8 to integrated production actions designed to protect fauna and beneficial organisms. Conversely, actions to involve farmers in regional and local plans, AEMs, and aspects of the landscape that prevent pesticides from spreading to other areas are regarded as unimportant (1 or 0). Artificial measures to assist beneficial fauna are also regarded by the same expert to be of little importance to the protection of natural resources.

The above shows the need for a holistic approach to farm holdings and the difficulty of applying general requirements to specific situations. In promoting pesticide reduction by taking account of the role that beneficial insects can play, Fruitnet has set up a wide-ranging system of supervision that enables the requirements to be adjusted to the precise situation on the farm in terms of both the prevailing natural and agronomic conditions (crop rotation, for example). In addition, under the registration requirements, producers must justify their decision to spray their crops and must list the actions taken to avoid having to resort to spraying. Under this procedure, not only are the means used evaluated (conservation strips, compliance with legislation, participation in voluntary mechanisms), but they are also assessed in relation to an objective, namely crop protection. The aim is to obtain effective methods that allow for pesticide reduction. Similarly, the Biogarantie certification, which bans the use of all chemical pesticides, aims to use nature and different cultivation methods in order to reduce the burden of disease. In their case, the evaluation is far more stringent because any use of pesticides results in the withdrawal of the certification for the product in question. As regards these two certifications, the protection of biodiversity on the farm is one means of reducing pesticide use rather than an aim in itself. Implementing these techniques requires the farmers to have a certain expertise, which they can get from advisers or publications (Biogarantie) or from close monitoring from supervisors. Supervision at Fruitnet is particularly well developed, not only due to training courses, but also to supervisors who visit the holding several times at the end of the production season and who are available to provide advice on any question the rest of the time. This enables them to observe very precisely the progression of the disease as well as to postpone the spraying.

We have thus noted the emergence of three very different types of pesticide-related risk management.
EurepGAP imposes procedures and standards on producers that result in standardisation of their work as well as control procedures. The issue of changing farmers' practices, as well as pesticide reduction, is not examined outside this context.
Type 1 certifications impose very precise requirements which are identical for all producers. Supervisors are present to enable them to comply with them, with the final product being the main objective.
Type 2 certifications, on the other hand, whilst being general in nature, promote an approach that attaches more importance to producers' experience, but which is also more nature-friendly since they take account of the presence of beneficial species and look at the question of intervention thresholds in the event of an outbreak of disease.
This approach enables farmers to develop their expertise progressively. For example, Fruitnet inspectors can tailor their advice to the farmer they are dealing with. If a farmer is convinced of the merits of the integrated method, it will be possible to advise him to take more "risks" than a farmer who is not yet convinced. Thus, the idea is to get farmers to treat their crops with pesticides as "late" as possible and to let the orchard defend itself. It is thus a question of setting the economic risk of having a harvest damaged against the risk caused by using pesticides when there is no need to do so. The latter risk is also economic in nature and requires farmers to set the price of the pesticides against the price of losing their crops or seeing them relegated to a lower quality category. The supervision process enables a gradual movement, year on year, towards less and less pesticide use. This can be achieved because producers gain in confidence when they see that refraining from using pesticides has not led to their harvests being damaged: they both see the positive results of the method and place greater trust in the supervisor who recommended the method to them.

The farmer's work consists of observing and adapting to the climatic, soil and ecological conditions. For example, a chicory producer says that he goes to check on his crops twice a day and that that is the price he pays for achieving a quality product. Conversely, type 1 and type 3 specifications promote requirements and objectives that enable each producer to be more predictable, but reduce their autonomy and decision-making ability. Producers sometimes regard this as a considerable constraint which prevents them from acting on their own initiative: "*I'm forced to produce in a straitjacket*". By regarding nature as an ally, specifications such as those of Biogarantie and Fruitnet respect the autonomy of farmers in terms of both their work and the development of their expertise.

5. Competitive relationship

Type 1: The three certifications which focus on the result (Flandria, Charte Perfect and Terra Nostra) are similar in the importance they accord to the distributors' requirements in the negotiations and construction of the certification. Thus these three certifications cite economic necessity, i.e. a response to

distributors' or local manufacturers' requirements, as the driving force behind their creation. In these three examples, the geographical link is a strong one; the aim is protecting local production as a function of the markets available. In the Walloon Region, potato producers are attempting to protect their market in the region against competitors from France, the Netherlands and Germany, using Terra Nostra, which is based on quality, to achieve this. Similarly, Charte Perfect was a response to the need to maintain producers close to the processing plant. The geographical link is also a factor in the Flandria label, which demonstrates that one of the objectives of the Flanders Region is to allow the development of Flemish producers. In this case, this means that geographical origin, even though it does not appear in the specificity criteria, is an element in the characterisation of the product. Thus the producer must implicitly be located in a certain geographical region in order to be able to use the label. In the cases of Terra Nostra and Charte Perfect, the producers are exclusively Walloon and the quantity produced corresponds to the demand. In the case of Flandria, although the majority of producers are Flemish, producers from Wallonia or France can also benefit from the certification. The philosophy of these certifications is therefore based on creating loyalty, and on local producers' products and a reduction in the costs of transport.

Type 2: With this type, it is the production method which determines the specificity of the foodstuff. Other products which are produced using the same production method but which originate in another country can be judged equivalent. This means that products with very different origins can appear with the same label (integrated production and organic farming). This type of certification based on production method aims to be general and non-local, and implicitly accepts competition. In the Walloon Region these two certifications have both developed their strategy to ensure markets country-wide.

In terms of organic farming, the non profit-making organization Bioforum brings together actors throughout the chain: producers, consumers, small-scale and, more recently, large-scale distributors. It seeks, with the aid of public funding, to support markets for local producers and works more on principles of proximity (e.g. development of organic cafeterias). But large-scale distributors remain free to find products of organic farming abroad which are equivalent to local products. It is therefore down to each country to sell its produce through local distributors.

Walloon integrated production is developing a more active strategy based on trade with countries in the southern hemisphere, in particular New Zealand. This strategy offers various advantages:

- ensures regularity in supply for the distributor (sale of fruits out of season)
- guarantees that products are equivalent: those involved in the Fruitnet certification are themselves responsible for negotiating the criteria ensuring equivalence between the specifications
- with time ensures markets for Walloon products through trade movements with other producers.

Type 3: Within EurepGAP, all certified producers, irrespective of their origin, are equivalent; competition between certified producers rests on the same rules as in the absence of certification. But conditions are made more difficult for non-certified producers, since not only certified distributors which only accept certified producers, but also distributors which are not involved in the EurepGAP approach encourage their producers to get certification, or even set certification as a non-official condition for new producers. The intention with this kind of certification is to integrate the different national standards to create a homogenous area with harmonised products, allowing distributors to circulate products in a European, or even global, economic space.

As we can see, the creation of certifications and the elements which constitute quality will shift relations between producers, particularly in terms of competition between them. The type 1 "obligation for a result" certifications require certain know-how, as well as investments, which protect the producer from competition and ensure slightly more secure markets – on the condition, of course, that the product conforms to the commercial demands. Contrary to the globalisation movement, which promotes all products being available everywhere, we see here the appearance, through the definition of a specific product, of more local agreements between distributors and centres of production. Thus it is local rules (between producers and distributors) managed within the certification which allow the producer access to an overall market represented and managed by the distributor.

The products in the type 2 certifications mostly correspond to private certifications (such as Fruitnet or Biogarantie) and also to public specifications. They are less dependent on large-scale distributors and can sell within other, shorter, chains, or through other distributors which are less involved in certification, or

abroad. Conversely, their weakness is the fact that all products from all over the world with the same certification can enter into competition with their products. Thus all of the producers of apples using integrated production are more or less subject to the same rules, which are therefore global rules (McKenna and Campbell 2002). In exchange, the opportunities for export are significantly increased as compared to (some) previous certifications. We can therefore see a tendency among these certifications to "globalise". In this respect, the "cost of transport" parameter, which some nature-protection and consumer organizations maintain, should be taken into account in sustainable food products in order to favour local products and could transform relationships within these certifications.

6. Conclusion

Our research into certifications led us to observe that the certifications studied concerning initiatives with requirements for fruit and vegetable producers' practices each have their own response to the issue of sustainability, i.e. linking up environmental, social and economic issues. This means that the contribution made by certification to the sustainability of production systems cannot be looked at in a general manner. Subsequently, our research has enabled us to bring to light various elements which could help understand how certification works. Our reflections were guided by two analyses. First of all, it became clear that the specifications alone are not enough to assess certification. Secondly, instead of researching the added value of the certifications in terms of the product, the focus should better be on what is learned and on the changes that are in practice implemented by the farmers.

The specifications alone are not enough to understand a certification for several reasons. First of all, we are faced with a dynamic where each certification changes and converges through being exposed to the others. Although these certifications were created for separate reasons and through separate initiatives, they are harmonising under the pressures of both legislation and self-regulation, and the pressure from distributors, who also impose their own criteria and want to be in a position to judge a certification. EurepGAP thereby becomes a new standard and a condition for producer access to large-scale distribution. A second reason is that the requirements in the specifications are often very general, and that the elements used to judge compliance with the requirements must be known in order to compare them. For example, in the EurepGAP specifications, one of the requirements is that the farmer must demonstrate his/her skill in pesticide management. But how is this skill to be judged? Does the farmer have to respond to a questionnaire, or merely have proof of a level of study? The job of the certifying bodies is to put in place criteria for fulfilment of these requirements.

As we have seen, quality is not linked solely to the characteristics of the products, but also to a system of organization within the certification (Lassaut and Sylvander 1997). The various certifications studied offer very different definitions of quality, responding to different concerns. The elements which enable producers to learn in turn allow us to understand better the contribution made by these certifications in a more global view of sustainable agriculture.

Our observation of various certifications led us to draw up a table which enabled us to deepen our analysis and distinguish three types. The table shows various elements in addition to the specifications which make up the certification and which are important to consider when evaluating a certification.

These elements enable us to distinguish three types of certifications, which are also three ways of managing the pesticide issue. Pesticide management of the kind used for type 2 certifications, involving a change of practice for producers, uses nature as an ally in suppressing disease and requires ongoing learning throughout the chain. These certifications share their uncertainty with the consumer and open up the question of pesticides and their response to it.
Type 1 certifications also involve a change of practice for producers, but a large part of their management rests on the choice of pesticides, considering which products to use depending on different criteria. These certifications rest on a predictable final product of uniform size which they share with the distributor. It is the distributor who is responsible for communication with consumers, which is not centred on uncertainty but rather on assuring a level of quality and control.
Type 3 certification is based on respect for procedures on the basis of the quality approach of the enterprises. It externalises the issue of pesticides to legislation and ongoing scientific research, since it offers no new approach to this issue. The certification is currently not communicated to the consumer but rather serves as a basis for relations between producer and distributors. In contrast to the two other types

of certification, which aim to promote farming in a region or country, this certification aims to create a common basis for trade among the different European countries and importers.

Table 4.1: Features of the 3 identified certification types

	Type 1 certifications			***Type 2 certifications***		***Type 3 certifications***
	Flandria	**Terra Nostra**	**Charte Perfect**	**Biogarantie**	**Fruitnet**	**EurepGAP**
Product quality criteria (above and beyond legislation)	Compliance with 'extra' category	Criterion of washability and nitrogen levels	Conformity with industry specifications	None apart from those negotiated with distribution (taste)	Sugar content	none
Certification of final product	Yes	Yes	Yes	No	No	No
Supervision	Auction houses	Walloon Potato Federation (FIWAP)	Hesbaye Market Gardening Centre	Supervision after certification to be sought by the farmer (book, private advisers)	GAWI	Within other certifications or more specifically CIM
Timing of supervision	Before certification then during	Before certification then during	Before certification then during	Following request for certification	Following request for certification	Before certification
Instruments of supervision and particularly presence of crop sheets	Crop sheet Human supervision Reduced list of authorised pesticides	Crop sheet Human supervision Reduced list of authorised pesticides	Crop sheet Human supervision Reduced list of authorised pesticides	Private human supervisor + documentation and test by farmer	Human supervision Reduced list of authorised pesticides	Human supervision
Link to nature and particularly its place in combating disease	Nature excluded from production	Nature excluded from production	Nature excluded from production	Nature used	Nature used	Nature excluded from production
Supervision of certification by public authorities	Private	Private	Private	European specifications transcribed in each country + private certification	Regional specifications + private certification	Private, supervision financed regionally
Opportunities for farmer interaction in modifications to the specifications	Meeting as part of certification/presence of mediatory supervision	Meeting as part of certification/presence of mediatory supervision	Meeting as part of certification/presence of mediatory supervision	Meeting as part of certification	Meeting as part of certification/presence of mediatory supervision	none
Records required in addition to self-regulation	Justification for decision to use pesticides	Justification for decision to use pesticides	Justification for decision to use pesticides	None	Justification for decision to use pesticides Record of measures which are beneficial to nature	none
Elements seen by consumers regarding the approach and philosophy of certification				Irregular product, personal contact in smaller shops and farm visits, exhibitions	Logo with ladybird, orchard visits	none
Link with consumer	Subsequently			From the beginning	From the beginning	none
Origin of equivalent products	Only through certification	Only through certification	Only through certification	Worldwide	Worldwide	Only through certification (but European certification)
Role of distributor	Definition of product	Definition of product	Definition of product	Ensuring market	Ensuring market	Definition of procedures

Chapter 5 A consumer test of a framework assessing certification systems for fruit and vegetables: pesticide use and sustainability

Louviaux Mélanie and Marc Mormont

SEED - FUL

Introduction

The second contribution of the SEED –FUL group to this research is more specific, as it involved examining the sustainability of the labels and their approach to pesticides, from the point of view of consumers. Our work consisted in devising and implementing a participative framework, which could also be the subject of evaluation[7].

From the consumers' point of view, labels raise the more precise issue of the pertinence of indications of quality in terms of the aim of reducing pesticide-related risks, given that most quality labels do not focus solely on pesticides or make them a priority. We must therefore ascertain how this issue is addressed. There are also many different labels, a fact which, according to many critics, causes confusion in consumers' minds. Their reputations are not fixed, but change over time. Rather than giving a snapshot analysis of consumers' perceptions of labels (e.g. through a survey), we have chosen to use the more qualitative method of setting up "deliberative" focus groups[8], which have the advantage of enabling us to understand how ordinary people perceive the issue of pesticides and how they develop a "considered" opinion on pesticides. We believe this is the most appropriate method for stimulating reflection on public policy because, to a certain extent, it enables us to think about what would happen if one or another path of action were taken. The basis for this choice is that consumer habits and choices depend on policies, how they can be understood and what their purpose is. But these policies are also based on decision-makers' perceptions of consumers. Our approach therefore aims to help the sectors involved and to encourage public policy makers to assess themselves and their actions.

1. The objective, participative framework, analysis chosen and type of participants

The participative framework used must be defined as a function of the research objectives because of its implications for the results (Duchesne and Haegel, 2004). **The objective** was to lead consumers to arrive at an evaluation of the various labels/certification systems selected for the study[9], from the point of view of their approach to pesticide use. To achieve this objective, a particular participative framework was devised consisting of several successive focus groups involving the same participants; we should therefore begin by considering the specificities.

The term "focus group" in fact covers a very broad range of uses[10]. In the beginning, focus groups were used in particular in marketing in the USA to grasp the deeper motivations used – not always consciously – by consumers when making purchases, by measuring their reactions to products (Duchesne and Haegel, 2004). The use and objective usually attached to the focus group method is knowledge of what is being measured and how. In the present case, this could therefore have meant measuring the participants' preferences and motivations, through their reactions to different labels. *The first adaptation* which must therefore be highlighted concerns *the particular use and objective attached to the focus groups in this research*, i.e. the development of a collective evaluation of these labels. The hypothesis was that it is

[7] A full and detailed report of this analysis can be found in Annex 5.1.

[8] We will explain later on that by deliberative focus groups we mean research that focuses on discussion between actors and not on perceptions.

[9] These were the "labels" Biogarantie, FruitNet, Flandria, Terra Nostra and EurepGAP, which are also studied from other angles in the other chapters of this report.

[10] Cf. Annex 5.1, full report, point II.2 "What is a focus group? Focus groups in the plural".

pertinent to attempt to create other ways of assessing an issue, looking at how consumers in certain conditions (where interaction is central) handle it when they are given the opportunity to do so and express things their own way. In this sense, this framework aimed to be more participative[11] than consultative (Rowe and Frewer, 2005), giving the participants the opportunity to decide themselves on the way they see the issue and to highlight other elements than those anticipated by the researchers. This method seemed well-suited to environmental issues and sustainable development, which raise this issue and the pertinence of these new connections, just as the participation of "non-researchers" raises the pertinence of considering new or different elements.

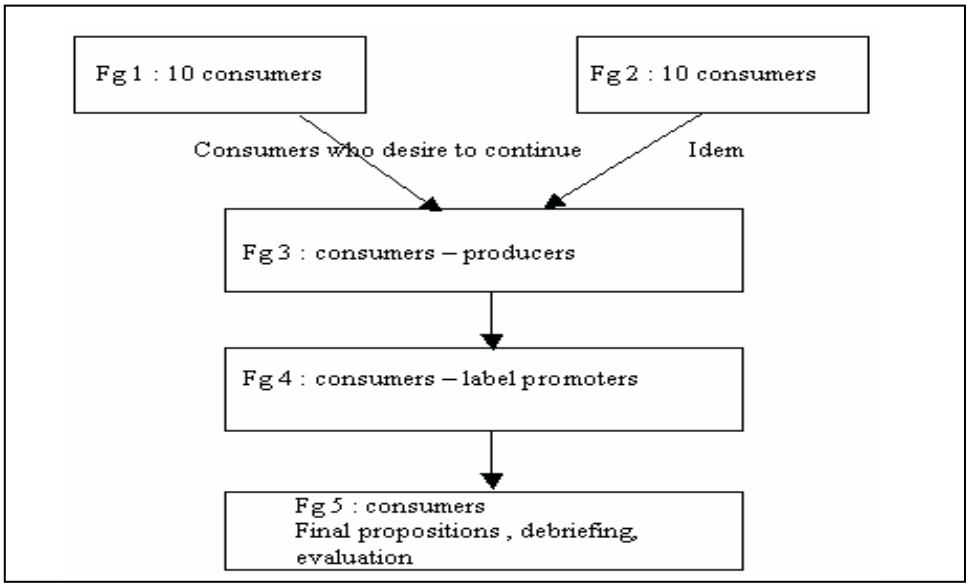

Figure 5.1: Consumer focus group trajectory

As is usually the case, the first two focus groups (FG 1, 2) were conducted with different types of consumers, and they were subsequently invited to continue the process such that (and this is the *second adaptation*) the *same consumers* participated in the three subsequent focus groups (FG 3, 4, 5). This enabled them to accumulate different information, gradually face their opinions, and thereby enhance their evaluation and build up the skills to do so.

Finally, *the last characteristic* concerns *the direct meeting between these consumers and certified producers in focus group 3 and label promoters in focus group 4*. The latter played a role akin to that of the experts or support people used in consensus conferences, in the sense that they provided information and responded to participants' questions. However, contrary to experts or support people who are invited to "objectivise" certain facts, uncertainties and scientific knowledge on a subject, the producers and promoters were in this case invited more to "testify" to their own practices, experiences, constraints and strategies with regard to the labels and to consumers. *This direct dialogue between consumers and others involved in the agri-food sector* was of interest because consumers are rarely present in the various demand qualification processes, although they are often represented by various bodies (Dubuisson-Quellier, 2003).

The theory behind this concept of dialogue can be elaborated as follows: the knowledge which consumers acquire from the various sources of information are a first type of learning; a simple kind of learning consisting in acquiring information which enables them to understand things with which they were previously unfamiliar or less familiar. But the debate between consumers and the invited producers,

[11] This process is similar to that of consensus conferences, but less formal and official. We would recall at this point that a consensus conference is a more formal process, composed of a panel of ordinary people and experts, the objective of which is to provide a decision-making authority with nuanced information on controversial issues, taking account of the opinions and questions raised by the citizens. It is a rather innovative perspective which aims to modify the relationship between administrations, public authorities, experts and ordinary people

and subsequently promoters, also permits a second type of learning with two elements: firstly understanding of their own position and their own behaviour, and secondly (the reflexive aspect) the development of individual and collective solutions. In that sense, the experiment of these focus groups could be defined in terms of "what can we learn from watching consumers learn?"

The type of analysis carried out must then consequently be defined. It was decided that it should be thematic, argumentative and cut across the five focus groups. The chosen subject for analysis was the ensemble of themes brought up by the participants and discussed surrounding labels and pesticides, and their questions and suggestions. The focus groups were conducted around evaluation and proposals for improvements in a non-directive manner, in particular to leave the participants free to come up with their own categories for evaluation and also to assign responsibility for carrying out the proposed changes. Furthermore, the framework did not aim to achieve a consensus among the participants, but rather a range of reasoned points of view which might differ from each other. This meant that there was a need to consider the interactive dimension, both among the participants and between them and the certified producers and subsequently the label promoters. In fact, the exchanges of view led the participants to broaden their considerations and question their own practices and arguments, demonstrating significant and useful reflexive capacities from the point of view of the quality of the discussions and the suggestions which arose from them.

The types of results presented in what follows are therefore twofold. The first type of results concern content-based elements related to the labels and the pesticides, i.e. the participants' concerns on these issues and the suggestions for improvement which they proposed – these are highlighted and are, of course, their opinions and not those of the researchers. These form the structure of the report, which is therefore based around three main themes or concerns on the part of consumers: 1) controls of pesticides and of compliance with the specifications; 2) information; 3) the price and quality of products carrying the labels. The second type of results concern the interactive dynamic within the framework and what it can produce among the consumers in terms of collective reflexivity and evaluative and suggestive capacity. This will be dealt with for each of the themes. Logically, the conclusion will also contain two elements: 1) identifying the sustainability criteria underlying the reflections and suggestions from participants and 2) questioning the capacity of this kind of participative framework to question the other existing frameworks which are often used by those involved in the agro-food chain (distributors, consumer associations, the state, etc.) to define consumers' expectations and thus various public and commercial policies.

One final clarification is needed regarding the nature of the results in question. They are qualitative results which, as such, do not pretend to provide a representative view of consumers. Nevertheless, the quality obtained should not be understood to be skewed by too selective recruitment. **The recruitment** of the volunteer consumers was carried out by the researchers with the aim of obtaining a range of different profiles: gender, age, income, profession, some who buy products carrying the labels and others who do not[12]. On the other hand, and in accordance with our objectives, seeking this diversity did not aim to *explain* the different individual positions at hand from the profile of the person voicing them, but rather to *start with differing concerns and perceptions* on the issue of the pertinence and sustainability of the labels and the approach to pesticides. Predictably, **the consumers who agreed to participate** were not those people who would classify themselves as "not at all" interested in the subject. But contrary to what one might expect, neither were they people who consider themselves "very interested" in the issue or campaigners. It would be more accurate to describe the participants as people who have some interest but little knowledge and no fixed opinion on the subject, timidly agreeing to be involved in the experiment. In that sense, this type of discussion would seem to be capable of involving participants who are more or less the ordinary consumer[13], or at least capable of giving an account of and considering ordinary consumers (we will come back to this). We should also specify that there is no *single* ordinary consumer; it is the *diversity* of the consumers present which allows reflexivity.

[12] Cf. Annex 5.1, full report, point II.3 "Recruitment of participants and group composition method" and point II.4 "Overall tendencies among consumers and some approaches from their recruitment".

[13] By "ordinary" consumers, we mean average consumers, or consumers who are not necessarily well-informed on the subject.

2. Controls of pesticides and labelled producers' compliance with specifications

2.1 NEITHER TRUST NOR DISTRUST, BUT RATHER A LACK OF KNOWLEDGE[14]

One of the initial concerns of the research was to grasp how consumers view one of the important elements in the certification procedures: controls on compliance with specifications carried out by an independent authorised body. The labels are based on strict controls of compliance with their specifications by independent certification bodies, which are supposed to ensure consumer confidence. For a label to make sense in the eyes of consumers, they must be able to grasp its significance and thereby relate it to its constituent characteristics, such as the controls of the specifications. But this connection, which is necessary to the label's success, is not made spontaneously by consumers[15]. This was revealed in the first focus groups, in which the majority of participants discovered this characteristic of the labels for the first time. The questions which they subsequently asked revealed their lack of knowledge concerning this aspect and their desire to understand and to know more about the way in which the labels work, thereby progressively learning to distinguish between the controls of pesticide residues which are obligatory for all products and the controls on compliance with specifications, which are exclusive to certified producers.

Their lack of interest in controls in general before participating in the focus groups demonstrates that there was no great degree of distrust of the products they habitually consume. However, they did not have blind trust either, as demonstrated by their many questions and their desire to learn more about how the controls work and the institutions which are responsible for them. For the participants, the issue behind the controls of products and labels seems therefore less an issue of distrust/confidence and more an issue of lack of knowledge, in particular of one of the main principles of labels. Once it is identified as such, we can see that not only does this lack of knowledge severely impede the functioning of the labels, but the repertoire habitually used to communicate with the consumer, which aims to reassure by offering controls and guarantees, appears to need reappraising[16]. In effect, it seems that from the point of view of the consumers participating, in order for these labels to be sustainable it is not enough for them to become more trustworthy: sustainability is about more than just confidence-issues.

2.2 IMPROVEMENTS TO THE SPECIFICATIONS? LACK OF KNOWLEDGE AND BROADENING OF THE ISSUE THROUGH THE "PIE" PROPOSAL

The lack of knowledge demonstrated by the consumers regarding the principle of an independent body verifying compliance with specifications indicates that their priorities do not include improving the specifications, at least not in the sense we could expect such improvements, notably in terms of pesticide treatment, of the kind "we think that this or that label's pesticide approach is appropriate, using criteria - scientific, environmental, economic, social, long term, etc.- which the others do not consider in their specifications but perhaps should". We will demonstrate the way in which the consumers shift and go beyond their views in this regard.

The starting point for the consumers was the fact that they are not very familiar with the labels and are not able to distinguish between them. Nonetheless, they do not wish for the labels to disappear, as they consider them to be useful for differentiating products of a superior quality compared to others. What they would like to see, however, is clarification and improved visibility of the labels. On this basis, they came up with a dual proposal: regroup the existing labels[17], presenting them in the form of a single label, which would be a strong visual signal, along the lines of the "value" products which are found in certain

[14] Cf. Annex 5.1, full report, point IV.1. "Neither distrust nor trust, but rather a lack of knowledge."
[15] Cf. Annex 5.1, full report, point IV.5. "Labels and independent controls of compliance with specifications: connections necessary but not guaranteed."
[16] Cf. Annex 5.1, full report, point IV.3 "Concrete implications: questioning the repertoire and giving information in interpersonal situations".
[17] We should indicate that in parallel to the issue of existing labels, they also made proposals concerning future labels, suggesting that the launch of new labels onto the market should be strictly regulated by the State to avoid having too many of them. Cf. Annex, full report, point V.3. "Yes but... who should be responsible for the information and in what form?".

supermarkets[18]. But in fact, they went even further, coming up with the idea of this single label in the form of a "pie", i.e. divided into several parts, allowing several statements to be made to the consumer simultaneously. The following is a more detailed description of this proposal to enable us to grasp exactly how it goes beyond strictly improving the specifications and how it broadens the question:

- The proposal for a "pie label" reveals that, ahead of issues of confidence and controls, the participants deem it essential to work on communicating information to the consumer using a clearer message. There is therefore a need to reduce labels in terms of the *multiplicity* which currently exists, but this would not imply the consolidation of all of them into a complete *single* label, as it would have three parts. This desire for a label which is both *simple* and *complex* is not a contradiction for most of the consumers, but rather seems to be one of their specificities, i.e. a desire to organise several heterogeneous or even contradictory elements or make them co-exist.

- The first 'slice' of the pie, "environmental approach in the strictest sense": the requirements as indicated in the Fruitnet and Bio specifications are maintained as they stand, whereas for the other current labels, it is suggested that their approaches be brought together under a single term, such as rational agriculture (understood to be a type of production which uses pesticides rationally, as required under current legislation, but without the employing the additional efforts required in integrated production and organic production).

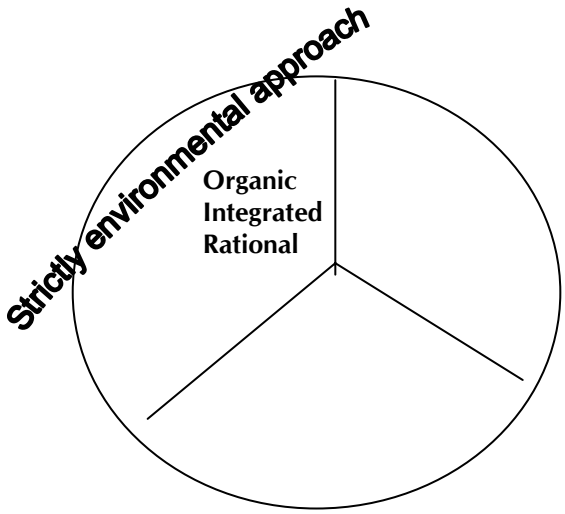

Figure 5.1: First slice of the pie: communication regarding environmental approach

This demonstrates the importance for consumers of labels which reflect commitments on the part of producers, not just controls of the products and guarantees in this respect. Consequently, we can identify the need for a new type of repertoire to be used to address the consumer. If the current repertoire could be described as a label guaranteeing a product produced in compliance with specifications which are controlled and translated into standards, the new repertoire imagined here is one of a label as a kind of *promise* of a product where the producers can *testify* (even indirectly) to the quality, notably through their *commitments*.

- The two other 'slices of the pie' expand on two aspects of the environmental dimension as it is habitually considered in the specifications. Firstly, *the size and type of farm* (non-industrial or industrial production) relates back to suspicion of large-scale intensive farming systems. And secondly, *the origin of the product*, which is also added by the participants, stresses the environmental impact of the exports and imports required in the current agro-food system. The participants are aware that their behaviour consolidates the system and its significance, and hereby attempts to give ordinary consumers (i.e. themselves) greater power of action. The addition of "origin of product" is also linked in their view to the simplicity which needs to be (re)adopted in the food system (production and consumption) in order for it to be more sustainable. By 'simplicity' they ultimately mean the capacity to cope with what is around us,

[18] This association was not made explicitly, but other examples can also be found, e.g. the designation "contrôle et origine" developed by one of the major Belgian distribution brands.

such that in time autonomy becomes possible. This proposal therefore stems from a reflexive analysis of their own consumption practices, which they see as often lacking this 'simplicity'.

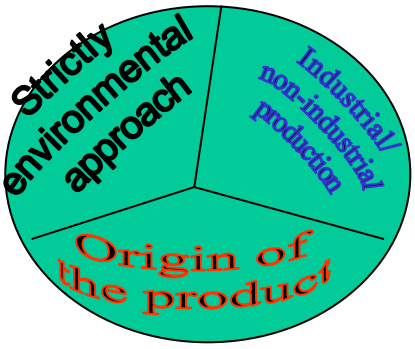

Figure 5.3: The three slices of the consumers' pie proposal

This original way of dealing with improving the specifications should be seen for what it is: we should not conclude that the consumers are not concerned about the specifications (and therefore the environment), but rather see how they redefine the scope of and broaden the environmental question in their own way, in particular stressing the link with consumer information, because of their lack of knowledge. Since the consumers came up with this proposal at the end of the process, we might imagine that it is the logical product of the fact that they are better informed than they were. However, as the next point partially examines, it is in fact much more than that; it is a specific feature of the approach used, in which they have been led (through their interactions) to adopt systematically when producing their proposals: the inclusion of ordinary consumers.

2.3 THE BASIS OF THE "PIE" PROPOSAL: REALISM AND ABILITY TO INCLUDE THE ORDINARY CONSUMER, REFLEXIVITY AND TEMPORALITY

The "pie" proposal tackles several aspects to do with the information which the labels should give to consumers. Thus the group opts for a *clear and simplified visual message* (a single label, but in three parts). However, given that this proposal came about at the end of the process, we might expect that they would present this information in the form of an *exhaustive list of elements* concerning the pesticides applied to the product (which pesticides, in which doses, when, etc.). The way in which analysis of the framework as an interactive process is particularly instructive is that it tells us that this kind of proposal (an exhaustive list) did indeed emerge, but that the participants' interaction led them to go beyond it. Certain members of the group put themselves in the shoes of ordinary consumers and led the other participants to admit that a list of this kind would be too complicated and therefore would not be read. In this sense we can talk of the "realism" of the participants or, in other words, their capacity to include ordinary consumers.

> *C. One could imagine packaging where there are indications of the kinds of pesticides used and their content…*
>
> *M. But I'm wondering whether it is really the reading that matters… I mean, I don't know, but maybe we need something which has more impact, something much more visual, along the lines "**we**, **the such-and-such producers, pay attention to this!**"*
>
> *J. Yes, because the fact of using whichever pesticide has been used, I reckon that a lot of people, myself included, if you put the name on the packaging, well, fine, but… We would never be able to tell if it's good or bad. And we don't know what concentration should be used either...*

In this respect, we see that the consumers participating did not become experts on consumer issues or labels, but have acquired and offer expertise on how to communicate with them as ordinary consumers**.** This has indeed resulted from the collective dynamic which encouraged their critical, reflexive and suggestive capacities, following the exercise of counter-argument which takes place among the participants, and leads them to broaden their considerations.

Although these interactions are an important ingredient in this 'realism' or inclusion of the ordinary consumer, the temporal dimension of the collective framework also plays a significant role in this respect. It seems to enable the participants to be reflexive with regard to the learning which they themselves gain from their participation in the focus groups, and they are aware that this has changed them as compared to ordinary consumers or citizens. They therefore understand that the information available should be developed for the ordinary consumers, as they were prior to their participation in the focus groups.

2.4 REALISING THE PIE LABEL: DIFFICULTIES, LIMITS OF THE METHOD, STIMULATING REFLEXIVITY AND CONSUMERS' PARTICIPATION

An observation is required concerning the difficulty which would arise in realising the "pie" proposal, i.e. the difficulty of defining the criteria: at what point does production cease to be non-industrial and become industrial? On what basis can labels other than the Bio and Fruitnet labels be reduced to rational agriculture? How can efforts to do more than is required by current legislation be evaluated, etc?

In order to solve this difficulty of defining the criteria and of adopting such a "pie label", two elements have to be specified. Firstly, the principle of the "pie label" arose as an answer to the problem of the visibility of the numerous existing labels. Consumers participating, in the name of the Belgian consumers, suggested a visual label, providing consumers simultaneously with different information but not too much. Secondly, the chosen criteria reflect the preferences of the consumers participating, and these are not representative for the Belgian consumers. Therefore we suggest organizing other focus groups to put these criteria in discussion with other consumers. It would be interesting because this "pie result" does not take into account, for instance, the health aspects while other surveys show their importance for consumers. This can be explained by the specific thematic of our research: the pesticides' reduction strategies. Consequently, the consumers participating suggested environmental concerns, although they broadened it.
The repetition of this kind of process with other consumers' groups should focus the topic put in discussion. We suggest broadening it to encompass the labels on the food products in general (in order not to focus only on the pesticides on fruit and vegetables but to talk about sustainable consumption which includes the health, the taste and other concerns). We also suggest that the latter participative process takes into account the two main specificities of our focus group cycle: working with the same consumers across the five focus groups and arranging meetings between them and other actors of the food chain. Indeed, this process was not conducted to end up with a snapshot analysis of consumers' perceptions of labels, instead we aimed at making consumers evaluate the various labels selected for the study and stimulating them to formulate improvement proposals.

The fact that such questions about the criteria arise (and we can imagine numerous additional debates alongside them) makes the "pie" proposal interesting at another level. It invites us, in contrast to the existing labels which are designed to be lasting, to always be obliged to think, redefine, question; to have to question different dimensions simultaneously, and to clarify without standardising in a reductive manner, and thus to have to imagine sustainable solutions in Stengers' sense. In her view (Stengers, 1999), sustainable development is a question of reassessment and reflexivity because "*although learning to think [particularly of the future consequences of our present form of development] is not new and should in fact be obvious, learning to think is indeed learning to resist all that makes us forget that it should be obvious!*". The participation of consumers in this kind of framework testifies to the importance which they accord to continuing to reflect, to evaluate, to reassess, etc once a mode of action has been adopted.

This leads us to underline one of the limits of this participative method, namely the fact that it requires more and more participative approaches and dialogues. Indeed, defining the pie's criteria requires organising new discussions between consumers and the other actors: researchers, producers, label promoters, physicians, agronomists, distributors, state actors, etc. It also requires that the current institutions take into account the numerous aspects that are important for consumers in matters of their consumption. The results show that the labels stay situated in a consumption approach that fails to reflect the complexity of their behaviours of consumption (that are about different concerns and actions: purchases, food preparation, upbringing, health, environment, equity, diversity, etc.).

3. Lack of knowledge of controls and beyond: various lessons and approaches to consumer information

3.1 THE LACK OF KNOWLEDGE DISCUSSED AND HIGHLIGHTING HOW THE FOOD SYSTEM WORKS AND ITS DELOCALISATIONS

Our decision to analyse in terms of lack of knowledge was progressively reinforced as the participants cited labels and pesticides as not only an object of concern linked to controls, but an object of a general lack of knowledge, questioning many aspects along the lines of "but what actually happens?". These aspects included information for consumers, the power of the supermarkets, the type of quality, and the gap between their actual expectations and what is said to be their expectations. An interesting point is that where there is a lack of knowledge, there is room for learning (Sylvander and François, 2005). In the case of these participants, this was learning on two levels; firstly their actual questions were answered, and secondly, on this basis, they realised that the majority of people currently do not have access to this information.

Their questions reveal a general phenomenon which is a product of modern times; the delocalisation of social systems, i.e. "*the extraction of social relations from local contexts of interaction, and their subsequent reorganization in undefined space-time fields*" (Giddens, 1994). In the more specific context of the production and consumption relationships involved here, a whole series of delegations and delocalisations is present throughout the chain, and consumers are no longer aware of how these all function to bring fruit and vegetables to their plates. Highlighting these questions is essential, because they do not come about frequently and even more so because they are contrary to the principle of delocalisation which, by definition, presupposes an autonomous and unquestioned function[19]. This relates back to reflexivity, which encourages thinking (as mentioned above) and, we could add, questioning, which encourages further learning.

3.2 INTERPERSONAL SITUATION AS EQUIPMENT FOR COGNITIVE AND PRACTICAL CHANGES

These questions and learning lead the participants to reconfigure their social relations and their relations to knowledge and objects in nature. For example, following the focus groups, the participants do not look in the same way at fruit with or without a label, or which is or is not bought in a supermarket, because they are now aware that a standard "fruit" (e.g. without a label and bought in a supermarket) does not give access to any information about the history of its production, its producer and his commitments, the quality of the fruit, its variety, etc. But these delocalised elements to which we do not have access are precisely the kinds of things which the producers were able to present during their participation in the focus groups and which were of considerable interest to the consumers. These elements really enable them to consider the product in a different way (cognitive change) and, they admitted, give them a desire to buy some products rather than others (change of practice).

> During the final evaluation in the experiment with the participants: *F: I found it very interesting to have the opinion of the farmers and representatives of the labels, I learned a lot from that […], and it's true that it's also changed the way I buy; I look to see if there are labels, you look more closely at the packaging to see where the product comes from, and if there is no information it bothers me now, and I also try to buy seasonal fruits…*

In more general terms, these cognitive and practical changes of the participants lead us to question the conditions in which they emerged (Mougenot and Haynes, 2005). They seem to depend partly on the register in which the information exchanged is couched, i.e. personal experience - the experience of producers (their personal history, commitments, constraints and how these have been experienced; the approach is therefore no longer just about risk, controls and guarantees which are supposed to be objective, etc.), and that of the participants (reassessment of their own responsibility, modes of consumption, etc). They also relate back to the nature of their exchange, i.e. an exchange in an interpersonal situation, between consumers, but also between producers and consumers. This leads to a different way of questioning the producer-consumer link when it comes to labels, because these attempt to give consumers guarantees and information on the type of production. However, this producer-consumer relationship is often analysed only from the point of view of relationships of obligation or

[19] Cf. Annex 5.1, full report, point IV.2 "Questioning of delegation or the delocalisation of production systems and their controls".

confidence, and remains within the commercial framework, as it concerns the consumers' purchases. The framework has therefore permitted a different kind of perspective, demonstrating the possibility which it offers to participants, outside of the commercial framework, to equip themselves collectively with the ability to judge the sector as a system. This is a skill which enables them to establish a discussion and a relationship with particular producers (and thus with the history of their products and the production context) which can be informative on both a cognitive and a practical level.

3.3 REPERCUSSIONS FOR THE APPROACHES TO PROPOSALS FOR INFORMATION

The participants, who are conscious of the shifts in their views following their participation in the focus groups, have thereby spontaneously transferred certain characteristics tested in the focus groups into the proposals they produced concerning the information to be given to ordinary consumers. Through their proposals, they testify that the labels' basic premise of using a logo to make the link between the product and its history is ambitious and important, but not enough, and that there is a need to provide information or equip consumers differently. This is what is indicated by the analysis of the proposals they produced concerning the type of information to be given and above all the manner in which it should be given in order to interest ordinary consumers in the producers' projects.
Chronologically, they first start with the idea of multiplying the number of such focus groups, in view of the quality of the reflections achieved and their ability to bring about change:

> *Y: it's true that the vast majority of people basically get into the dominant consumption system, which does not make quality the priority. It's true that it's a generalisation, probably for the most part, but I still think that there is a slow, gradual movement in reaction to that. The proof is here tonight, but it will take time…*

Nonetheless, as the extract also shows, the participants remind each other that these formulae can only affect a limited number of people.
We can therefore draw an analogy with their comments concerning direct sales. Direct sales offer the advantage of a personal relationship between producers and consumers. But they also offer other important elements in the eyes of the participants, such as, in particular, the fact of "dispensing with" the intermediary of the supermarkets, thereby reducing price of products and encouraging production and sales on a more human scale. However, they think that it is unrealistic to want to dispense with supermarkets, insofar as they tally with current lifestyles, making them indispensable or inevitable for some of the participants and the majority of ordinary consumers.
There is, therefore, a dilemma between their desire to dispense with the supermarkets by promoting direct sales systems and the direct relationship to the product and the producers which they allow, and also to put pressure on the supermarkets and the information they convey. Given the limited and unrealistic nature of the first proposal, the originality of their reasoning rests in the inclusive logic of the "*both/and*" type (as opposed to "*either/or*") which they use, thanks to their interactions, to solve this dilemma, combining *both* proposals rather than opting for one *or* the other:

> *M: So, in my opinion the work should be done (…) on the supermarkets themselves rather than telling people to take the step of when it's apple season going out to find them directly from the producer or that kind of thing*
>
> *B: I think these are approaches that can be used in parallel*

They therefore suggest that supermarkets should be avoided where possible, but also that supermarkets can be used by putting pressure on them to provide certain types of information and foods. We have summarised these in the two categories "putting pressure on the supermarkets" and "outside of the supermarkets (suppression)" into which their proposals fit.

One such proposal should be highlighted because of its specificity of using the location of the supermarket, but transposing the characteristics of information given in an interpersonal situation: we are talking here about tasting sessions of labelled products held by producers in supermarkets. The aim is that the producers make the labelled products and their characteristics known to consumers, but in the location of the supermarket. This is therefore information which is given in an interpersonal situation, but in a location which, in contrast to direct sales, is frequented by a large number of people. This proposal claims to be realistic because it does not require any binding efforts on the part of consumers. The participants are aware that this initiative would entail a cost, and that all information campaigns cost money, and that there is a need to find a way to ensure that this cost is not born by the producers. This

would mean bringing this type of initiative into an "information and education programme on quality foods" imposed on supermarkets. This may not seem very realistic at first glance, but it nonetheless indicates one of the consumers' priorities. For this reason this initiative can be ranked among the participants' proposals which aim to "put pressure" on the supermarkets in order that they should encourage (particularly financially) this kind of information initiative through tastings and meetings with producers. This category of "putting pressure on the supermarkets" also reveals that the participants do not too rapidly and/or exclusively take refuge in *new* things, but rather that they also attempt to improve (or put pressure on) that which already exists. In order to do this, they are also led to fall back on an additional actor: the state.

Table 5.1: Supermarkets and certification systems

"Working with" the supermarkets and putting pressure on them	Working in parallel, outside the supermarkets: the State has a role to play
-Tastings held in supermarkets by the producers -Indication of the variety names, in order to train the consumer and avoid limiting varieties or creating a uniformity of taste -Encouragement of television screens in the aisles to inform and explain -Strict regulation of the information provided -Training for heads of supermarket departments -Ban on consumers touching the fruit and vegetables	-Promotion of small alternative schemes to large-scale distribution: supporting other sectors of production and marketing, e.g. supporting communities in quality approaches -Reinforcing large-scale awareness-raising campaigns, particularly on the link between food and public health

3.4 THE BASIS OF INFORMATION APPROACHES: INCLUSIVE "BOTH/AND" LOGIC AND NEW ASSOCIATIONS

This table, which groups together the proposals of the kind "suppression of the supermarkets" and "putting pressure on the supermarkets", has the benefit, like the "pie" proposal, of reflecting ideas which have emerged from an ordinary logic (i.e. a logic specific to ordinary consumers), that is, the inclusive logic of "*both/and*". The root of this is compromises (or combinations) just like those made by consumers on a daily basis (Fiorino, 1990), in contrast to experts, who often seem to be trapped in an exclusive approach linked to their own discipline and their validity approaches. Consumers' combinations and compromises must now more generally be seen for what they are: not just a defence of particular interests or the creation of solutions which are neither radical nor direct to achieve the set objective. In fact, understanding what is happening at the moment of these compromises, as well as what prompts or encourages them (here the interactive dynamic) is essential, because the combinations proposed offer an area with open points which can be discussed, redefined, contemplated, corrected, etc. In short, in looking at them, awareness is gained of our own actions and those of others, and our own and others' way of seeing things and describing a problem. The compromise should therefore be seen as the expression of a "collective interest", in the sense of an interest which "collects or is the sum of several different interests". This is a type of reasoning which is similar to the philosophy of sustainable development, which aims to integrate social, environmental and economic dimensions, implying compromises at the point where several fields, issues, interests and actors meet. As will be demonstrated at the end, the criterion of sustainability is added to these compromises, in as far as these are not completely closed and that reversibility (a capacity for modification) remains possible.

4. Price and quality: (re)distribution of roles and responsibilities

4.1 QUALITY AND PRICE OF LABELLED PRODUCTS: DIVERGENCES OF OPINION AND COLLECTIVE DECONSTRUCTION

As the proposals summarised in the preceding table and those still to come in this report illustrate, the consumers questioned every link in the chain, from the producers to the pesticide manufacturers, via processors, distributors, ordinary consumers, campaigners, researchers, label promoters and politicians at both national and international level. The discussions surrounding the quality and price of labelled products are a perfect example of the finesse of the designated actors (including themselves), the tasks

proposed and the nuances added. This finesse cannot be understood outside of the conditions in which it emerged, i.e. for the main part the large role played by the interaction between participants and producers, and subsequently promoters.

One first result which should be highlighted is that being confronted with the producers and label promoters progressively led the consumers to question the definition of quality, making it seem like a construct – and therefore something which can be debated and can change – and not something which is a given, or set in stone.

> *A-M: But what do you (producers or label promoters) actually mean by quality? Is it the appearance of the fruit? The taste of the fruit? The size? I'm completely lost!*

It appears that the collective job of deconstructing the definition of quality put the consumers more at ease to express their regrets and expectations. For example, they indicated their regret that the "commercial presentation" quality is currently favoured and justified in the name of consumers' expectations, whereas they actually deem the "nutritional" quality more important. This subject did not fail to elicit a reaction from the producers or the promoters; they reacted strongly, arguing that this type of quality is not *their* wish, but rather *that of consumers* who have a preference for whatever is cheapest and buy only with their eyes. These divergences of opinion between consumers and producers and subsequently promoters produce a new result which is instructive in terms of the dual question elicited in the consumers. On one hand, they become aware that, in fact, this is often the way in which they (and/or other consumers) act, and this leads them to be reflexive, reassessing their own practices and consequently accepting part of the responsibility[20].

On the other hand, however, they also insist that they feel "manipulated" or led to act in this way, listing the general changes, balance of power, constraints and various societal phenomena which have contributed to the advent and significance of the consumption society in which they take part[21]. Following the deconstruction of the definition of quality, it is demand and supply which they highlight, attesting that their judgement and competence as consumers are not set in stone, but rather are under permanent construction in the relationship they have to the products and the information around them, and that their specificities differ depending on whether they are in the supermarket or in other sales structures and marketing types[22].

The consumers' proposals which follow from this are thus of two types: either in connection with creating responsibility among consumers (in terms of demand), or with creating responsibility among producers, researchers and retailers (in terms of supply and production). More specifically, the former are connected to consumer education: *mass awareness-raising campaigns* but also all *forms of information available in interpersonal situations* (in particular with producers, who can give consumer judgement a different view) as well as *banning consumers from touching the fruit and vegetables* (to prevent waste associated with damage caused to fruit and vegetables 'on the shelf'). The latter is also connected to education, of (supermarket) departmental heads, with a similar aim to avoid damaging and consequently rejecting fruit and vegetables on the shelf. But the consumers also pointed out the importance of encouraging research and subsequently the production (in particular through training of future farmers) and sale of alternative varieties[23]. By alternative varieties, they mean varieties of fruit and vegetables which are more resistant and therefore require less treatment with pesticides, and also older varieties, with different tastes, in a bid to combat tastes becoming uniform and the standardisation of the appearance of fruits, as they perceived it:

[20] Cf. Annex 5.1, full report, point VI.4. "Power of the supermarkets and construction of quality: divergences of opinion".
[21] Cf. Annex 5.1, full report, point VI.6. "Power because of significance, ambivalence and irreversibility: an original way of looking at the issue of sustainability".
[22] For a clearer and more detailed view of the construction mechanisms of product and consumer qualification, cf. Dubuisson-Quellier S. Juger pour échanger, "Chapter 2: Product taste and consumer taste. The plurality of qualification tests in the marketing of foodstuffs".
[23] Cf. Annex 5.1, full report, point VI.2. "Proposals and budgets".

> *F FG2: If they sold slightly more normal products [not all of the same size and type], people would be obliged to buy them, and we'd also be able to combat the all too common idea that a pretty fruit is a good fruit…*

The discussions on the price of labelled products, which the consumers did not separate from those on quality, illustrate several interesting elements[24]. One of them is outlined here in particular and was easily recognized by all, namely the participants' sense of injustice regarding the current imbalances in the balance of power. Thus the "supermarket" intermediary was highlighted as a strong link in terms of the balance of power (information, definition of quality, prices, etc.), but as a weak link in terms of specifications and quality constraints, in as far as they have off-loaded many of these constraints onto the producers, the consumers say. Nevertheless (and this is the important point) the consumers do not make the intermediaries into a scapegoat responsible for all the problems, nor do they paint the producers as defenceless victims. On the contrary, their sense of injustice seems to go even further. What they find most unjust is a situation where all proposals – and therefore all current and future responsibilities – rest on a single actor. They hereby confirm that they have a vision whereby no one actor is responsible, but rather there is a chain of responsibilities.

4.2 CAUGHT BETWEEN STANDARDISATION AND DIFFERENTIATION, EQUITY AND DIVERSITY?

This sense of injustice and inequality born out of the discussions concerning price and quality was then extended to norms. The consumers were asked, normatively, whether quality foods should be imposed on everyone. This would imply imposing other types of production (integrated or organic) on all producers, with the condition that they would also be financed differently, so that the price would be acceptable to consumers and producers. When this question was asked in the group, they were obliged to consider the consequences of their proposal. Thus, in wanting to see quality food available to everyone so that nobody would be excluded (including the least affluent and those who pay less attention to food), they realised that they were excluding freedom of choice, both in terms of production and consumption. Freedom of choice is not absolute, as it always depends on the choices available. However, in the sociological sense of the word, which they questioned in detail, it is the "standardisation" of purchasing and production practices, creating a dilemma between on the one hand imposing something on everyone, and therefore standardising, and on the other hand encouraging people in a given direction, thereby leaving a choice between a variety of purchasing and production practices.

On the level of their reflections, they ultimately preferred to *encourage* producers rather than imposing anything on them, and to build in parallel on the education of consumers, such that individuals are induced to choose quality products by themselves. Alongside their proposals for various forms of education, they also suggested various forms of encouragement:

- allocate premiums differently (for employment, quality, the environment) in order to better encourage small-scale producers of quality products, which should allow them a better quality of life and would enable them to sell their products at a more affordable price
- use taxes to discourage pesticide users and encourage them to use other methods or, among authorised pesticides, the least harmful products.

Additionally, this exclusion dimension led the participants to insist on the importance of establishing differentiated standards, depending on the size of the farm and the sales structure. In an inclusive approach, their objective is to promote small structures in the elements which are specific to them, *while simultaneously* preserving the larger ones (which are the majority of producers), but without the standards for these larger enterprises threatening the existence of the smaller ones. From this emerges the criterion of equity, which is essential for the participants, and goes hand-in-hand with the importance they accord to diversity and freedom of choice for all (both consumer and producer).

The ambivalence which they expressed between imposing and encouraging also shows their tolerance, or their capacity for insight (i.e. the inclusion of different points of view, interests and constraints, including those of producers), leading them to see the complexity of the subject rather than being radically decisive, i.e. "we the consumers demand increased food safety!". This enables us to go beyond the image of consumers reduced either to simple purchases or to irrational fears regarding the safety of their food.

[24] Cf. Annex 5.1, full report, point VI.1. "The extra cost of a label: acceptable to and for whom?".

Finally, we could point out that the quality of these results is linked less to the participants in particular and more to their participation in a collective framework exploring these questions. The final word can go to the participants, who expressed their surprise regarding the benefits the framework produced. Some of them expressed their new-found awareness of the multitude of areas which they now link to the issue of pesticides.

> *M: Another thing I didn't know, or didn't think about, was that the pesticides used have such a broad impact, or such repercussions for so many other economic, environmental and social areas; in fact, these pesticides, they're really !*&£!…*

Others pointed out the differences in viewpoint which can exist from one consumer to the next, which they had no idea about and which they would like to pay more attention to in the future, because understanding these differences can be very beneficial.

> *B: What was interesting was all the information we received, being able to exchange ideas because sometimes we have an opinion, and we don't realise that other people, who are also consumers, don't have the same opinions, and you can debate that. It's also the fact that someone is listening to us, that's rewarding…*
>
> *A-M: And what I really wasn't aware of is all those interconnections, and that's also enabled me to have a certain appreciation of other consumers, or maybe to be a bit more understanding, a bit more curious…*

5. Conclusion

Although learning through an interpersonal situation was in itself rewarding in many ways for the participants, the fact that the results of this framework are addressed to the public authorities is also a stimulus for them, because it lends a concrete meaning to their participation. It is important to reflect on the kind of lessons which public institutions (and other agro-food actors) can learn from this type of experiment. These are twofold. Firstly, there are the participants' proposals and the approaches they suggest, particularly in terms of a repertoire with which to address consumers, the equipment to give them, their sustainability criteria and their redefinition of the issue of pesticides and labels. Secondly, there is the framework itself, what it brings about and the way in which it reassesses the habitual representations of the consumer.

The participants' reassessments allow us to question the reflexivity of public institutions on their capacity (or lack thereof) to question their own definition of these issues concerning pesticides, labels and consumers. More precisely, we can question the way in which they conceive and "construct" the public which they address, whose competences and judgement, we have seen, are not set in stone, nor defined outside of particular relationships that they have with the products, producers, retail outlets and the information surrounding them. This "construct" is linked to the mechanisms used to gather data on consumers' respond to strategic or political choices. For public institutions, as indeed for market mediation professionals, the aim is to objectivise consumers and their preferences through quantitative data, in order to gain an idea of reality with a view to acting on this. But when these actors get hold of these data, however representative these may be, they are beyond the framework of the tests and other measuring instruments which enabled them to be drawn up (Dubuisson-Quellier, 2003, p.52)[25]. This is precisely what the framework in our research questions, demonstrating a different instrument and its conditions for gathering these data.

The participative framework in question here differs from the usual frameworks in three main respects which make it a data-gathering tool with results, particularly concerning how to comprehend consumers, which can be complementary. *Firstly*, and in contrast to, for example, a survey, which places the consumer in a situation of isolation from other consumers and other actors involved, our framework is collective and interactive. Through the dynamic created within it, ordinary consumers reveal themselves

[25] "The quantitative studies designed to identify the components of demand are numerous, and employ a large number of market mediation professionals, some of whom, such as survey organisations, specialise in producing this kind of data. These approaches all rest on the hypothesis of broad heterogeneity in consumers' behaviour. This generalised knowledge of consumer behaviour therefore becomes a precondition in any exercise in reduction, or segmentation, of demand" (Dubuisson-Quellier, 2003, p.50).

differently: as capable of getting involved in this kind of framework and interested in doing so; as capable, following their interaction, of broadening their considerations, of reflexivity and cognitive and practical changes; as capable ultimately of developing expertise on how to communicate with ordinary consumers (cf. realistic proposals and inclusion of ordinary consumers). *Secondly*, consumers are usually asked to express a preference among pre-ordained options. Here, however, the framework places the consumers in a situation where they explore and evaluate a complex issue. This therefore allows redefinition of the question, and also original juxtapositions, expressing or rather "putting together" elements which are *a priori* heterogeneous and contradictory (cfr. the "pie" and "do with the supermarkets *and* do alongside them" proposals). In doing this, they express judgement from a position which is fairly explicitly that of ordinary consumers, without losing sight of the ambivalence and complexity of the issue. *Thirdly*, consumers' choices and perceptions are habitually supposed to be stable, or susceptible to influence essentially through marketing. However, the temporality of the framework allowed the consumers to mature and develop their reflections and proposals. The staggering of the meetings accentuated the consumers' reflexive approach, helped to create confidence within the group ensuring quality results, and also allowed the participants to transfer certain characteristics tested in the framework (connections as equipment for judgement) to their proposals (cfr. the "supermarket taste sessions" proposal as a means to inform consumers by putting them in touch with producers).

The consumers' main redefinition is having comprehended the issue from multiple dimensions and points of view[26], questioning the labels and their approach to pesticide from a broader perspective, encompassing day-to-day, commercial and information-based relationships with food. Thus they have truly reconfigured the issue, since these are dimensions which are not always associated with the issue of pesticides and labels. This multi-dimensional approach on the part of the consumers offers a particular view and reflection on the question of the sustainability of the labels and pesticides. Equally, it invites us to comprehend the consumers, their behaviour and their reflexivity differently. It also has practical implications. The result is that those seeking an analysis and institutional actors will have to detach themselves from repertoires which think merely in terms of risk and lack of knowledge. Indeed, from the point of view of the consumers it is not enough to make labels more trustworthy in order for them to be sustainable. It is therefore instructive to see their reconfigurations, reflections and proposals in a different light by attempting to separate out the underlying sustainability criteria.

An initial key criterion seems to be **equity**. It stems from the complex and nuanced analysis which they have made of the current situation and the responsibilities it entails, thus consequently requiring, in their view, solutions which are also shared among the actors. This criterion of equity must be seen in connection with another important criterion for the participants, **diversity**. This came up again and again, in particular in the dilemma they faced between imposing one choice on everybody, and therefore standardising, or leaving a choice between a variety of practices, both in purchasing and in producing. They mentioned it in terms of opposition to sustainability, i.e. the standardisation and selection they perceive in various areas of their lives, and which they judge to be unsustainable in the sense that they risk not being able to be perpetuated over time. They expressed the importance of preserving a range of varieties, production methods and also of types of commerce, differentiated standards, knowledge and types of research (on the risks of pesticides *and* also on alternative varieties requiring less pesticide treatment). This diversity is entirely indicative of the inclusive ("both/and") approach highlighted above.

[26] The social aspect of the question: in terms of exclusion of consumers, of (small-scale) producers, and also (and herein lies the original part), in terms of exclusion of certain types of commerce, products and varieties, and linking all of these exclusions together.
The economic aspect: starting from the cost to the consumer's wallet of labelled products, extra costs for producers and, finally, the profits and commercial strategies of intermediaries, particularly supermarkets.
The environmental aspect: with regard to the impact of pesticides on foodstuffs and health and also, more generally, with regard to the sustainability of the production at issue, in view of the diversity of production methods and the varieties cultivated.
The ethical aspect was also mentioned, opposing the collective interest which justifies public intervention and the liberty of the individual to consume whatever he or she wants.
Aspects to do with education and information for consumers: but not exclusively consumers, since they also discussed education for supermarket departmental heads, supermarket managers, producers and future farmers.

They also coupled this criterion of diversity with that of **sobriety** of lifestyles and modes of production, and those which must be encouraged in order to achieve sustainable development. Although diversity and simplicity might seem paradoxical at first glance, this is another instance where the realism already discussed plays a part. The consumers in fact drew attention to the risks of excessive diversity, in particular the risk of sowing confusion among consumers. In this respect, they particularly stressed the need for simplicity in the messages transmitted and the type of repertoire to be used to achieve this (approach versus controls, name of varieties indicated for products sold loose, diverse producer-consumer relations, etc). But the other major risk they highlighted was that of both consumers and producers losing sight of what is around them, for the benefit of more "exotic" things/products, which over time do not lead to autonomy.

Implicitly, another criterion emerged which differentiates from what is often linked with sustainable nourishment, namely the reference to future generations and the actions now required for their sake. This link with the future was, of course, mentioned, but there was also reference to a **future anchored in the past**. This is the link implied (without, however, entering into the "things were better then" myth) when they express the need to ensure that knowledge of nature is not lost or that older fruit and vegetable varieties should not be allowed to disappear, risking our capacity to adapt in the future.

A final criterion (of a slightly different order) which is worth mentioning is the importance in the consumers' view of a **State which coordinates** this issue across various ministries (health, agriculture, environment, education, etc). Although the consumers expressed some concerns about the functioning of the State[27], they nonetheless believe that there is a role for it to play which should not be given to private actors. It seems that they do not want either a 'nanny' State (which dictates behaviour and standardises), or an absent State (which palms off responsibility to producers), but rather a State which monitors change and ensures equity. More profoundly, and somewhat implicitly, their proposals above all suggest the need for a State which is capable of coordinating matters.

Finally, although these sustainability criteria may appear self-evident, analysis of the discussions surrounding them allow us to identify elements which make it clear that currently they are not self-evident. These elements were expressed by the participants through their dilemmas in, for example, wanting to be able to dispense with supermarkets and at the same time finding them practical, simple and pleasant; regretting the loss of certain lifestyles and culinary knowledge, but appreciating the time left available for other tasks. Or the dilemma between the constraints imposed in terms of employing alternative modes of consumption (products which are local, seasonal, labelled, etc) and, on the other hand, the pleasure and simplicity offered by the dominant mode of consumption. What these dilemmas demonstrate are the irreversibilities which the industrial fruit and vegetable market has gradually produced. By irreversibilities, we mean a configuration which is stable at any given moment and holds together a range of natural and social processes such that it makes it impossible to change some elements of the configuration without changing some or all of the others. In this light, re-reading the examples above leaves us with the impression that it would be impossible to dispense with the supermarkets without changing the whole of consumers' food-related habits[28].

At the same time, the focus groups have brought to light these irreversibilities which highlight the fact that they stand out through the force of the evidence they relate back to and that they are currently not questioned to any great extent. In this example, the search for sustainable solutions (and therefore for alternatives for the current system which, through its excesses, threatens its sustainability) comes up against a stumbling block, i.e. the dualism between the supermarkets on one hand, and at the other extreme direct-sales endeavours (by producers, in small markets, through buyers' groups, etc.). This dualism inevitably leads us to conclude that the alternative is reserved for a small minority of the population and cannot become more widespread. But the strength of an analysis in terms of irreversibilities is that it allows us to understand the whole sequence of events necessary for the creation

[27] Cf. Annex 5.1, full report, in Point V. "Additional observation on consumers and their ambiguous link to the State".

[28] According to the participants: the time devoted to shopping, opening times of smaller shops, type of products consumed, recipes for preparing "forgotten" local products, taste for these products, relationship with producers to be in a position to understand and accept fruit and vegetables which differ from the habitual size and colour, etc.

and significance of the dominant configuration. Consequently, the link to the past – and therefore to developments – as well as to diversity, as these two aspects were dealt with by the participants, become key elements in acting and producing sustainable solutions.

Can we therefore consider that these focus groups have led the consumers to see the labels as devices which may not have the purpose of becoming more widespread or imposing themselves, but which enable diversity to be preserved, and as devices from which we can also learn?

Chapter 6 Certification initiatives as equilibria of stakes

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Introduction and problem statement

Through the course of the preceding chapters, it became clear that several different types of labeling and certification initiatives encompassing environmental standards can be identified in the market place. From Chapter 3 we remember that, based upon the rules in the instruction books, certain initiatives are more progressive than others. From Chapter 4 we learn that initiatives can differ based upon their principal focus on the end product, on the production process or on rules and procedures.

Our basic hypothesis in this chapter starts from the division of labels and certification systems in two distinctive groups, based upon their impact towards environmental sustainability.
The first group, of which Biogarantie can be regarded as the main example, predominantly acts as facilitator of the introduction of more environmentally sound production methods. This group can be regarded as the innovators in the field of environmental sustainability, those who pave the way for the remaining majority of farmers. Their motivation should be sought outside the economic spheres. However, their real impact (expressed here as their contribution to an overall reduction in ecologic degradation) remains marginal, due to the limited number of participants. These systems act as niches in the market place and they primarily have a signalling function, both towards private parties and policy makers.
The second type of systems, of which Flandria/FlandriaGAP is a good example, are market oriented systems which integrate environmentally sound techniques to an extent that economic sustainability is not endangered. Their principal motivation for integrating environmentally sound techniques can be found in the word 'reputation'. However, given the high numbers of participants in these schemes (and given the considerably high scores for their instruction books, see Chapter 3), their contribution to overall environmental sustainability might be much more significant compared to the first group. Further in the text, we will refer to these kinds of systems as 'certification metasystems'.
From an economic point of view, the second group is of much more importance compared to the first group, due to the high numbers of participants. Given the important signalling function of the first group, the real impact with respect to both economic and ecologic sustainability thus comes from the second group.

In the remainder of the chapter we focus on the second group of systems, because their prime motivation for the introduction of environmental standards can be fully situated in the economic spheres. Furthermore, these initiatives have the highest economic (and ecologic) impact. We try to uncover how these systems are organized and how they evolve. To underline the theoretic statements we make throughout the chapter, we draw parallels with the real market situation. Because Flandria/FlandriaGAP and EurepGAP are the most representative cases for the second group of initiatives, these initiatives will primarily serve as examples.

This chapter focuses on the reasons why these second group of certification initiatives are organized as they are. Because many stakeholders are involved in these certification initiatives, the best approach to obtain information with regard to their stakes and differences herein, seemed to be the use of focus group sessions. These sessions both yield information regarding stakeholder attitudes towards each other and regarding our subject of interest. Furthermore, through these group discussions, more information and more objective information can be obtained compared to classic in depth interviews. These sessions were primarily organized with the following objectives:

- to identify the different stakeholder groups' attitude towards each other;
- to identify differences in information asymmetry levels;
- to identify those stakeholders who primarily influence the evolution within the system;

- to obtain qualitative information with respect to stakes, objectives, evolution, construction process and alternative policy options (see chapter 2) amongst others.
- to obtain input for the quantitative research conducted in Chapter 7.

1. Research methodology

Four major sources of information are referred to in this chapter: focus groups with the principal stakeholders, a farmers' questionnaire, in depth interviews with key players and literature and market data review. The next section briefly outlines our methodology for the information sources. It further provides a framework for analysis of the stakeholders' participation in the initiatives.

1.1 FOCUS GROUPS AS PRIMAL SOURCE OF INFORMATION

In general, focus groups are discussion sessions between several stakeholders under supervision of a moderator. The main subject of the discussion is fixed but, within this subject, the discussion topics evolve depending on the stakeholder group composition. The technique is particularly interesting for the exploration of the reasoning behind certain points of view.

1.1.1. Focus group trajectory

From March, 2005 to June, 2005, 6 focus groups were conducted with the principal stakeholders. Each focus group covered a different subject and consisted of a different stakeholder composition, in line with the subject. Table 6.1 reflects the structure of the focus group sessions. Throughout the chapter, wherever relevant, remarkable positions and points of view will be amplified. A detailed report of the focus group cycli can be found in Annex 6.1.

1.1.2. Focus group dynamics

Based upon the constellation of the different focus groups, some generalizations can be made regarding behaviour, information asymmetry and power relations between the stakeholders active in the certification network.

The first focus group consisted of farmers participating in different certification initiatives, and with different degrees of information with regard to certification. These participants were all very active during the process, keen on understanding the dynamics in the other certification schemes and willing to express their personal sentiments and experiences with regard to labels, with vivid discussions as a consequence. Based upon the motivation for farming, three groups could be distinguished: those with a strong ideological conviction, those with a positive attitude towards sustainable practices and those who predominantly see farming as an economic activity. A correlation could also be observed between degree of participation in the discussion and level of information.

Table 6.1: Structure of focus group sessions

	Stakeholder type	Subject
Focus group 1	Vegetable growers following Biogarantie, FLANDRIA and EUREPGAP	- motivation for participation in the initiative - (dis)advantages
Focus group 2	Vegetable growers following FLANDRIAGAP and EUREPGAP	Consequences of participation at farm level
Focus group 3a and 3b	initiators, auctions, retail, consumers and producers organizations	- producers' stakes versus other stakeholders' stakes - certification initiatives versus other measures aimed at reducing pesticide use
Focus group 4	Vegetable growers, initiators, auction, retail	driving forces and evolution within the initiative
Focus group 5	All involved stakeholders	feed back and discussion

In the second focus group, the participating farmers were all members of the same certification initiative and the majority was active in the board of members of an auction. As a consequence, the information asymmetry amongst the participants was considerably smaller, as well as the differences in opinion. The

objective quality of the information provided was, in comparison with the first focus group, much higher. Hence, amongst farmers, a divergence can be observed considering the degree of information with respect to certification books. With the auctions being puller of some certification initiatives, it is argued here that those who are more closely linked to the auctions (or with a more positive attitude towards the auctions), are generally better informed and, as a consequence, have less diverging (subjective) opinions with respect to certification. Depending on the researcher's objective, whether this is capturing (subjective) opinions or (more objective) information, the focus group constellation should be adapted.

However, the farmers' level of participation declined when other involved parties were also invited. The farmers' representatives at auction level now mainly acted as spokesmen for the farmers. It should be noted that the discussed topics also evolved from certification in general to more technical and specific aspects of certification. Hence, with respect to the construction process and the evolution of certification standards, other parties possess more information and have a clearer opinion.

One lesson of these focus group dynamics is that a participatory information campaign across all farmers in the certification network (not only restricted to those who are interested), could significantly improve the acceptance and knowledge of certification books and facilitate the acceptance of occasional adaptations.

1.2 FARMERS' QUESTIONNAIRE AND IN DEPTH INTERVIEWS

In January 2006, 68 farmers participating in the FlandriaGAP-initiative were surveyed. The questionnaire is mainly built around 2 choice preference experiments, aimed at measuring the (dis)utility for farmers when changes are made in the certification book prescriptions. The first experiment encompasses general changes in the prescription book, the second focuses on the measures aimed at reducing pesticide use. The methodology and outcome of these experiments will be discussed into detail in the next chapter.

On various occasions during the project cycle, private and governmental experts in the field of standards and labeling were consulted, enabling us to strengthen or weaken statements from the focus group cycli.

1.3 METHODOLOGICAL FRAMEWORK FOR ANALYSIS

To guide our discussion regarding the current construction of these 'certification metasystems', we make use of the framework introduced by Mainville et al. (2005) for the analysis of the adoption of certification standards by retailers. However, we do not restrict ourselves to the analysis of retail behaviour, we are rather interested in how the stakes of the different parties are integrated in the certification book (the current equilibrium state). We therefore only use this framework to identify topics of interest (the influencing factors) in certification initiatives. Table 6.2 summarizes these topics. Throughout the text, these will be elaborated more in detail.

Table 6.2: Factors influencing the decision to adopt public/private certification

General conditioning factors	Benefit/cost effect	Firm characteristics
• Strategic objective of certifciation • Institutional context • Product and market characteristics	• Output price differentials • Input price differentials • Transaction cost differentials	• Product requirements • Importance of product in sales • Scale of operations • Market power of firm • Reputation and brand capital

Source: Mainville et al. (2005).

2. General features of 'certification metasystems'

For a description of the Flandria/FlandriaGAP and EurepGAP system, see Chapter 3.

2.1 INVOLVED STAKEHOLDERS

The principal stakeholders in the 'certification metasystems' (those who implement the certification books) in the Belgian fresh fruit and vegetable market place are the participating farmers and 6 Belgian vegetable (and fruit) auctions, united in LAVA (Administrative and Logistic Association of Auctions), and

independent controlling bodies (f.e. Certagro). Another closely involved stakeholder is the fruit and vegetable retail and distribution sector. Government, farm suppliers, pressure groups and consumers are more indirectly involved in/influenced by the initiative.
The auctions and retailers both fulfil the same role: facilitating the transaction between producers and consumers by reducing transaction costs and adding surplus value to the product.

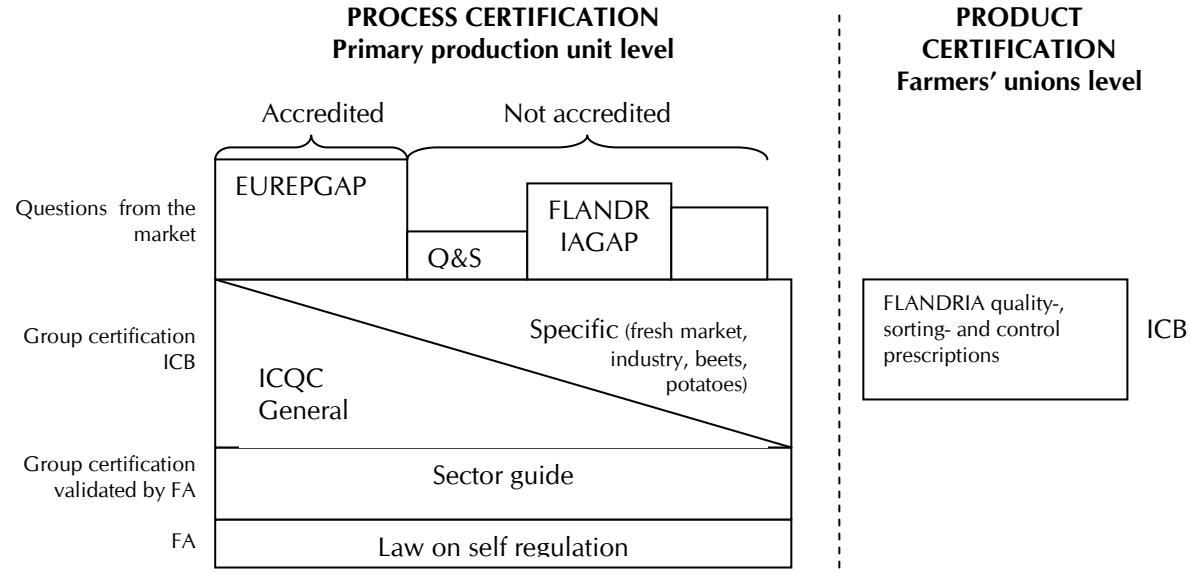
The **producers** implement the certification standards at farm level. On individual level, they have a modest impact on the adaptations in the certification books.
The **auction**s' core business is to ensure that demand matches supply. As promoters of the Flandria certification initiative, they are the main actors in the construction and adaptation process of the certification book. Also part of their task packet is motivating farmers to participate in the initiative. Furthermore, they have a consultancy role towards the farmers, with regard to certification amongst other things. They also participate in the communication efforts associated with the initiative. With respect to their customers, they have to guarantee choice, uniformity and quantity. To this end, grading, monitoring and control (both at farm and auction level) are also part of their core businesses.
With respect to certification books, the **retail** initiates and/or subscribes to certification initiatives. Based upon the type of initiative, they formulate extra demands in line with the firm policy and perform additional controls. As final actor in the chain, they have an important role in communicating the advantages of the certified produce towards the end consumer.
The **media**, as a more indirect (i.e. a secondary) stakeholder, plays a vital role with respect to the way the food chain is presented to the general public, taking into account that they have become the primal source of information concerning food (and food scares) for the general public.
Pressure groups (consumer, producer and environmental associations) try to influence the equilibrium in the certification books in a sense that their supporters' stakes are defended the most.
Whether the initiative will survive or not largely depends on the **end consumers**' willingness to buy. This partly depends on factors internal to the initiative, but to the same extent on the attitude of consumers themselves towards more sustainable production practises.
The **governmental bodies** mainly influence the lower boundaries of certification initiatives. With legislation in continuous evolution, certification initiatives on their turn have to evolve in order to at least encompass the base legal level. The FA (Food Agency) checks whether these legal requirements within the food chain are met, irrespective of the type of private certificate already administered to the product or producer. Furthermore, sustainable production practises are financially supported at EU and country level, with a major influence on the persistence of the initiative as such.

2.2 INSTITUTIONAL CONTEXT

Before outlining the institutional context of certification in the Belgian produce sector, it is important to stress its specific nature. Contrary to the meat sector, where control of the public standards is quite straightforward due to the presence of a single regulation in Europe and the capacity of governments to put in place credible monitoring systems (via slaughterhouses), the problem of the definition and monitoring of a safety Minimum Quality Standard (MQS) in the produce sector, mainly relating to pesticide residues, is more complex. Rather than increase monitoring by increasing public expenditure, European governments prefer to depend on the private sector, increasing their legal responsibility and promoting the emergence of private standards and monitoring of these standards by independent certification bodies (Codron et al., 2005). Figure 6.1 (based upon De Blaiser, 2005) illustrates the institutional context of certification in the Belgian produce sector.

Process certification standards are aimed at steering the production process towards better agriculture practises. Product certification standards outline the minimum characteristics to which the end product has to comply. Both on product and process level, the law can be considered as the base line, the minimum product and process requirements. In accordance to the General Food Law (Regulation (EC) 178/2002), Belgium has promulgated a law on self regulation, traceability and notification for the Belgian food and farm sector (KB 14/11/2003), valid since 01/01/2005. This law focuses on the preservation of food safety at all stages in the food chain. The primary sector has to comply with a 'light version' of this law, with regulations concerning registration and good hygienic practises, because HACCP-like systems are to demanding for implementation at farm level. Control of this minimum standard is governed by the Food Agency (FA), through an auditing system. The audits are complemented with unannounced controls.

Different mechanisms have been put in place to facilitate compliance with the law on self regulation. The most common option for a farmer is to comply with a sector guide, which is (usually) proposed by his sector federation and approved by the FA. Currently, 43 agricultural sectors are preparing sector guides. These privately initiated certification books stipulate all the legal demands that have to be met considering food safety, by introducing regulations concerning traceability and registration. Adaptation of public policy to a changing environment can be very slow, as is the case for the Law on self regulation. The approval process of a sector guide takes more than 1 year (not taking into account the time necessary for the formulation of the sector guide). Retraining of the FA-controllers to auditors is also time-consuming, forcing the FA to temporarily contract out these audits to smaller accredited private control bodies.
To enhance the general process quality throughout the vegetable chain, major players (from production and processing level in various sectors) have proposed a common production and processing standard (the ICQC – standard; Integral Chain Quality Control). This standard integrates the specifications of the Sector Guide as well as other legal and supralegal prescriptions at stake in the agricultural sector. In the future this standard will be used to cover the production conditions of Flandria (i.e. it will become their process standard), the major certification system for vegetables in Flanders and the bench case in this text.
The past decade, several more restrictive certification standards have been initiated, to comply with the extra demands from market players downstream the food chain, as is the case for EurepGAP, or for diversification purposes, as is the case for Flandria/FlandriaGAP.



* ICB: Independent Control Body (private)
* FA: the Food Agency (FAVV – AFSCA)
* ICQC: Private Standard for Integral Chain Quality Control
* Q&S: Quality and Certainty: German fresh fruit and vegetable standard

Source: Raf De Blaiser, 2005

Figure 6.1: Institutional context of private and public certification initiatives in the produce sector

Thus, contemporary agri-food systems are increasingly governed by an array of inter-related public and private standards, both of which are becoming an a priori mandatory part of doing business in supply chains for agricultural and food products, beyond the most basic bulk commodities (Henson and Reardon, 2005).

2.3 MAIN STRATEGIC OBJECTIVES

The different actors present in the focus groups were asked what their primal (top of mind) motivation was for participation in certification meta-systems such as Flandria/ FlandriaGAP. Table 6.3 summarizes their main opinions.

The distinction due to differences in **strategic objectives** of standards is of major importance in the case of possible opposite stakes in the chain. Grades and standards (G&S) can take standardizing, differentiating and risk-reducing functions.

A driving force in the fresh produce chain is the demand for **uniform and standardized products**. Consumers expect the same product attributes whenever they visit one of the retailers' stores. This criterium is a baseline for each retailer. The auction mechanism is also built round this basic principle. Farms can only deliver products in limited quantities and during a certain period throughout the year. To solve this problem, common standards have to be created to ensure product uniformity and deliverance continuity over different producers and over time.

Table 6.3: Certification book participation - top of mind reasons

Producers	Auctions	Retail	Consumer	Governm	Summary
Trust – vs. short supply chain	Trust in the chain	Safeguard (due diligence)	Information		**Risk reduction**
Differentiation	Differentiation / recognisability	Differentiation*	Choice	Role of pioneer	**Differentiation**
	Uniformization / standardization	Uniformization and clarity			**Standardization**
Involvement / optimisation				Role of pioneer	Optimisation
License to deliver		Imposing demands on suppliers			Necessity

* depending on the type of initiative. EurepGAP f.e. has no differentiating functions

Given the possibility of standardized products, the different distribution chains all focus on certain consumer segments. Within these segments they try to create consumer loyalty. For **retailers** who differentiate away from low cost products, certified products can again play a role. The reason is twofold:

- a negative image has to be avoided at all costs, hence extra guarantees for food safety, hygiene and traceability are a must: strategy of **risk reduction**.
- a positive (quality) image has to be created, among other things to justify the price premium, hence extra product features have to be added. Extra product features are related to quality, origin, social and environmental standards: strategy of **differentiation**.

From **auctions**' point of view, the purpose of the Flandria certification is twofold:

- to create a clear distinction with bulk products;
- to create a large quantity of product, aimed at gaining a certain degree of vertical and horizontal market power

The distinction is achieved through 2 main principles: integrated farming practices and high product quality. A large product offer requires product uniformization and standardization, hence certification demands cannot be too restrictive, otherwise too many growers have to drop out.

In the **farmers**' questionnaire, 47% of the participants spontaneously (i.e. in an open question) indicated 'obligation' as main reason for participation. In the focus group sessions, this driver was also mentioned as highly important. It does not mean that other market parties are forcing farmers into this choice, but it is an economic obligation. Not participating means exclusion from the top quality segment, resulting into lower prices. The top quality price is a necessity for Flemish farmers' economic sustainability, confronted with smaller production areas and higher personnel and energy costs compared to their southern competitors. During our survey, a major part of the farmers indicated that the certification is considered as an extra burden, mainly due to the administrative tasks involved. They argue that in the end, a farmer is more and more diverted away from his core (and preferred) business, which is producing grocery.

The farmers were also asked to score (on a 1 to 7 scale) different positions concerning their motivation for entrance in the initiative (see Table 6.4). All considerations are, on average, of importance for the farmer. Most important are those considerations that refer to the economic advantages of certification, such as labeling extra quality (i.e. diversification), market certainty and chance for a financial surplus.

The percentage of farmers not participating in certification books and / or using the auction channel is low to marginal (f.e. 95 % of tomatoes are marketed using the auction channel) and depends on crop type. The focus group participants identify two types of producers not willing to participate in certification books: those who prefer not to be controlled and those who produce in bulk, with revenues based upon quantity instead of quality, and often with an individual and exclusive contract with a buyer. The first step

towards participating in certification is becoming member of an auction, because this already implies visual inspection and crop registration. It is hence argued that the auctions play a crucial role in the acceptance of certification by farmers.

The following paragraphs focus more into detail on the standardizing, risk reducing and differentiation functions of certification books, with respect to stakes of the involved actors.

Table 6.4: Importance of considerations when participating

Consideration	Average importance (from 1 to 7)
Extra quality is labeled	5.50
Market certainty	5.48
Chance for financial surplus value	5.31
Obligatory from the market	5.20
Taking responsibility	5.06
More environment conscious use of pesticides	4.91
Optimization of production process	4.44
Participating in an important tendency	4.33
Personal satisfaction	3.69

2.3.1. Standardization

Although considered as obvious, standardization is crucial to the strategy of the different market players, and especially to **retailers**, whether they focus on cost reduction or differentiation. The prime reason is the maintenance of consumer loyalty for a certain produce whenever this loyalty has been created. Secondly, it facilitates the product flow (logistics), the price formation and the monitoring and control.
In this context, it is important to make the distinction between process and product standardization. In case of **process standardization**, without prescriptions for the product features, end products can still widely differ. A differentiation strategy can be built round the extra quality features resulting from harmonized processes, with organic produce as the main example. EurepGAP on its turn mainly focuses on risk reduction by prescribing 'Good Agriculture Practises'.
In case of **product standardization**, market players try to harmonize the extrinsic and intrinsic features of the product, both between places and time. No specific rules are imposed concerning the way the product standardization is reached, leaving the grower with considerably more freedom of management. This system is more common in the United States compared to Europe.
However, a major part of certification initiatives tries to combine both the process and product certification strategy, as is the case for Flandria/FlandriaGAP, leaving the grower with little room for personal choices and action, but with significant marketing (and thus price) possibilities as a reward, due to the superior intrinsic and extrinsic product features.

Standardization as such is not mentioned as a strategic objective for **producers**. The regulations concerning standardization are an important part of the Flandria instruction book, which focuses on product quality. After harvesting, the farmers have to sort their produce based on colour, shape, length and look. At the auction, specialised personnel determine the level of quality (Flandria or less). The classification will affect the end price of the produce. One could argue that standardization creates advantages for the producer (higher price, improved logistics,...) as well as disadvantages (non-conformity is not rewarded, conformity creates extra costs/efforts at input, labour and output level). In an environment where production circumstances are heavily dependent on external factors (such as climate and pest incidence), some major disadvantages from farmer's point of view can occur. Although the gains are only limited to those parts of the produce that are sold as certified, costs related with the certification have to be made for the full area of that same produce. Farmers are not protected nor compensated in the certification contracts for the adverse effect of these external risks. Closely related to this, and certainly equally important, is the bottleneck between standardization, differentiation and risk reduction from farmers' point of view. The need for standardized products urges for homogenous breeds and large scale production, significantly increasing the change of food safety risks due to a lack of diversity. On the other hand, diversification and standardization are in a sense opposite terms. Because diversification normally

means increasing the minimum standards, less degrees of freedom for the grower are the obvious implication. As will be pointed out further in this text, this is especially the case for standards aiming at increased environmental quality, since these put an extra stress on the resource base and tools available for the farmer, necessary for maintaining a standardized production.

2.3.2. Risk reduction

Food safety issues are more acute in the fresh produce sector (compared to other sectors) due to the perishability of these products and their vulnerability to pathogenic agents (Unnevehr, 2000). The atomized production structures and the weak producer brands expose retailers to substantial risks, both versus consumers and government. To tackle this, from **retailer** point of view, following Codron et al. (2005), two general types of strategies can be pursued. In the first case, retailers implement a given public minimum quality standard (MQS), supplemented with a Premium Private Label (PPL), which goes beyond this standard and is focused on quality improvement via a partnership with a specific group of suppliers (as is the case for the Fruitnet-Delhaize alliance), adding a communication to the consumer guaranteeing production practises. The second strategy consists in improving the quality of products supplied by farmers in general, not just by the retailers' own suppliers. The objective is to make that all the products that come to market meet a set of criteria, and thus avoid food safety crises that reduce overall consumption of the produce. It is important to mention that produce safety is only a secondary concern in the main current strategies of quality differentiation pursued by retailers. The retailers pursuing a differentiation strategy focused on produce safety are few and the interest of retailers to act collectively enforcing a private MQS is an insurance strategy to protect the collective set of retailers from a safety monitoring shortfall that would lead to a crisis that would hurt all together (Codron et al., 2005, Fulponi et al., 2006).

Retailers generally are interested in a MQS as high as possible, because then the consumers know they are getting a safe product, and the producers must bear the costs of attaining that quality level.
According to Giraud-Héraud et al. (2003), as the MQS rises, so do the costs incurred by suppliers and retailers to differentiate the product from the generic; for the producer these are production and reporting costs; for the retailer these are the costs of monitoring and the cost of being constrained by a contract versus sourcing from the spot market. The optimal price of the differentiated product manifests a progressively declining gap from the price of the generic line. When the MQS is very high, the retailer no longer has an interest in selling the PPL and the entire product line then converges to the generic products (meeting the MQS only).
Furthermore, profits to the retailer are higher when the MQS is higher. When the MQS is high, the retailer can forego contracts and buy the generic product on the spot market, where producers compete to supply the product.

Farmers, on their turn, do perceive an important role for certification books in relation to risk reduction. The farm sector is often encountered with major crises, due to production factor abuses, mainly at spot market level. In this environment, the certification procedure offers a guarantee for the producer and the other chain members, enabling them to prove the differences with the bulk products, resulting in a positive consumer reaction and hence, positive reactions from players downstream. Certification thus increases trust in the quality chain. On a more personal level, by adhering to certification prescriptions, farmers show responsibility towards the other chain members (especially towards fellow producers and consumers).

Food safety measures not only work as a means for creating a distinction between certified and uncertified products, also within the group of certified products they play a vital economic role. Although inspired from a social point of view (namely reducing the risk of encountering major food scares), the economic importance of traceability has been recognised widely, both among retailers and farmers. The impact of a one pallet board recall is marginal compared to that of a full truck load, and hence more restrictive traceability measures are, despite the administrative burden, welcomed by farmers.

Some farmers, especially those engaged in organic farming, use the short supply chain (with different types of direct selling) as their preferred market channel. In this system, the farmer acts as the label, the certificate for a trustworthy production. With our supply chains becoming longer, the contact between

producer and consumer disappears, calling for other means of guaranteeing the trustworthiness of the product. The farmers identify the vital role of certification and labeling in this sense.

2.3.3. Differentiation

The differentiation strategy is mutually interesting for both retailers and growers, especially in the Flemish context, where farm units are generally small. Hence, growers have to find other means to distinguish themselves from fellow European competitors. Extra product or process features result into a higher quality image and thus, a higher price per unit. The retailers who focus on the quality oriented consumer segments also need produce with extra features, resulting in possible mutual stakes between growers and retailers.

Regarding differentiation, farmers point out that certification books, due to the extra requirements, create surplus value, resulting in an extra price or access to a previously closed market outlet. If the certification standard is accompanied by a label, it can be used as a marketing tool, aimed at creating consumer loyalty. The label then fulfils the role of a brand name, accompanied with a quality image. This strategy finally creates differentiation in the market place.

However, these mutual stakes can quickly become opposite depending on the type of promoters (i.e. the initiators, the pullers) of the certification initiative and the associated communication strategy related with the initiative.
EurepGAP, initiated by a consortium of major European retailers, is a Business to Business (BtoB) certification standard. Retailers using this standard have the required guarantee concerning the process (and some product) characteristics, while retaining full freedom of promoting the produce as a private label. It is worthwhile mentioning that the initiators also opted for the restricted BtoB communication to avoid problems with produce not meeting certain exterior and interior standards, taking into account that EurepGAP is a process (and not a product) certification standard.
Flandria on the contrary, initiated by 6 major Belgian fruit and vegetable auctions, is a Business to Consumer certification standard, accompanied with a specific label. When this approach is applied, retailers are constrained in their retail store communication possibilities. Furthermore, competing retail channels can offer the same produce, equally recognisable for the final consumer. From growers' point of view, this strategy can prove very useful since the associated label acts as a pull mechanism, because consumers' demand for this specific produce forces the retailer to place it on the shelves. 70% of the Flandria products are sold abroad. There, retailers can still use the standard for differentiation purposes, unlike in Belgium, where both Colruyt and Carrefour offer the Flandria products.

2.4 PRODUCT CHARACTERISTICS: ENVIRONMENTAL STANDARDS

Given the subject of this project, we restrict this section to Environmental Quality Standards. For a description of the Safety and Quality characteristics of fresh food products, we refer to the Annex 6.2.

The environmental standards required by **retailers** are mainly applied through farm practices schemes, such as SQF1000 or EUREPGAP or the GAP requirement of the GFSI. Environmental standards may also include the environmental component of manufacturing processes and/or packaging, which are part of GMP or GDP.

From the beginning on, Flandria has integrated environmental standards in the certification book, mainly because a major part of the production was already produced in an environmental friendly way. During subsequent adaptations, these measures were upgraded, **at a pace enabling compliance of the majority of participating gardeners**. A good example is the 'observe and alert' system, where the pest pressure is monitored on test plots, and a warning is sent when the economic threshold level is reached. This system significantly reduces pesticide appliance while not hampering the quantity and quality of output produced. The introduction of natural enemies in greenhouse gardening took place in 1971, long before certification book initiation. The label Flandria on its turn has offered a means to promote and communicate these environmental friendly techniques. Table 6.5 summarizes the advantages and drawbacks for farmers with respect to biologic control versus classic pesticide based control.

An expenditure of € 2000 to 3000 per hectare should be calculated for the use of biological opponents. The economic advantage of biological pollination and control mainly relates to labour reduction, taking

into account that a single spraying session can last up to 5 or 6 hours. Opposite, biological control demands more monitoring and control to maintain the desired levels of beneficial organisms. The financial success mainly depends on the starting phase of the biological culture. If successful, the cost can be reduced to up to one third of the cost of classic pest management. The ecologic and human advantages relate to the decreased use of classical pesticides, with less pollution and less contamination danger for the applicator.

When the pest incidence is locally too high to be controlled biologically, greenhouse gardeners might opt for classic harmful pesticides (indicated with the red colour code on the Service for Residue Control (SRC) Cards), while taking into consideration that this will also result into an adverse effect on the beneficial organisms. Another consideration is made with regard to the toxicity level of the product, based upon the time of application. In the starting phase of the crop, a gardener will opt more quickly for a red product, because the danger of exceeding the fixed waiting period is then still absent.

Table 6.1: Advantages and disadvantages associated with the use of biologic control vs. classic pesticides from farmers' point of view

Advantages	Disadvantages
Less labour intensive	More monitoring and control
Less pollution	Success depends on starting phase
More applicator friendly	Not efficient in case of high pest incidence
Can be more cost effective	Reduced investments in classic pesticides
Extra value for the product	Mainly restricted to greenhouse gardening
New breeds	Difficult to communicate
Development of more selective classic products	Classic pesticides harm the beneficial organisms
	Product rejection by importing countries

Another economic drawback for farmers from the increased use of biological pesticides is the reduced application of chemical pesticides, resulting into lower sales for the classic phyto pharmacy industry. This will lead to lower investments in research for new products and approval procedures of existing products. The number of classic products available thus decreases. On the other hand, the evolution in the field of biological organisms has urged the classic phyto pharmacy sector to develop more selective products. Likewise, investments in breeding programs resulted into an increase in pest resistant crop varieties.

Finally, it is worthwhile remarking the demand from Belgian vegetable importers (such as the United States and Russia) for complete absence of living organisms on the crops. When organic production practises are applied, the risk of a natural enemy ending up in the final product is always imminent. One such organism can result into the rejection of the full batch.

From **farmers**' point of view, **ecology** is becoming **too demanding**. The market and governmental actors should give more attention to the technical feasibility, based upon scientific research. As an example, the demand now raised by several retailers (f.e. Colruyt and Lidl) to limit the amount of active pesticide ingredients in the end product, is considered as unrealistic. To avoid resistance, the farmer periodically has to switch to other products. Furthermore, the available pesticides have become less intrusive, both with respect to spectrum, effect and point application, urging the farmer to increase the number of treatments. The farmers also question whether a higher number of AI's present in the food product is more harmful with respect to food safety compared to the alternative situation. The distributors argue that their demand originates from the potential adverse effects on their reputation when pressure groups (f.e. TestAankoop) communicate about multiresidu levels in fresh food products. These groups on their turn feel the pressure of their supporters. In this issue, the auctions also play an important role, by stimulating and performing research aimed at solving similar questions from players downstream, with the introduction of the 'observe and alert' – system as a good example.

Another major bottleneck with respect to environmental standards is the **legislation** for pesticide use (as stipulated in Directive 91/414/EEC), taking into account that the certification standard should encompass at least the legal prescriptions. A too restrictive legislation results into limited options for the farmer, which induces crop resistance. The farmers argue that, if more products would be approved, the residue

levels in the food product will probably be lower. The whole question of pesticide approval is in fact a vicious circle. Because Belgium is a rather small production area and approval procedures are costly and lengthy, phyto pharmacy industry is not willing to invest in registration. According to the farmers, the solution would be to approve the products at EU level. Currently, the Directive 91/414 is revised with the aim of subdividing the EU into three climatic zones and approving AI's depending on the respective climatic zone. The problems associated with this new directive are twofold. The directive deals with AI's, and not with products, again creating bias between different countries (some products will be allowed in one country while prohibited in another, although their AI's are equal). Secondly, the subdivision in climatic zones could prove very difficult. France for example would be part of the southern belt and Belgium of the central belt, which seriously hampers our competitive position (because in a warmer climatic zone products are expected to decompose more quickly).

As indicated in Table 6.5, communicating the extra efforts regarding pesticide use is on the one hand important and on the other not straightforward. In the paragraph 4. Communication, the communication efforts from Flandria regarding integrated farming are discussed.

2.5 MARKET CHARACTERISTICS

2.5.1. Theoretic underpinnings

If market players are interested in buying and selling products with extra features compared to the legal standard, specific contracts are a necessity, stipulating these extra requirements. Depending on the type of product and asset specificity etc., different types of contracts can be negotiated between chain members, aiming at reducing the transaction costs within the chain. In addition, the role of certification standards as a means for supply chain governance and the level of integration in the chain associated with this, should be acknowledged. The type of market structure determines the type of certification, in all its aspects, which, on its turn, determines the type of contractual arrangements between the contracting parties. In case of a relationship between many suppliers and many possible buyers, negotiating personally adapted contracts are time and money consuming, resulting in high transaction costs. To reduce the costs, a common standard can be put forward. This standard is the result of a bargaining process between the contracting parties (or their representatives). Certification books are such a type of contract.

When a standard is too generic, distance with the spot market product is too small, and liability problems might be imminent. Oppositely, when the standard is too severe, compensation mechanisms should be more elaborated, and associated control and monitoring efforts are high, as well as transaction costs. Furthermore, the independency of the actors involved decreases due to the need for asset specificity. The risk of empty shelves is than also imminent (which was often the case for organic products in the past), because supply is too small.

Three main types of implementations of standards and grades can be identified in the marketplace, resulting in a different market organization and, as an aside, cahier de charge: (1) farmer-driven initiatives, comparable to the 'national brand'-approach, (2) retail driven vertical alliances between producers, manufacturers and retailers and (3) generic standards common to several retailers. The Flandria/FlandriaGAP-initiative examples the first type, while EurepGAP represents Europe's main example of the third type. Examples of the second type are the Fruitnet – Delhaize alliance or the 'Filières Qualité Carrefour'.

Flandria, unlike the majority of other certification and labeling initiatives in the Belgian fresh produce sector, is inextricably linked to the major fruit and vegetables auctions in Flanders, associated in LAVA. These auctions were initiated with the aim of creating market power for the suppliers by offering a large product quantity. Over time, they have evolved to a mediating role between actors upstream and downstream in the chain. Over the years, the responsibilities of the auctions has grown dramatically, now covering fields such as estimation of supply and demand; optimisation of sales; product quality; research; promotion; farmer counselling and introduction of environmentally friendly techniques.

2.5.2. Market shares

Off all vegetables produced in Belgium, approximately 600 000 ton is meant for processing, a share of 35% of total marketable vegetable production (NIS data for 2003). Typical varieties are green peas, carrots

and cauliflowers. Vegetables grown in private gardens account for 10% of the total vegetable production (or 174 619 ton, NIS data for 2003). Several focus group participants made a remark concerning the potential risk of pesticide use in the group of hobby gardeners, because a (monitored) code of conduct for this group is absent and ignorance is widespread. With this number in mind, the effect on environmental sustainability of their pest management attitude might be significant.

Vegetables for fresh consumption account for 52% of the production (approximately 879 000 ton). Of this share, 44% (or 389 000 ton) is produced in greenhouses (mainly tomatoes and lettuce), 56% in plain air. The majority of these products can be certified within Flandria (55 product groups, in FlandriaMail Professional, 2005). Certification books are now introduced for more than 90% of the vegetable groups produced in Belgium (FlandriaMail Professional, 2005). The VBT (VBT Jaarverslag, 2005), the Association of Belgian horticulture auctions, reports a vegetable delivery of 966 144 ton in 2003 (and 1029 831 ton in 2004) for their 10 principal product groups. These numbers indicate that a part of the produce marketed via the auctions is also meant for processing.

The total number of vegetable growers adhering to Flandria is about 3500 (FlandriaMail, 2005). According to NIS, 2981 firms were in 2005 registered for producing fresh vegetables in open air and 1527 greenhouses, amounting to 4508 production units for fresh vegetables. These figures show the importance and spread of the Flandria vegetable standard. Approximately 1000 gardeners associated with the Auction of Mechlin also follow the more restrictive FlandriaGAP/EurepGAP standard. In October 2005 this number was limited to 208 (153 greenhouse gardeners and 55 outdoor vegetable growers, MV Info, 2005). The rapid change in FlandriaGAP-EurepGAP certified producers is a proof of the rising demand from buyers for these more restrictive process standards.

The market share of Flandria is highly dependent on type of product. From the 7 principal fruit vegetable varieties (such as tomatoes, peppers and cucumber) delivered to the Auction of Mechlin, at least 6 of them are offered for more than 80% in the Flandria-version (4 for more than 90%). More than 90% of each of the 7 principal leaf vegetable varieties (lamb's lettuce, iceberg lettuce, classic lettuce etc.) is offered in the Flandria-version. Eight out of twelve of the open air vegetables (such as cauliflower, broccoli, leek and carrots) also reach the 90% level.
Based upon these figures, one could argue whether the Flandria-products are still the top segment in the market. On the other hand, the strength of the auctions has always been to create sufficient supply of uniform quality. These numbers indicate that buyers can always rely on sufficient supply of the vegetables with the Flandria quality level.

3. The instruction book as an equilibrium of stakes

3.1 THE CONSTRUCTION PROCESS OF INSTRUCTION BOOKS

We hereby focus on the construction process of the FlandriaGAP-standard. The construction process of the EurepGAP-standard is largely similar (and is documented in Annex 6.3).

A Redaction Committee, composed of technicians from the auctions, adapt the Flandria/FlandriaGAP certification standard, after analyzing existing certification books in the market place. LAVA, as manager of the Flandria standard, decides upon approval.

Government officials are not involved at redaction level, but they do play a role during accreditation, by checking whether the standards surpass the law and the correct procedures have been taken into account. For the accreditation procedure, an advisory committee is founded, consisting of representatives from environmental movements, the Farmers Union, consumers (Test Aankoop), two universities and the Belgian Federation of Distribution enterprises (FEDIS). The committee's advice is not binding, but repeated denial will result into non accreditation from the Belgian Organisation for Accreditation (BELAC).

The Flandria standard covers both product and process certification, which are independently certified. The process certification, at this moment, is not yet certified, but in the near future, will be based upon the ICQM-standard (Integral Chain Quality Management), supervised by VegaPlan vzw. The product quality is independently certified.

The average producer has no direct impact on the rules and formulations in the cahier de charge. To avoid unrealistic instruction books, groups of 10 to 20 farmers, together with 2 technicians from the auctions, discuss the practical feasibility and consequences of new rules. Other complaints are normally communicated towards the samplers at auction level. Based upon statistics from these complaints and the control results, adaptations to certain bottleneck rules are made, normally discussed at a monthly reunion of the Redaction Committee.

3.2 DRIVERS FOR CHANGE

The main drivers for adaptation of the standard are, as stipulated in FlandriaGAP (2004), changes in the current legislation, fine tuning with other private initiatives, changed demands from buyers, new production techniques, scientific results, remarks of participants and of involved organizations (f.e. auctions, auditors, control bodies). During the focus groups, the participants complemented these drivers for change with the following: relaxation of certain rules, incorporation of what is already done in practice, economic stimuli and proactive action. In fact, improved ecology as such is not the motive for change. Adaptation is a continuous process; each year new versions of the certification book are launched. During adaptation, LAVA takes into consideration that the full number of participating farmers should be able to make the transition more or less fluently.

The following rationale is followed:
1. Is the proposed change technically feasible?
2. Does the change offer an economic opportunity?
3. Are there interesting environmental side effects?
A more detailed description of the latest changes in the certification book of FlandriaGAP are given in Annex 6.4.

4. Communication of certification efforts: labeling

In case of Flandria, the standard is accompanied with a label, and hence, communicated towards the end consumer. From growers' point of view, this strategy can prove very useful since the associated label acts as a pull mechanism. As indicated in a personal survey by Dimarso (2005), nearly 40% of consumers is familiar with the name Flandria in relation to vegetables.

For diversification purposes, some quality distribution chains prefer niche products, implemented through collaboration agreements with a restricted number of farmers and direct communication towards the end consumer. The Flandrialabel has become too wide spread (in the Belgian market) for this purpose, they argue. Another possibility is the use of product segments within a label. The distributor can then differentiate based upon the vegetable variety (and not upon the label itself). Some distributors prefer this system, and hence, prefer Flandria.

In the focus groups, it was argued that consumers demand quality products, but they are hardly interested in a profound analysis of the accompanied label. The major part of consumers expects that the retailers guarantee the products meeting their quality demands, i.e. the retailers do the thinking. This attitude is closely linked with the consumers' direct and harsh reaction when crises appear. All products, whether certified or not, will suffer from a food scare, because the consumer is uninformed.

When communication is at stake, some important subsections can be identified: is it necessary, what should be communicated, who should do this, abundance of different labels.

4.1 WHY A LABEL?

It is argued that a label creates recognizability and, after a positive sales experience, trust at consumer level. A label in this sense functions as a proxy for the farmer, because the distance between farmer and consumer has grown dramatically. Secondly, a label is the signboard for the specificness of the product (or underlying process), with regional, organic or fair trade products as main examples. Thirdly, from initiator point of view, a label can create consumer loyalty and hence, reduce the power of the retailer, due to the pull mechanism, i.e. the national brand approach.

4.2 ARE LABELS AND NICHE PRODUCTS INEXTRICABLY LINKED?

Flandria is, in the Belgian market place, considered as a base product (not a niche product), due to the large part of vegetable growers participating in the initiative (approximately 3500 growers). In the European market, where Flandria's share is about 3%, it is still a niche. The question whether labels should be niche products or not is quite lively nowadays. A major driving force for the debate is the possibility of gaining (Flemish and) European subsidies for quality chains. The European regulation states that these subsidies should be reserved for 'specific products', fuelling the debate whether certain products (f.e. these of Flandria are specific or not. The Flemish government has approved Flandria's claim of being a specific quality product, because specific and large scale are not necessarily opposite. Whether Europe will follow this reasoning is still an open question.

By promoting local (small scale) initiatives, one might create a schism in the large group of current Flandria producers. By adhering to these schemes, some individuals will improve their situation, but the situation of the group in total will deteriorate, due to loss of one of Flandria's major strengths, its large supply, making the initiative less commercially attractive for the market (with the need for standardization in mind).

Another remark worthwhile mentioning in this context is whether the market should focus on the underlying varieties and processes (as niches) instead of focussing on the label as a niche. In that case, a label can cover both niche and non-niche products.

4.3 WHAT SHOULD BE COMMUNICATED?

It is widely acknowledged that the communication message (the label in this case) should be **straightforward, unique and short**. The problem is that a more complicated message is not processed by customers due to the multitude of messages; hence certain important aspects of products (or processes) cannot be clarified. Due to these short messages, a lack of knowledge exists on consumer level, mainly a lack of knowledge concerning the content and meaning of the label. The meaning of the term 'Integrated Farming' for example, part of Flandria's label, is unknown (and difficult to explain). Opposite to this, representatives of the consumers state that consumers nowadays are evolving from product interested into process interested consumers, opening the doors for a more in depth communication strategy. It is argued that the information gap should be filled by chain players (and not by activating consumers), because creating information sensitive consumers (f.e. by informing students at high school level) will only be effective in the long run. Although Flandria stands for quality products produced according to the rules of environmentally conscious farming, consumers mainly perceive the products as regional (Flemish) quality products.

4.4 MULTITUDE OF LABELS

Consumers do not see the forest through the trees anymore. Too many indistinctive labels exist in the market place. The difference between labels mutually, as well as between a label and the current legislative level is often very unclear, unnecessary hampering consumers' purchase decision process. The obvious result is that labels loose their communicative power. It should be noted that currently, unlike the meat sector, the fruit and vegetable sector is still not overlabeled. From farmers' point of view, the less labels (and certification books) the better (due to the transaction costs involved). They argue that the demand for more labels comes from the distributors, for diversification purposes. At the same time, distributors apply the technique of merchandising (offering the same product as the competitor, but with a different packing). Some retailers do not ask for more labels, they prefer a larger diversity (in vegetable varieties) within the existing labels.

4.5 ORIGIN

It should be remarked that a reasonable part of the farmers do not see a major problem in other fellow European farmers participating in the initiative, as long as they abide by the rules in the Flandria certification book. They do find that, at governmental level, the regional laws should be harmonized at the European level, to make competition more straightforward. Another major issue for the farmers is the type and level of certification standards and controls applied in Southern European countries and North Africa, because these countries offer low cost products from doubtful origin (concerning production

process and product quality), putting a high pressure on product prices in our market. The initiators of Flandria argue that, in this sense, the high levels of quality and productivity, together with the unified supply (through LAVA), mean an important counterweight against (the cheap) products from new and non-EU member states. Especially the high level of organization (cooperation between the different LAVA-auctions) is considered as a major competitive advantage.

Likewise, the entry of new foreign (mainly Dutch and French) farmers to Flandria, is considered by the initiators (the auctions) as mutually beneficial for both parties (as indicated in FlandriaMail Professional, 2005). These foreign growers are mainly attracted by the transparency of the price formation system (the combination of auction clock sales and forward sales), advantageous for the grower. Other arguments are the consistent attitude of the farmer unions (auctions) with respect to the certification books, the quality control and the personal contact with the farmer, the latter being largely absent in our surrounding countries. For the buyers, the concentration of supply (with lower transaction costs as a result) is also interesting. What with the Flemish farmers? It is argued that only those production areas where sufficient supply of uniform quality can be attained are able to become price makers in the market place, beneficial for all participating farmers. Whether the auctions can be considered as price makers, is off course question of debate (see price formation).

4.6 INTEGRATED FARMING AND COMMUNICATION

Part of the Flandria logo refers to environmental conscious farming practises, by means of a 'Green Bow' (see Figure 6.2). This has always been the number one rule within the Flandria–initiative. The Green Bow was aimed at becoming the Belgian symbol for environmental conscious farming, but it has somewhat missed its communication purposes, due to the many food scares, which forced the Flandria-initiators to put more stress on the food safety and control measures in the initiative, as well as on the GAP. Because other initiatives also use the bow (f.e. Eburon and Haspengouw) and due to the difficulty of (briefly) explaining environmental conscious farming, Flandria's communication strategy is mainly based upon its superior product quality.

Figure 6.2: Communication of Flandria's environmental efforts by means of a Green Bow label

5. Monitoring and Control

The role of monitoring and control of private standards is crucial with regard to the equilibrium of stakes between the actors involved. Following subdivisions are made to capture the full extent of the topic:

- Drive towards third party certification;
- Individual or group certification;
- Control frequency;

5.1 THE RETAIL DRIVEN SHIFT TOWARDS THIRD PARTY CERTIFICATION

Private standards as such are ineffective without an enforcement mechanism. In this sense, third party certification (TPC) is emerging as a key institution for enforcing private standards, because it is both independent from producers and from governments (Hatanaka et al., 2005).

Independent certification bodies (ICBs) can be accredited[29] by international or national institutions that may be either private or a hybrid of both public and private. EurepGAP for example is a private accreditation institution, contrary to LAVA, the Flandria-promoter. The costs involved with obtaining this legal status are currently considered as to high, as well as the duration of the procedure involved. One of the primary reasons given for the proliferation of TPC is its perceived character as being independent and

[29] i.e. an authoritative organisation gives formal recognition that the particular third-party certifier is competent to carry out specific tasks

objective. The independence of TPC from other actors in the chain (buyers and sellers) distinguishes TPC from first (audited by suppliers) or second-party certification (audited by retailers' technicians) (Tanner, 2000), giving TPC more legitimacy since ICBs are thought to have no stake in the outcome of the transaction (Fagan, 2003).

Several advantages of TPC can be identified from **retailers**' point of view:

- retailer responsibility for policing the safety and quality of their products is minimized (i.e. it is transferred to the ICB) (Bain and Busch, 2004) enabling them to invest in other domains (such as R&D);
- liability shifts from retailer to third party certifiers (Tanner, 2000);
- costs of monitoring food safety and quality can be shifted to suppliers (Henson and Northen, 1998);
- TPC can be used by retailers as a marketing tool, by communicating their standards via labels (Farina and Reardon, 2000);
- TPC also reduces transaction costs through assuring higher levels of food safety and quality (Henson and Northen, 1998), by reducing waste and increasing efficiency in the chain.

From **producer**' point of view, it is less clear whether the final outcome of TPC is positive:

- they may gain economic opportunities in the market place over those producers who are not certified. However, instead of gaining a competitive edge, TPC may be more about simply remaining in the market place;
- positive bias towards large farms, because the certification costs can be spread over a larger production;
- the costs of TPC are transmitted to the farmers;
- the accomplishment can mean prestige and personal pride for the farmer (as indicated by Hatanaka et al., 2005 and in the focus groups);
- buyers' claims of poor quality (to reduce price) can now be challenged more formally;
- increased efficiency and economies of learning at farm level due to the audits.

Each auction has its particular way of implementing the monitoring and control system. In general, external product controls are effectuated at auction level, with focus on external quality, shelf life and registration, while internal product controls, with main focus on residue analysis, are performed in a specialised lab (Fytolab).
Process control (at farm level) is executed by auction representatives, augmented with occasional third party controls executed by Certagro or another ICB. When a complaint is raised, i.e. when the standards are not met, the farmer temporary looses the Flandria label, implicating sales below the favourable Flandria price.

5.2 INDIVIDUAL OR GROUP CERTIFICATION

In case of group certification, the farmers' union (in casu the auction) is controlled and certified by the independent control body. This union, on its turn, effectuates the controls at farm level. When successful, the farmer receives an attest from the auction's control officer. The independent control body also examines a sample of the farmers (the square root of the total number of participating farmers at union level).
In case of individual certification, an independent control body directly controls the production process at individual farm level. The approved farmer then receives an individual certificate.

The majority of certified farmers opt for the group certification system, for reasons outlined below. The group certification system has some important advantages from **farmers' and auctions'** point of view:

- the costs at farm level are lower;
- the relationship between farmer and auction controller is less formal compared to the independent controller, leaving the farmer with more breathing room;
- farmers who have difficulties to comply with the rules (f.e. those at an advanced age) can be treated more softly, enabling the union to maximize the number of approved farms, and hence, creating sufficient supply;
- the controls are sometimes combined with audits and consultancy;

Some drawbacks can be identified as well:

- weak elements can survive longer in this system, resulting in a possible higher threat off non-compliance and eventually, chance for crisis within the initiative;
- retailers prefer that all certified produce is independently controlled, to reduce the influence and power of the unions and to secure 100% compliance with the standard;
- some farmers adhere to several certification standards. The independent control body can then combine the controls for each standard, resulting into lower transaction costs for the farmer.

5.3 FREQUENCY OF CONTROLS

Currently, farmers participating in Flandria are controlled minimum once in three years, and on average they are controlled once a year.

Regardless of the type of control, the number of controls is of importance, for several reasons:
- the more controls, the less chance for evaders to survive in the system;
- the costs for control (i.e. monitoring costs) are borne by the farmer (or the auction, depending on the system);
- controls are time- and effort-consuming;

From **retailer** point of view, the more controls the better, because this will increase the probability of meeting the standard. Taking into account that they don't directly pay for the number of controls (indirectly it could be translated into the end price), it is clear why they argue for more (and independent) controls. Retailers are extremely concerned about their reputation; this is why they perform extra sample controls (at the product level) on the products in their shelves. The more controls upstream, the less need for these extra controls.

5.4 PUBLIC VERSUS PRIVATE CONTROLS

With the system of self checking been put in place, as a result of the General Food Law and the RD of 14/11/2003, the Food Agency aims at reducing the need for unannounced inspections. The farmers have to prove to adhere to the rules as stipulated in the Law on self checking, for example by following specifications in the sector guides approved by the FA. Both auditors from the FA and from ICBs, if accredited by BELAC for the involved sector guide, can perform the necessary audits. The ICBs can make combined audits, by checking simultaneously whether the specifications in the sector guide and in the private certification standard are followed correctly.

The FA does not make a distinction between firms participating in a private certification initiative and those not. With respect to unannounced controls, each farm has the same probability of being controlled by the FA (or its subcontractors). They argue that adhering to the law should always be considered directive for adhering to a private standard (and not the other way around).

6. Sustainability of private certification initiatives

6.1 INTRODUCTION

The next section is crucial with respect to the question whether voluntary certification initiatives are sustainable in the long run or not. As indicated by the majority of the focus group participants, a clear distinction should exist between legal requirements and the certification standards. As the recent introduction of hygienic measures or the law on self checking clearly shows, the legal standard is evolving as well. When the distinction disappears, the private initiative's two remaining options are disappearance or further evolution. In case of disappearance, one could argue that the initiative is still sustainable, because it has pushed the law to a higher standard. Although the initiative itself disappears, its legacy becomes common practise, and hence its final purpose is fulfilled. On the other hand, to guarantee its own reason for existence (i.e. to remain self sustainable), it is clear that the certification standard has to continue to surpass the law.

Market actors do not fully agree upon the evolutionary potential of standards, resulting in opposite stakes in the chain. Crucial for this issue is the division of costs over the different parties involved. Due to the competitive nature of our economic system, further evolving standards will hardly be compensated in the price at farm level (see price formation). As a result, market gardeners experience the current certification

standards as the final limit; no further evolution is economically viable from their point of view. Oppositely, stakeholders further downstream in the chain favour evolving standards, as it is a necessity in a competitive economy. It is clear, when taking the market power of these players into account, that the latter will be the case.

Another bottleneck from farmers' point of view associated with this, is the tension between current sales and future changes in the certification book. To maintain the current sales in the high quality FLANDRIA-class, farmers admit to sometimes make false statements in the certification book's registration forms (they admit that 'paper is willing'), otherwise they risk loosing the certificate for the product batch in question. Then, a wrong conclusion regarding the evolutionary potential of the certification standard can be deducted from the control figures, when these indicate that farmers have no difficulties with adhering to the current prescription level.

Regardless the outcome of this discussion, possible fields of evolution are, amongst others, as indicated by the focus group participants:

- fair trade products;
- seasonal products;
- labour conditions;
- taste related issues;
- incorporation of health improving substances;
- water recycling issues;
- use of renewable energy resources.

During the subsequent discussions, several factors were appointed by the **farmers** with respect to the economic surplus value of certification. Firstly, it creates increased market certainty for the involved farmers, which is important given the risky nature of agricultural production, not only because of the difficulties to control a complexity of different factors such as climate, pest pressure and nutrient levels but also because of the rather low return on investment. Greenhouse gardening in particular demands high capital investments even before the first crop can be harvested. The channels demanding the certification normally (on average) offer better prices compared to those without these demands. Secondly, the farmers also identify the possibility of earning a direct and indirect financial surplus. The direct financial surplus should be interpreted, as outlined further in the text, as maintaining the price level on its historical level, given that the trend for agricultural commodity prices is downward. The indirect financial surplus can be attributed to the optimisation of the production process, resulting into increased efficiency and in the end, lower costs per unit (with f.e. traceability as an example). This argument can be closely linked to the third factor, stating that certification standards are normally based upon best practises. Finally, the farmers argue that certification accelerates the natural selection amongst farmers, which makes the sector more viable.

The **retailer** identified two main drivers for economic surplus value; the positive effect on market positioning and the safeguard function, both closely relating to the strategic objectives of certification.

6.2 BENEFIT/COST EFFECTS

When certification standards, considered as contracts, become more restrictive, transaction costs will increase, as well as input and output price differentials.

6.2.1. Output price differentials at farm level

Adhering to the certification standard is a prerequisite for starting price negotiations in preferential sales channels. This means that **the prices are not fixed a priori and depend on the supply and demand ratio**. The Flandria certificate is only administered to the products from the highest quality class, and price formation at auction level is based upon the quality level. One can argue whether features other than the product quality (such as environmental friendliness) are reflected in the price formation.

Price formation system

Price formation in the fresh vegetable market can no longer be considered in a local context. Buyers are increasingly represented in the different auctions over Europe and even abroad. The transportation cost is off course a driving factor in the market of fresh produce, still favouring local production for local

consumption. The price formation system in the Belgian auctions is based upon the combination of auction clock sales and forward sales.

For reasons of transaction costs involved, retailers operating internationally, now increasingly demand the EurepGAP-standard. Two options for the auctions exist to increase their supply in the EurepGAP version. The Auction of Mechlin introduced the FlandriaGAP standard (instead of the more theoretic and less locally adapted EurepGAP standard) to guarantee a rather soft transition for the affiliated farmers, bearing in mind that the majority of these farmers produces at small scale. However, the **FlandriaGAP-initiative** seems to be doomed to be fully **replaced** by the EurepGAP-system, due to the continuous demand for EurepGAP-products, mainly from non Belgian buyers. In practice FlandriaGAP version 2005 has been made fully compatible with the current EurepGAP-standard.

Table 6.6. Evolution of preferential positioning of Flandria

Period	Product Quality level 2	Product Quality level 1	
		Process quality level 2	Process quality level 1
1995 - 2000	Flandria declassed	Flandria	/
2001 - 2005	Flandria declassed /	Flandria	FlandriaGAP/EurepGAP Q1
2006 -	EurepGAP Q2	Flandria	EurepGAP Q1

Q1 = Product Quality level 1; Q2 = level 2

The drive towards EurepGAP within the retail sector is not only affecting the sustainability of the FlandriaGAP-system. As indicated in Table 6.6, the **Flandria-standard** has **degraded** to a second class process standard, but remains a first class product standard. Due to pressure from market players downstream (mainly German retailers), the auction will offer the FlandriaGAP/EurepGAP and the Flandria products for sale in separate blocks. The prices will only temporary remain the same, finally resulting into a price premium for the FlandriaGAP/EurepGAP block, further encouraging conversion to this more demanding standard. The aim is to make sure that in a very short notice all Flandria-products are conform FlandriaGAP 2005 (or EurepGAP equal). The board of Council of the Auction of Mechlin agreed upon this, given that the buyers are not asking but demanding this shift (MV Info, 2006).

Auction Reo, the second largest Belgian vegetable auction, did not make the transition from Flandria to FlandriaGAP, instead they opted in 2001 for the introduction of EurepGAP as their most restrictive standard, because the auction acknowledged EurepGAP becoming the leading European vegetable standard. The price formation system is comparable with the other auctions, expect for one (crucial) difference, the ponderation of the EurepGAP price. When prices for EurepGAP products are lower compared to these of the less restrictive Flandria products, both prices are ponderated (see example), therefore EurepGAP certified vegetables at least realize the same price. A lower price results from the auction's clock mechanism. EurepGAP and Flandria products with the same product quality level are offered for sale simultaneously. If a buyer decides to purchase all of the EurepGAP certified produce, other buyers have to compete for the remaining offer, resulting in higher prices for the Flandria product. A higher EurepGAP price, on the contrary, is not ponderated. This system is used to promote the following of the EurepGAP standard. The auction reasons that market gardeners will only be motivated to convert when the new standard is coupled with a price premium.

Table 6.7. Price ponderation mechanism at Reo auction

Tomato variety	Initial auction price	Quantity (%)	Ponderated price
Prince +57 FLANDRIA	0,223 €/kg	10%	0,213 €/kg
Prince +57 EUREPGAP	0,163 €/kg	2%	0,213 €/kg
Prince +57 FLANDRIA	0,223 €/kg	10%	0,223 €/kg
Prince +57 EUREPGAP	0,269 €/kg	2%	0,269 €/kg

Farmers' opinion concerning current price formation

The gardeners participating in the survey were asked whether they are satisfied with the current price formation system or not. Almost 80% of the respondents are satisfied with the price formation system through clock and forward selling. The 20% non-satisfied farmers mainly question the price variability in the system, due to the variability in supply and demand, creating price uncertainty for the gardener. The majority of participating farmers (70%) prefer the current system over other price formation systems. 23%

of the gardeners indicated to prefer a guaranteed minimum price for the certified product, while 7% are in favour of a system in which a fixed percentage is added to the price of the non certified product. Other systems, such as fixed price and quantity agreements between buyers and sellers, are not seen as equally favourable by the affiliated farmers.

During the focus group sessions, it was repeatedly acknowledged that the **product price did not increase** due to the introduction of more severe certification books. This is contradictory to the farmers' initial expectations when considering participation or not. The reasoning is the following. The innovators and early adopters (those who participate in the new standard from the beginning) will probably gain a periodical surplus value. The price of the former product will remain more or less status quo, due to the decrease in demand and supply for this product. With the number of adopters increasing, the equilibrium price for the new standard starts decreasing to a level comparable with the equilibrium price for the former standard. The laggards still retaining the former standard will then receive a product price far below the price before introduction of the new standard. Thus, the gardeners do not participate in these initiatives because of the possibility to capture a surplus price, they do so to retain the price they could realize before the new standard was imposed. The result of this shift is a higher product standard with equal product prices, advantageous for retailers and consumers but at the cost of the gardeners.

A parallel can be drawn between this evolutionary path and that of **firm size**. The price for the former standard products does not sufficiently cover production costs, hence the laggards will disappear. The innovators will fill the resulting gap by acquisition of these firms or by investing into larger firms, partly aimed at covering the costs of compliance with the increased standard.

It is important to notice the difference between small scale (niche) initiatives and initiatives such as Flandria and EurepGAP, which are meant to become quasi **generic standards** in the mainstream market. To ensure compliance of the majority of affiliated farmers, the generic standard cannot be too restrictive, hence the surplus price disappears in the long run. As indicated earlier, the generic standards are advantageous both for the auctions, because the offering of large quantities makes them commercially attractive for buyers, and for the retailers, because they have to make sure that they do not end up with empty shelves (which is the case when a standard becomes too restrictive).

The farmers opting for **price formation outside the auction** system take advantage of the auction system, because, as a rule of thumb, a strong price at auction level will result into a strong price outside the auction. However, if the number of farmers operating outside the auction system increases, prices will drop, for two main reasons. First, market power imbalances between farmer and buyer push the price downward and second, individual farmers lack sufficient insight in the current prices.

Willingness to pay/accept

In a choice experiment (see Chapter 7), a price component was added, with a twofold purpose. On the one hand, a price measure is necessary for the assignment of monetary values to the perceived utilities associated with the other attributes. On the other hand, it is interesting to calculate a utility measure associated with an increase or decrease in price at farm level. We opted for a relative increase/decrease in end product price, because absolute price levels depend upon crop type and variety. Furthermore, they are subject to continuous changes, due to seasonality and changing supply and demand.

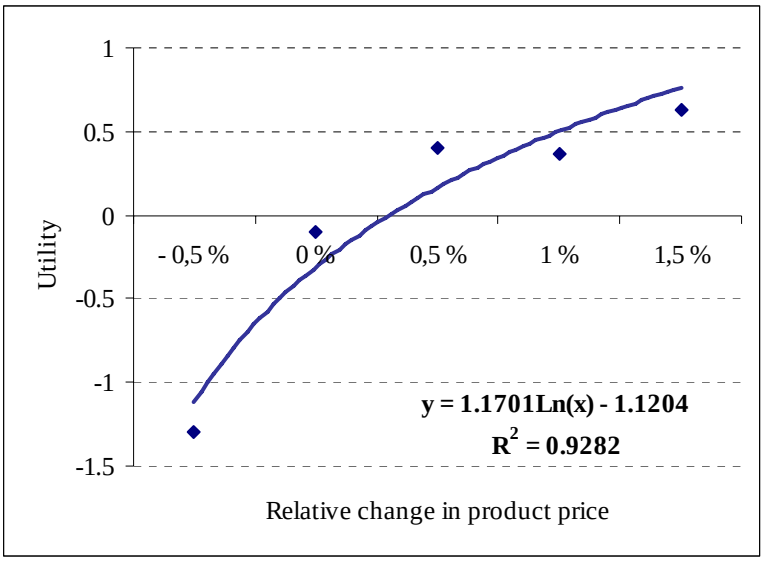


Figure 6.3: Utility of a relative change in product price (at farm level)

The proposed price change levels ranged from -0,5% to +1,5%. For the chosen price levels, utility estimates were obtained. Data analysis shows that the relation between price change and utility is non-linear, with a higher disutility estimate for a decrease in price level compared to the utility measure for an equal increase in price level. This is remarkable, though not surprising. The market gardening is a sector with fierce competition, both locally and internationally; hence product price equals marginal costs. On the other hand, in this capital intensive sector, changes in price level can dramatically affect the solvability and liquidity ratios at farm level.

6.2.2. Input price differentials

The question of changes in the inputs, and thus input prices, heavily depends on the changes in the standard and on the individual farm characteristics. In the Flandria-initiative for example, changes in the standard, as argued before, will only be made when the appropriate techniques are available and when the economic cost at farm level is bearable for the majority of participating farmers, or when the changes offer an economic opportunity for the farmers individually (f.e. pollination) or as a group (f.e. traceability). Normally, considerable time is given for the farmers to implement the new rules, i.e to do the required investments.

Concerning individual farm characteristics, the changes in the standard predominantly affect the **older firms**, for several reasons. Firstly, the required investments are larger compared to newer, already adapted firms. A good example is the waste water recuperation and recirculation, largely absent in older firms, but standard applied in newer firms. Secondly, the farmers themselves are on average older, hence they are no longer willing to make large investments. Thirdly, the older the firm, ceteris paribus, the less profitable the firm will be, because it is less adapted to the requirements of the current market. Hence, the margin of these firms will be under higher pressure, leaving less room for new investments. Fourthly, firms tend to be bigger nowadays, thus extra costs can be spread over a larger production. A second group of more affected firms are those which combine **several crops**, because they have to comply with the changes for each different crop. Some of the changes will be generic and thus equally important for firms with monoculture versus firms with mixed cropping, while other will be crop specific.

Can changes be significant?
Normally, changes of the production process due to changes in the certification standard are rather small. The farmers' reason that those who are not able to make the proper adjustments are in general incompetent of surviving in the current market.
Some examples of investments due to the increasing standard are the phyto storage clauset, computer for administrative purposes (as well as taking computer classes), break free striplights, separated lavatories for men and women, away from the harvesting and processing area, investments in fresh water use and recycling (not yet obliged), protective clothing, electric forklift, etc. The largest investment is normally due

to changes in pesticide treatments allowed. If the cahier de charge becomes more restrictive in this sense, the production can decrease.

6.2.3. Transaction cost differentials

Adoption of the various quality assurance systems can play a role in mitigating costs in the food chain. In the short run, firms incur sunk costs (e.g. start-up costs) related to adoption of the quality system. These sunk costs will, of course, vary depending on firm size, product type and existing quality system. There is also an apparent desire to shift the costs of quality control to others in the chain. Transaction costs are the costs of undertaking an exchange between a customer (buyer) and a supplier (seller). They consist of the informational search costs, the negotiation costs and the monitoring/enforcement costs of undertaking an exchange. Transaction costs encompass all aspects of the contractual relationship between the customers and suppliers (Hobbs, 1996). Transaction costs are of major concern for the different stakeholders involved. As indicated before, due to the multitude of suppliers, specific contracts are to be negotiated to guarantee product uniformity and quality over the different suppliers.

The **market gardeners** are in fact mainly influenced by the need for **asset specificity** due to the standard. On the one hand, the number of resources available for the farmer is restricted compared to those producing for the spot market, on the other hand, extra demands are made concerning product and process features, with less degrees of freedom for the farmer as a consequence.
Furthermore, to guarantee a transparent monitoring and control system, the certification book stipulates many rules related to documentation and **administration**. Although not part of the core business of the gardener, this property has become increasingly important in the current certificated market. It should be noted that the extra costs due to this registration and administration process (mainly man hours) are seen as both economically and psychologically unfavourable from farmers' point of view, the former because no extra compensation is given for the administrative burden, the latter because farmers are in general not very used to and keen on paperwork. The farmers acknowledge that after a period of time they are habituated to certain administrative tasks, resulting into a decrease in time loss. In general, transaction costs for farmers decrease over time, due to **economies of learning**. Furthermore, the administrative tasks to be performed for certification purposes, might even result into a decrease in costs, because the farmer is more informed about inefficiencies in his management system and is able to act appropriately. As indicated in the questionnaire, the duration of weekly administrative tasks varies between 15 minutes and 1 hour, depending on the farmer and the farm type.
Apart from the certification book demands, greenhouse gardeners are more used to administration compared to gardeners with open air production, due to the higher number of personnel and the biologic crop protection measures applied. Furthermore, the majority of greenhouse gardeners practices monoculture, which further limits the administration required.
As mentioned before, the **controls** also incur transaction costs at farm level (preparation and execution time). Whether the costs of control are covered by the auctions or not, depends on the auction involved. Considering enforcement costs, non compliance results into loss of the certificate for the product share under consideration.

The **Auction** of Mechlin deducts approximately 2% of the product price as a compensation for the functioning of the auction system. The contribution for Flandria is integrated in this amount. Meanwhile, the auction, as a farmers union, receives a budget from the European Commission as part of the Common Organization of the Market in Fruit and Vegetables (COM, see EC No 2200/96), meant for improving quality and economic value of the products, and diffusion of environmentally friendly production techniques. Fifty percent of the required budget should be raised by the union members (i.e. the gardeners), and is incorporated in the product price deduction mentioned before. At Mechlin, the product and process controls (both at farmer and auction level) are not separately charged, these are all incorporated in this contribution.
The auctions, as initiators and pullers of the Flandria-initiative, bear the costs for composing and afterwards negotiating the new standards towards both suppliers and sellers. Indirectly, these costs are paid by the farmers (through their auction contribution) and the tax payer (because of the European subsidy).

The switching costs for farmers (to another auction or cooperative, with another certification system and/or price formation system) are high due to two main factors: the COM-contracts with the union

members have a duration of 5 years and are difficult to break, and the auction should be informed 7 months prior to the farmer's transition, leaving the farmer with a difficult period to pass.

The retail has largely succeeded in shifting the transaction costs towards the upstream chain members. The costs involved at retail level decrease due to these certification initiatives, because product characteristics are well framed and third party control is applied. Due to due diligence and liability laws, retailers are increasingly interested in this kind of systems.

7. Conclusions

Based upon the dynamics during the focus group trajectory, following concluding remarks with regard to (generic) certification and labeling initiatives can be made.

The studied certification standards aim at separating top quality vegetables produced in an environmentally sound manner from others. The top of mind motivation for participation in the initiatives for the different stakeholder groups can be summarized to risk reduction, differentiation and standardization. For farmers the necessity, or the license to deliver, is equally important. Standardization is of major economic importance for retailers, but, in combination with the objectives of risk reduction and diversification, puts a high pressure on the individual farmer's degrees of freedom. The objective of risk reduction is mutually interesting for both retailers and farmers, while the advantage of differentiation for retailer or farmer depends on the type of communication.

Safety, quality and environmental standards should be integrated at a pace enabling compliance of the majority of participating farmers. Farmers acknowledge the prominent role of a label both with respect to communication of the quality and environmental quality features of fruit and vegetables. Further, the use of environmentally friendly crop protection techniques results into both economic advantages and disadvantages from farmers' point of view compared to the more classical pest reduction techniques. However, farmers state that ecology is becoming too demanding, because technical feasibility is not sufficiently taken into account. Both the restrictive legislation and the unrealistic demands of buyers should therefore better be scientifically revised.

Different drivers for adaptation of the standards are, amongst others, changes in the legislation, fine tuning with other initiatives, changing demands from buyers and the availability of new production techniques. In general, the sequence followed is: technical feasibility, economic opportunity, positive ecologic effect.

The label as such acts as a proxy for the farmer and is a signboard for the specificity of the product. It further helps to create consumer loyalty. Labels and niche products need not be inextricably linked, because, with the market becoming more internationally oriented, every Belgian product is a niche. To counter the negative effect of the multitude of labels, the communication message should be straightforward, unique and short. Furthermore, the difference between labels mutually and between a label and the legislation should be clear. Origin as such is not an issue for both auctions and retailers. Due to the difficult message and the many food scares lately, shifting attention away to food safety, communicating environmental quality attributes has not been overwhelming successful, certainly in the certification systems which are non organic.

With respect to monitoring and control, the shift towards third party certification has improved the reliability of the certification systems. It further mainly favours retailers' stakes, because both costs and liability can be transferred to the suppliers. Group certification on the other hand has some important advantages from farmers' and auctions' point of view. Because costs for monitoring and control are mainly shifted towards the suppliers, retailers prefer individual certification, which is the most stringent system. A high frequency of controls is, for the same reason, encouraged by retailers. Farmers acknowledge the need for controls, although they are generally not keen on them.

Certification creates price and market access differentials. The prime economic surplus value for farmers comes from increased market certainty and the financial status quo that can be realized in a market with downward prices. In the more generic certification systems, there is no direct relation between certification and price level. The certification standard acts as a license to deliver, with price negotiations only starting when the standard is reached. These price negotiations heavily depend on the demand and supply ratio, which should nowadays be considered in an international context. The farmers also have a

higher disutility for a decrease in the price level compared to the utility for an equal increase in price. Input price differentials predominantly affect older firms and firms with poly-culture. Furthermore, the certification standard results into an increase in transaction costs at farm level, due to the need for asset specificity and the increase in registration and controls. Economies of learning however reduce the transaction costs over time. The retail has largely succeeded in transferring their transaction costs towards players upstream in the chain.

With regard to sustainability of the certification initiative, the question is whether one should look at the legacy or the subsistence itself of the initiative. The former means that when a private initiative results into an upward shift of the legislation and thus becomes common practise, it has become fully sustainable. The latter implicates the need for further evolution, because the initiative will disappear when it is incorporated in the legislation. Considering the evolutionary potential of standards, opposite stakes can again be identified. Because further evolving standards are hardly compensated in the price at farm level, market gardeners experience the current certification standards as the final limit. Buyers however favour evolving standards, because this is a necessity in a competitive economy. Possible fields of evolution are health and taste related issues, and labour and fair trade amongst others. The Flandria-initiative for example has been characterized by a continuous and radical evolution. From its existence, it has been a top quality product standard. With the process standard being insufficiently elaborated for the increasing demands of retailers, a revision was imminent and resulted in the FlandriaGAP-standard. The continuous demand from retailers for the EurepGAP-standard forced the Flandria-initiators to further revise and adapt the FlandriaGAP-standard, which has now become fully EurepGAP conform. Within the very near future, Flandria products will no longer receive the same price as the FlandriaGAP/EurepGAP products. The higher negotiation power of the retail compared to farmers has thus paid off.

Concluding, the winners of this drive towards private certification are retailers, consumers and the public authorities. The retailers are on the one hand able to shift the costs to players upstream and on the other hand capture the gains (no farm level price increase, increased safety and (environmental) quality). The government, with the number of private certification participants increasing, can decrease its public safety expenditures. Furthermore, the drive towards certification paves the way for a better acceptance of more stringent government regulation. Consumers on their turn are given more certainty considering product and process features. Furthermore, their choice possibilities have increased dramatically. Finally, the general (environmental) quality level continuously improves while the product price remains more or less stable. From societal point of view, private certification standards can be seen as the means to voluntarily internalize external costs created during the farming process.

The positive outcome for farmers is less obvious. Certification can play an optimizing function, resulting in improved efficiency and better management. The reduction in degrees of freedom however, in combination with the absence of positive price compensation, can seriously hamper the farmers' sustainability. The internalization by means of certification of external costs resulting from farming should therefore better be accompanied by a price premium.

Part 3: Ecological sustainability increase and farm level implications

Comprising of:

Chapter 7: Farmers' preferences in evolving certification and labeling systems.

Chapter 8: Technical impact of greenlabels on the farming system level.

Chapter 7 Farmers' preferences in evolving certification and labeling systems

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Introduction

In this chapter we outline the economic consequences for farmers of participation in a labeling initiative (in casu the FlandriaGAP-initiative). The subject is approached by combining qualitative information (from focus groups with all relevant stakeholders) and quantitative information (a farmers' questionnaire). The questionnaire consists of two stated preference experiments, which will be discussed in detail. The stated preference methodology enables the researchers to estimate farmers' attitude towards possible future changes in the certification books.

1. Research objective

As described in 'Chapter 3' labels have a certain sustainability performance and there is still some scope to improve their performance at this level. Different propositions are possible to reach this. However, when analysing proposed changes, it is also important to take into account the economic effects and acceptance of these changes by the principally affected group, the farmers. In this chapter we propose and apply a methodology that can be used to assess ex-ante in how far strengthening of the label will affect the farmers' position and whether farmers are willing to accept proposed changes. The methodology is tested on the FlandriaGAP certification book, one of the major fresh fruit and vegetable standards in Flanders (and Belgium), an initiative that has already been described in the previous chapter. The case is interesting because FlandriaGAP has, since its initiation, evolved quickly and substantially, resulting into a changing equilibrium of stakes between market actors.

With the qualitative information from the focus groups as a starting base, quantitative research was conducted, aiming at measuring the farmers' attitude towards future changes proposed by other market actors and the researchers. Using econometric techniques, a utility measure could be obtained for the different attributes and levels of change; in addition, a monetary value was assigned to the different levels of change; hence differences in willingness to pay or accept levels were determined for the proposed changes (as well as for the different farmer types).

The next paragraphs are structured as followed:

- What is choice preference modelling?;
- Survey design, experimental design and data acquisition;
- Construction of the econometric model;
- Model parameters estimation;
- Interpretation of modelling results (with integration of qualitative results from focus group experiments);
- Conclusions.

2. Choice preference modelling, a brief introduction

Choice modelling refers to a family of survey-based methodologies used for modelling preferences for goods. Within the Choice Experiments (CE) approach, the value of a good is assumed to depend on the goods' attributes and the levels these take (Louvière, 2000). In a choice experiment, individuals are given a hypothetical setting and are asked to choose their preferred alternative among several alternatives in a choice set, and they are usually asked to perform a sequence of such choices. Each alternative is described by a number of attributes or characteristics. A monetary value is included as one of the

attributes, along with other attributes of importance, when describing the profile of the alternative presented. Thus, when individuals make their choice, they implicitly make trade-offs between the levels of the attributes in the different alternatives presented in a choice set (Alpizar, 2003).

The appeal of CEs lies in their natural ability to separately identify the value of individual attributes of a good or programme, as well as the value of a good as a whole, or of a programme which changes more than one attribute simultaneously.

Choice preference techniques are extensively used in transportation studies and in consumer studies. The technique has not yet been applied to the specific case of certification books in the agricultural sector, making this research an interesting scientific contribution to the existing literature concerning labels and certification and choice preference. The aim of our research was to test out whether this methodology can reveal interesting information in an ex ante analysis of proposed changes to an existing label.

CEs are ideally suited to inform the choice and design of multidimensional policies (such as certification initiatives). The marginal rate of substitution between different attributes and/or welfare measures (such as WTP for specific attributes of the certification initiatives) are of major interest in our study. In general, CE can provide four facets of information about values that may be of use in the certification policy context (Hanley et al., 1998):
1. which attributes are significant determinants of the value that farmers impute on certification initiatives;
2. the implied ranking of these attributes among the relevant farmer population;
3. the value of changing more than one of the attributes at once;
4. the total value of the good or policy.

2.1 CHOICE EXPERIMENTS VERSUS OTHER METHODOLOGIES

To collect information with regard to preferences for environmental goods, two broad categories of methods are developed. The first category is based on actual market behaviour and is more formally known as 'revealed preference'. It involves inferring values for non-market goods through the consumption of complementary goods and services (Garrod and Willis, 1999). Typical examples are Travel cost methods and Hedonic pricing. Although advantageous because they are based on actual market behaviour, these methods have two major drawbacks with respect to our research. First, they only permit the measurement of use values (instead of total economic value, which also encompasses non use values), while many of the benefits associated with environmental goods and services do not rely on their use or consumption but rather on the knowledge that the goods exist and will continue to do so (Garrod and Willis, 1999). Second, these methods rely on information that is currently available and are therefore not useful for ex ante policy appraisal.

The second category of methods, known as 'stated preference methods', instead relies on hypothetical markets to infer values for public or non-market goods. These approaches can be used to investigate preferences for attribute levels beyond those existing (such as new certification book rules). Among the stated preference approaches, the contingent valuation method (CVM) has been the most frequently applied. The method presents a hypothetical setting to respondents, who are than asked to state or express their maximum willingness to pay or accept (WTP or WTA) in order to gain or avoid some desirable change in provision of the good. However, this CVM is not ideally suited to deal with situations where changes are multi-dimensional and trade offs between them are of particular interest rather than the value of a good or a policy as a whole. This is why researchers are increasingly interested in an alternative stated preference approach, known as 'Choice Modelling' (Louviere et al., 2000).

Within the class of choice models, three main variants can be identified: contingent rating, contingent ranking and choice experiments (in which respondents choose their most preferred alternative), the latter being applied in this research. Both contingent rating and ranking are in the literature (Hanley et al., 2001) perceived as less optimal compared to Choice Experiments, the former because of the coginitive burden associated with ranking many attributes and levels simultaneously, the latter because of the strong assumptions necessary to translate the ratings into utilities, amongst other reasons.

The research question addressed in this chapter, 'How do farmers perceive changes in the certification book towards more environmental sustainability?' requires an ex ante evaluation of the combined effect of

changing different attribute levels simultaneously. By incorporating changes to different certification book rules simultaneously, farmers will have to make nuanced decisions. This better represents the true decision environment of farmers (certainly in relation to complex constructions such as certification books) and their true preference (taking into account that otherwise the imminent danger for exaggeration exists). With this in mind, Choice Experiments seem to be the most ideally suited technique currently available for this kind of research.

The following paragraph summarizes the underlying mathematical principles of the CE methodology, in an accessible manner for the non informed reader. Those interested in a more detailed description of the mathematics are referred to the Annex 7.1.

2.2 CONSTRUCTION OF THE ECONOMETRIC MODEL

The basic aim of the technique is to obtain utility estimates for the different levels of the certification book rules incorporated in our experiment (i.e. the different attribute levels). This utility measure can then be interpreted (is there a utility difference between the levels?) and used for, for example willingness to pay estimates, simulations and calculations of the effects of marginal changes to these levels. To obtain the utility estimates, multiple choice sets are constructed, each of which constitutes of several alternatives (3 in our experiments). The individual farmers were asked to choose amongst the three alternatives in the choice set their most preferred one. The alternatives on their turn are a combination of several attributes, with each of these attributes having different levels, depending on the choice set. A visual example of a choice set is given in Figure 1. As an example, with farmer 1 choosing alternative 1 in the first choice set, we know he derives a higher utility from the attribute levels of alternative 1 compared to those of alternative 2 or 3. A more formal explanation is given below.

To model choice behaviour by a decision maker (farmer), most of researchers depart from the principles of the Random Utility Theory (McFadden, 1974) and the Characteristics Theory of Value (Lancaster, 1966). The latter states that individuals derive utility from the characteristics of the goods rather than directly from the goods themselves. Random utility models are derived from assumptions about individuals' evaluation of goods and services. These assumptions about individuals' behaviour are introduced to account for the researcher's inability to fully represent all variables that explain all preferences in an individual's utility function. The random utility hypothesis states that individual agents choose from among the available alternatives in order to maximize their utility and that the distribution of choices made in the population is a reflection, in part, of the distribution of individual preferences. Therefore, the probability (P_{in}) that an individual farmer n chooses alternative i (which has an attribute vector X_{in},) from a choice set of J alternatives (in our research 3) can be represented into:

$$P_{in} = P(U_{in}) > P(U_{jn}) \qquad \text{for all j} \neq \text{i} \qquad (2)$$

This formula indicates that a farmer will choose alternative i in the choice set only when this alternative has the highest utility for the farmer, compared to the other two alternatives in the choice set. The utility function U can be further decomposed into a deterministic part (V), function of the observed factors (the certification book attributes incorporated in the experiment), and a stochastic part (ε_{in}). The latter rises from unobservable factors which affect choice, unobservable taste variations, measurement errors in the explanatory variables in function V and model specification errors. Because the researcher has no knowledge about ε_{in}, these terms are treated as random, as well as the utility for each alternative. Amongst the many statistical distributions available, the one most extensively used in discrete choice modeling is the extreme value type 1 distribution (also known as Gumbel or Weibull, Louvière, 2000). This distribution can be used as the mechanism for translating the unobserved random index associated with each alternative into an operational component of the probability expression. This component can then be integrated out of the model to arrive at a choice model in which the only unknowns are utility parameters associated with each attribute in the observed (deterministic) component of the random utility expression. The model has the following functional form:

$$P_i = \frac{1}{\sum_{j=1}^{J} \exp-(V_i - V_j)} \quad (3)$$

This is the basic choice model, called the conditional logit choice or multinomial logit (MNL) model (Louvière, 2000). As suggested by McFadden (1974), the deterministic parts V_{jn} are assumed to be linear, additive functions in the attributes (Xs). Hence, V_{jn} can be written as:

$$V_{jn} = \sum_{k=1}^{K} \beta_k X_{jnk} = \beta' X_{jn} \quad (4)$$

If an element of X_{jk} appears in the utility expression (V_{jn}) for all J alternatives, such a variable is termed generic (i.e. the utility parameter β of X_{jk} is the same for all j). Because in our experiment, all attributes (all certification book rules incorporated in the experiment) relate to one certification book (namely FlandriaGAP), the coefficients to be estimated can be treated as generic. The probability of individual n choosing alternative i can thus be represented by:

$$P_{in} = \frac{\exp(\beta' X_{in})}{\sum_{j=1}^{J} \exp(\beta' X_{jn})} \quad (5)$$

For the estimation of the model parameters in the MNL model, conventional maximum likelihood procedures can be applied. Maximum likelihood estimates of can be obtained by maximizing a log-likelihood function over the parameter space.

$$LogL(\beta) = \sum_{n=1}^{N} \sum_{i \in J_n} f_{in} \log\left[\frac{\exp(V_{in})}{\sum_{j}^{J} \exp(V_{jn})} \right] \quad (6)$$

In the standard interpretation, estimates of represent taste parameters, as they are related to the intensity with which the associated attribute contributes to utility.

After application of the procedure outlined above, various results (model outputs and behavioural outputs) can be obtained (Louvière, 2000):

- Model outputs:
  - estimation of utility parameters
  - statistical significance of utility parameters
  - overall goodness-of-fit tests
- Behavioral outputs:
  - Elasticities of choice
  - Valuation of attributes (WTP and WTA)

More detailed information concerning the calculation of these results is provided in the proceeding paragraph (Estimation of the model parameters).

3. Survey design and data collection

3.1 SURVEY DESIGN

The survey consisted of three parts. The first part covered questions concerning personal and farm characteristics of the farmers affiliated to FLANDRIAGAP. In the second part, the vegetable growers were asked to choose amongst several alternatives constructed based upon changes in the certification book as

a whole, while in the third part, they were asked to make a choice amongst several alternatives with attributes only relating to pesticide use reduction.
The choice experiments are built round three scenarios, a base scenario reflecting the current prescriptions level, and two scenarios with more (or less) severe prescriptions.

3.2 DATA COLLECTION

In January, 2006, 68 farmers residing in the province of Antwerp were personally questioned. The selection of these farmers was purely at random, based upon visual recognition of the farms. This rather unstructured selection methodology results from the privacy policy of the stakeholders having access to the market gardeners' addresses. The law on privacy forbids the auctions or farmers unions to share this personal information with researchers. The region of Antwerp was selected because the auction of Mechlin is situated centrally, with the majority of market gardeners in their proximity. Furthermore, this auction is the most important initiator of FlandriaGAP. Our aim was mainly to test the methodology. Therefore the selection of farmers was not that crucial. Results coming out from this analysis must therefore be treated with caution.

Table 7.1 summarizes the descriptives and frequencies for the sampled farmer group. Some remarks can be made based upon these data. The number of farmers with a diploma of secondary education is much higher compared to the normal farmer population. This result suggests that there is probably a correlation between level of education and willingness to participate in a (quite difficult type of) survey. The result of 100% of the interviewees having farming as their principal occupation is also logic, given that hobby gardeners do not participate in certification schemes such as FlandriaGAP. Thirdly, the ratio of open air gardeners versus greenhouse gardeners is not representative for the population of gardeners. This will have some important implications for the Choice Experiments elaborated in the remainder of the chapter. This divergence directly originates from the sampling procedure, based upon visual recognition of the farms, with greenhouse farms much more easy to detect compared to open air farms (which can also produce non vegetable goods).

Table 7.1: Descriptives/frequencies for sampled farmers

Item	Descriptives / Frequencies
- Number of farmers	68
- Average age	45 $\pm$ 7,5 (s.e.)
- Diploma	94,3% completed secondary education
- Extra diploma	22% (f.e. B or C course)
- Primary occupation farming	100%
- Member of Auction of Mechlin	97%
- Manager since	1984 (average)
- Firm size	16490 $\pm$ 15593 m²
- Firm type (combinations possible)	
Open air cultivation	8,6%
Greenhouse traditional	40,0%
Greenhouse substrate	65,7%
- Number of crops	
1	74,3%
2	14,3%
more	11,4%
- Principal crop types	
Tomato (and varieties)	51,6%
Lettuce (and varieties)	31,4%
- Net income available/year	
< €10000	6,2%
€10000 to €20000	37,5%
€20000 to €40000	43,8%
> €40000	12,5%

4. Choice Experiment 1 – changes in the general equilibrium

4.1 EXPERIMENTAL DESIGN

During the focus group sessions and in depth interviews, several possible future directions for the initiative were appointed as well as current bottlenecks within the certification system. Based upon their relevance and the cognitive burden associated with large choice sets, it was decided to retain the following attributes with corresponding levels (see Table 7.2). The different attributes and their relevance will be discussed further in the text.

Table 7.2: Certification initiative attributes and attribute levels in choice experiment 1

Attributes	Attribute levels
• Origin	everybody accepted / only Flemish farmers accepted / only Flemish products accepted
• Control	2 controls per year / 1 control per year / degressive control system
• Certification	group certification / individual certification / free choice for farmers
• Adherence to measures in certification book*	mm 100% / mm 80% / mm 90%
• Administration	½ h per week / 1 h per week / 1and1/2 h per week
• Social component	not integrated / limited / extensive
• Communication	towards end consumer / towards retail / depending on preference retail
• Relative change in price	-0,5% / 0%/+0,5%/+1%/+1,5%

* MM = Major Must; mm = minor must; sh = should (reference level is MM 100% mm 80% sh 0%)

The full factorial (i.e. all possible combinations of attribute levels) results into $5 \times 3^7 = 10.935$ alternatives. To reduce this number, an orthogonal main effects plan was constructed, which contains a minimum of 27 alternatives for this design. The orthogonality of the design ensures that the attributes presented to individuals are varied independently from one another (zero correlation). This property guarantees that the influence of changes in any of the presented attributes on respondents' choices (or utility) can be measured independently. The consequence of making the experiment manageable is the loss of some statistical efficiency, namely the ability to measure certain interaction effects between the attributes. In a main effects plan, it is assumed that the utility of each alternative varies with the different attributes, but that the effect of each attribute is not dependent on the value that any other attribute takes (i.e. a main effect plan assumes that individuals process information in a strictly additive way).

The alternatives in the resulting orthogonal plan are randomly combined without replacement into a choice set of 3 profiles (a base scenario, reflecting the current situation, and 2 hypothetical scenarios). An example of a choice set is provided in Figure 7.1.

Attribute	Choice A	Choice B	Choice C
• Type of certification	Group certification	Group certification	Free choice
• Communication towards retail or consumer	Towards retail	Retail preference	Towards consumer
• Mandatory level of minor musts	80%	90%	80%
• Controls at farm level	Degressive system	2 controls/year	1 control/year
• Time for administration	30 min/week	1h30 min/week	30 min/week
• Origin	Only Flemish products	Only Flemish products	Everybody accepted
• Extension with social part	limited	non	non
• Relative change in end price	-0,5%	+1%	0%

Figure 7.1: Example of choice set

Participating farmers were asked to choose their preferred alternative in each profile set. For the general experiment, 27 profile sets were constructed. To reduce the cognitive burden for the participants due to a high number of choice tasks (27), the design was split into blocks of 4 choice sets per respondent. Because each respondent only contributes information corresponding to part of the overall design, the sample had to be increased. The farmer was asked to choose amongst A, B, and C, after comparing the different attribute levels.

The majority of surveyed farmers indicated to experience difficulties in choosing amongst the different options in each choice set. None of the presented options could fully persuade them, making the choice process not straightforward. It should be remarked that this is a feature of the choice process. Typically, some attribute levels in an alternative will be preferred over these of the competing alternatives, while other levels will be considered as disadvantageous. With certification books being equilibria of stakes, it is clear that even the base scenario (the current certification book) is not considered as the optimal (and thus preferred) choice for individual farmers. The farmers' statement indicates that the combination of alternatives in each choice card were in balance.

As indicated in the preceding chapter, in reality no price premium is given when new versions of the certification books are introduced, because certification and price formation evolve independently. Certification is a prerequisite for doing business, and hence uncorrelated with the price formation in a later stadium. In the experiment, a price premium is incorporated, as a measure of preference and to attribute a monetary value to the levels of (dis)utility experienced by the farmers. This is obvious because utility is a rather abstract idea, difficult to grasp. Furthermore, this price premium is necessary to divert the farmers away from the base scenario, taking into account that the alternative scenarios implicate further restrictions for the farmers. The experiment thus presented the farmers with a difficulty: in reality no premium is possible but the experiment includes a premium. Other possibilities to convert utility in a monetary value thought of were less attractive, f.e. reducing the relative amount of product that can be sold as certified, because these will also not be feasible in the real market and are difficult to introduce in a choice experiment. It is clear that this presents a constraint for the application of the methodology. However, as the results will show, it finally worked out well and the methodology allows representing and quantifying preferences of farmers.

The modelling results as described below are based upon the full sample of 68 farmers. Each farmer was presented 4 choice sets (with 3 alternatives in each choice set), hence 272 observations are included. However, 27 choice sets were generated for the experiment, hence the number of surveyed farmers should either be enlarged to 81 (3 times 27) or decreased to 54 (2 times 27), to maintain a fully balanced sample (i.e. each choice attribute level is presented in equal numbers to the correspondents). We argue here that the possible danger for attribute imbalance is smaller compared to the loss of information due to excluding the observations of 14 (68-54) farmers.

4.2 FARMERS' ATTITUDE TOWARDS THE DIFFERENT ATTRIBUTES

Before presenting the actual Choice Experiment, the farmers were asked to rank the attributes (on a 1 to 8 scale, with 8 the score for the attribute they most prefer to remain unchanged).

Table 7.3: Different attributes in CE1 and associated scores (on a 1 to 8 scale)

Attribute	Score
• Controls at farm level	4.64
• Communication towards retail or consumer	4.77
• Origin	4.81
• Type of certification	5.13
• Mandatory level of minor musts	5.63
• Time for administration	5.73
• Extension with social part	6.59

The lowest score is obtained for changes in the attribute 'number of farm level controls', indicating that farmers have the least difficulties with changes in this attribute. The reason is quite straightforward, given that this attribute both incorporated a more restrictive level (increase in number of controls) and a less restrictive level (degressive controls). Extension with a social part, time for administration and mandatory level of minor musts receive a high score, indicating that farmers prefer these attributes to remain at the present level, which should be the case given that the alternative levels mean further restrictions for the farmers. The ordering will also be confirmed in the results of CE1.

4.3 GENERAL MODELLING RESULTS FOR CE 1

The deterministic part of the utility can be presented as following, according to (4):

$$V_{jn} = \sum_{k=1}^{K} \beta_k X_{jnk} = \beta' X_{jn}$$

With the help of statistical sofware (NLogit in this case), estimates of the taste parameters (the β's in formula 10), corresponding with the different attribute levels, were obtained, as shown in Table 6, by means of the Maximum Likelihood procedure (see section 1.3).

In this choice experiment, some of the explanatory variables are categorical, while others are continuous. The categorical variables are integrated in the model using effects coding. The latter is preferred above dummy coding because, in case of dummy coding, the base level is perfectly confounded with the grand mean (Hensher, 2005). An example of effects coding is given in Table 7.4, for the attribute 'Type of certification'. Effects (and dummy) coding can also be used for continuous variables, in case the researcher suspects a non linear relationship between the attribute levels of the continuous explanatory variable and the choices made. This possibility is explored further in the text.

Table 7.4: Example of effects coding

Attribute levels	Effects Coding Variable		Formula	Utility estimate*
	BetaGroup	BetaIndividual		
Group certification	1	0	1x0.076 + 0x(-0,385) =	0,076
Individual certification	0	1	0x0,076 + 1x(-0,385) =	-0,385
Free choice	-1	-1	-1x(0,076) + -1x(-0,385) =	0,309

* The utility estimate used here originates from the basic MNL model

4.3.1. Basic MNL model with linear continuous variables

The commands to generate the taste parameters for the attribute levels in the basic MNL model with linear continuous variables are given in Annex 7.2. Before starting with the interpretation of the model results, it is necessary to check the overall model significance, which can be done with the help of the LL ratio test (Hensher, 2005). To this end we compare the log likelihood (LL) function of the estimated model to that of a base comparison model. The base comparison model only contains constants and reflects the average utility for each alternative. If an estimated model does not improve the LL function compared to the base model, then the additional parameters estimated do not add to the predictive capability of the base model. Results are given in Table 7.5.

Table 7.5: LL ratio test for the basic model with linear continuous variables

LL estimated model	LL base model	LL ratio $-2(LL_{base} - LL_{estimated})$	χ^2 statistic (14 – 3 = 11 df)	Sign.
-232,6215	-258,3015	51,36	19,7	yes

Table 7.6 summarizes the modelling results for the basic MNL model with linear continuous variables.

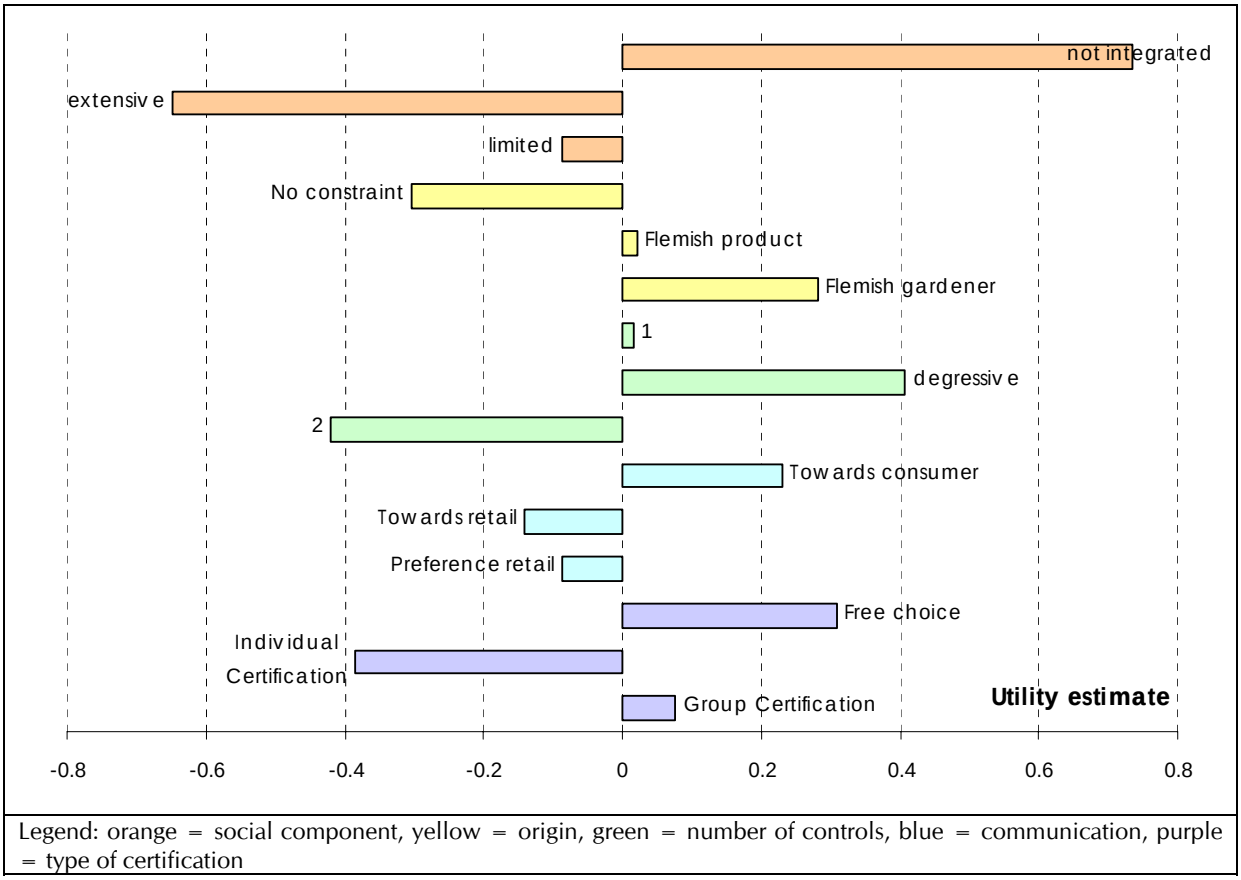
Table 7.6: MNL estimates for CE 1

Attribute	Attribute level	Coeff.[1]	Std.Err.	P-value	Δ Price (%)
Type of certification	Group Certification	0.07600	0.17286	0.6602	
	Individual Certification	-0.38546	0.18531	0.0375	0.707
	Free choice	0.30946			-0.567
Communication	Preference retail	-0.08727	0.17901	0.6259	
	Towards retail	-0.14208	0.17001	0.4033	
	Towards consumer	0.22935			
Minor must compulsory (c)	80%/90%/100%	-0.04610	0.01549	0.0029	0.085
Number of controls	2	-0.42146	0.17221	0.0144	0.772
	degressive	0.40601	0.16710	0.0151	-0.744
	1	0.01545			
Administration (c)	0.5 / 1 / 1.5 h/week	-0.01807	0.00479	0.0002	0.033
Origin	Flemish gardener	0.28232	0.16641	0.0897	-0.518

	Flemish product	0.02175	0.16815	0.8971	
	No constraint	-0.30406			0.557
Social part	limited	-0.08640	0.17351	0.6185	
	extensive	-0.64754	0.19539	0.0009	1.187
	not integrated	0.73393			-1.345
Relative change price (c)	-0.5 / 0 / 0.5 / 1 / 1.5 %	0.54552	0.18758	0.0036	
Status quo choice		-0.45522	0.41174	0.2689	

(c) = continuous variable, assumed linear
1: utility estimates for the attribute levels
Grey zones: significant at the 5 or 10% level (see P-value)

One of the three options in each choice set reflected the base scenario, the current situation. An extra variable was introduced in the model to measure the status quo effect in the experiment, i.e. to measure whether the gardeners systematically opted for the base case scenario or not. The coefficient of the variable 'Status quo choice' does not significantly differ from zero, implicating that this is not the case. The selection of one of the three alternatives was hence purely based on the attribute levels for each alternative.



Legend: orange = social component, yellow = origin, green = number of controls, blue = communication, purple = type of certification

Figure 7.2: Utility estimates for the categorical variables of CE 1

Figure 7.2 represents the utility measures for the categorical variables as obtained by the basic MNL model. It gives an impression of the signs and the magnitudes of the utility estimates for the different (non continuous) attribute levels. These magnitudes should not be interpreted in an absolute sense (what means a disutility of 0,8?) but rather in a relative sense (f.e. a higher disutility is associated with an extensive social component compared to a system with 2 controls per year). To translate these utility measures into a less abstract variable, one can always calculate WTP measures or marginal effects. The latter refers to changes in the probability of an alternative being selected when changes are made to its attribute levels.

4.3.2. Correlation between the attributes?

Based upon the correlation matrix, the researcher already has a clue whether correlations exist between the different attributes. This is not the case in our experiment. Because the alternatives in this study are

generic (i.e. the alternatives do not differ from each other based upon brand name), maintaining the orthogonality within each alternative separately is a sufficient condition (Hensher, 2005) to be able to estimate the taste parameters correctly. Because the experiment is constructed for orthogonality within and across alternatives, the danger for multicollinearity is largely absent. However, as indicated before (see 1.5.1), some design orthogonality might be lost due to the fact that the number of sampled farmers does not fully correspond with the number of choice sets in the orthogonal design. More formal tests should thus be applied to check whether multicollinearity is present in the dataset. The method of auxiliary regressions, described by Gujarati (1995), provides a formal way of testing for multicollinearity. To this end, a R_i statistic is calculated for each attribute, which is based upon the R^2 obtained after regressing the attribute on the remainder of the attributes (the method of auxiliary regressions). The statistic is than compared with an F-critical value with the same degrees of freedom. Table 7.7 shows, as an example, the test results for the auxiliary regression on the attribute level 'group certification':

Table 7.7: Correlation between attribute level 'Group certification' and remainder of attributes within alternative A

Formula	R^2	R_i	F-critical value	Prob. of rejecting correct H_0
$R_i = R^2/(k-2)/(1-R^2)/(n-k+1)$ with $k = 12$ and $n = 272$	0.02592	0.72	1.56	0.9708

*with H_0: the attribute level 'Group Certification' is not collinear with the remaining attributes

4.3.3. MNL model with non linear continuous variables

As indicated before, the possibility exists that the relationship between the different levels of a continuous variable (such as 'time for administration') is non linear. As an example, increasing administration time from 30 minutes to 1 hour could be perceived as not equally disadvantageous compared to an increase from 1 hour to 1 hour and a half. By means of effects (or dummy) coding the different attribute levels of the continuous variable, non linear effects can be estimated and tested for their significance. A model with effects coding for all different continuous variable levels has been developed and tested (for results see Annex 7.3). The majority of coefficients are again significantly different from zero. To test whether this model is a significant improvement compared to the model estimated in 1.5.3.2, the LL ratio test is performed once again. With the X^2-statistic for 5 degrees of freedom (i.e. difference in variables between new and old model) being equal to 11,1 and the LL ratio test 13,82, the new model is an improvement.

By means of a Wald test for linear restrictions, it is possible to test whether the attribute levels of the continuous attributes are linearly or nonlinearly related. The Wald test shows that the levels of the continuous variable 'Minor Musts compulsory' are linearly related (see left hand side Figure 7.3 also). However, as indicated by the Wald test, the levels of the attributes 'Administration time' and 'Change in end price level' (see Annex 7.4) are non linearly related (see right hand side Figure 7.3 and Figure 7.4), which means that a compromise between the continuous model and the discrete model is more appropriate.

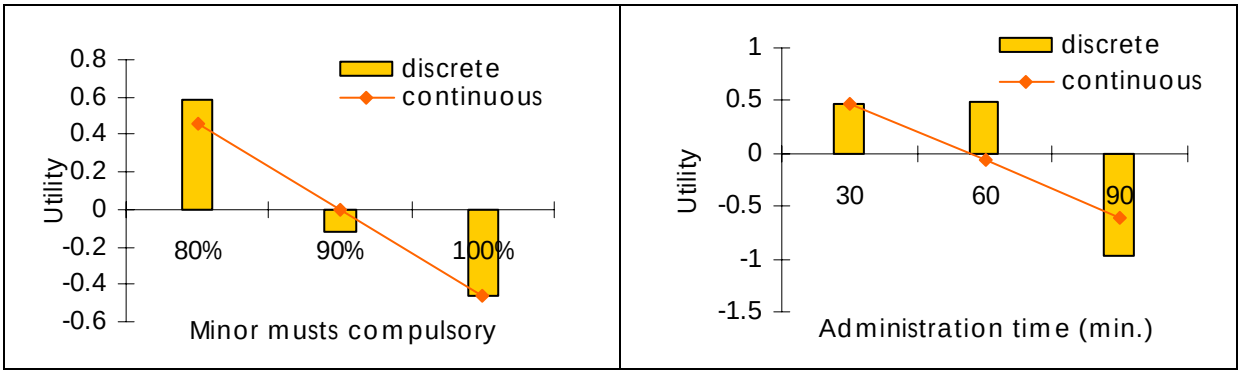


Figure 7.1: Representation of utility measures (discrete and continuous) for the attribute levels of 'Minor musts compulsory' and 'Administration time'

The Likelihood of the new model is also better (see Table 7.8), thus we replace the reduced model (with linear restrictions for the continuous variables) for a mixed continue – discrete model (see Table 7.9).

Table 7.8: LL ratio test for the restricted versus unrestricted model

LL unrestricted* model	LL restricted model	LL ratio $-2(LL_{rest} - LL_{unrest})$	χ^2 statistic (4 restrict. = 4 df)	Sign.
-225,9172	-232,6215	13,40	9,49	yes

* unrestricted model: the model which allows for non linear continuous variables

We can further remark that in this last model, the status quo coefficient differs significantly from zero, indicating that farmers recognize the base scenario and are diverted towards this scenario (change adverse farmer behaviour).

Table 7.9: new MNL estimates for CE 1

Attribute	Attribute level	Coeff.[1]	Std.Err.	P-value	Δ Price (%)
Type of certification	Group Certification	0.16670	0.18306	0.3625	
	Individual Certification	-0.54927	0.20032	0.0061	
	Free choice	0.38257			
Communication	Preference retail	0.01781	0.18798	0.9245	
	Towards retail	-0.30586	0.18832	0.1043	
	Towards consumer	0.28805			
Minor must compulsory (c)	80%/90%/100%	-0.05387	0.01689	0.0014	
Number of controls	2	0.17716			
	degressive	-0.59674	0.19951	0.0028	
	1	0.41957	0.17428	0.0161	
Administration (c)	0.5 h/week	0.46476			
	1.0 h/week	0.47857	0.16691	0.0041	
	1.5 h/week	-0.94333	0.21025	0.0000	
Origin	Flemish gardener	0.35220	0.17301	0.0418	
	Flemish product	-0.10155	0.17291	0.5570	
	No constraint	-0.25066			
Social part	Not integrated	0.75304			
	limited	-0.01199	0.18003	0.9469	
	extensive	-0.74104	0.21349	0.0005	
Relative change price (c)	-0.5 %	-1.09694	0.34131	0.0013	
	0.0 %	0.11610			
	0.5 %	0.18384	0.23634	0.4367	
	1.0 %	0.30145	0.23294	0.1956	
	1.5 %	0.49555	0.27169	0.0682	
Status quo choice		-1.08636	0.54625	0.0467	

1: utility estimates for the attribute levels
Grey zones: significant at the 5 or 10% level (see P-value)

4.4 INTERPRETATION AND DISCUSSION OF THESE RESULTS

4.4.1. Type of certification

Based upon the focus group outcome and in depth interviews, type of process certification was considered as a relevant and important attribute when considering a certification book as an equilibrium of stakes. Three types of certification were presented to the vegetable growers: individual certification, group certification and free choice (between these 2) for the farmer. At present, farmers have a free choice, hence the 2 suggested levels mean a restriction for the farmer. It is also hypothesized that group certification is preferable from farmers' point of view compared to individual certification, for reasons outlined in Chapter 6.

When analyzing the coefficients obtained for the attribute Certification, the signs are in line with the expectations. The P-value further indicates that the coefficients for 'Free choice' and 'Individual certification' significantly differ from zero, which implies that farmers clearly perceive a disutility between group and individual certification. The choice of certification book initiators to not impose individual certification is hence advantageous for farmers. The free choice option on the other hand is also

significant, and positive, meaning that the farmers do encourage a system in which freedom is left for the individual choice to be whether group or individually certified.

4.4.2. Type of communication

Opposite stakes exist in the market place when type of communication is under consideration. In the CE, farmers were confronted with 3 attribute levels capturing this aspect of certification standards: communication towards end consumer (through label), communication towards retail and communication depending on the retailer's preference (label or not). It is hypothesized that farmers derive a higher and positive utility from direct communication towards the consumer, because this creates a pull mechanism (i.e. consumers specifically request the labelled product, which result in better prices or increased market shares). The coefficients in the experiments indeed have the correct signs, but they do not significantly differ from zero, indicating that the farmer is not losing any sleep over it. Although farmers indicated during the focus groups that they feel a sense of pride when they recognize their products in the stores, they are, with the introduction of FlandriaGAP and EurepGAP, already used to BtoB communication. Even within Flandria, buyers can specifically request unlabelled products and packages.

4.4.3. Origin

Origin is integrated in the choice set because it is assumed that farmers do see a market advantage in restricting the number of farmers able to participate in Flandria, for three main reasons. Firstly, the name Flandria explicitly refers to the region of Flanders, hence it is perfectly suited for communication purposes. Secondly, if Flandria becomes a quality vegetable standard in other countries as well, Flemish farmers could lose part of their preferential position in the European market, increasing internal competition amongst farmers. Thirdly, the Flandria certification books are currently well adapted to local cropping circumstances. As is the case for EurepGAP, a more generic certification book risks becoming too theoretic. During contacts with farmers, it became clear that a major part of them indeed struggles with the fact that foreign (especially Dutch) farmers can enter the Flandria scheme.
It should however be remarked that a reasonable part of the farmers do not see a major problem in other fellow European farmers participating in the initiative, as long as they abide by the rules in the Flandria certification book. They do find that, at governmental level, the regional laws should be harmonized at the European level, to make competition more straightforward. Another major issue for the farmers is the type and level of certification standards and controls applied in Southern European countries and North Africa, because these countries offer low cost products from doubtful origin (concerning production process and product quality), putting a high pressure on product prices in our market. The initiators of Flandria argue that, in this sense, the high levels of quality and productivity, together with the unified supply (through LAVA), mean an important counterweight against (the cheap) products from new and non-EU member states. Especially the high level of organization (cooperation between the different LAVA-auctions) is considered as a major competitive advantage.

The different attribute levels presented to the vegetable growers are 'everybody allowed'; 'only Flemish farmers allowed' and 'only Flemish products allowed', the latter because some Flemish farmers also possess production units abroad (f.e. in Spain or the United States). The coefficients in the CE have the expected signs, and the attribute levels 'Only Flemish gardener allowed' and 'Everybody allowed' significantly differ from zero, at the 10% level, which indicate that the average farmer is not indifferent whether foreign farmers also enter the scheme or not. This is in line with the results from the survey question after CE 1 (where farmers were asked to tick off the attribute that had most influenced their decision) which indicated that almost 18% of the choices were primarily based upon this item, versus 11% on average for the remainder of the attributes). It should be remarked that it is contradictory that the attribute level 'Flemish gardener allowed' has a higher utility than the attribute level 'Flemish products allowed'. This may be due to the fact that the surveyed farmers did not really understand the meaning of the latter attribute level.

4.4.4. Control

One of the cornerstones of certification initiatives is the controlling system. A certification system stands or falls by its rigorous controlling system, necessary because of the otherwise inevitable free rider syndrome. A certification initiative offers an advantage to the individual farmer (whether this is market access, higher or guaranteed price or something else), to compensate for the extra administrative and

productive burden. If not effectively controlled, farmers will evade the certification rules, but will capture the surplus value offered under the initiative.

The type and number of controls are hence a major question of debate between the different stakeholders within the initiative.

As argued before, different types of control exist (group certification versus individual certification). Regardless of the type of control, the number of controls is of importance, for several reasons (see Chapter 6 also):

- the more controls, the less chance for evaders to survive in the system;
- the costs for control (i.e. monitoring costs) are born by the farmer (or the auction, depending on the system);
- controls are time- and effort-consuming;

In the experimental set up, three attribute levels were presented to the farmers: 1 control/year, 2 controls/year and a degressive control system. In the present situation, farmers on average are controlled once a year. The degressive control system rewards farmers with positive control scores by reducing the number of controls in the subsequent years. This system is under consideration in several other European certification initiatives, among which Q&S (Qualität und Sicherheit) and Biogarantie. The sampled farmers clearly preferred the latter, due to reasons mentioned before. The survey participants perceive a significant negative utility when the number of controls is increased. Peeters et al. (2005), after surveying 193 Flemish market gardeners, found that 90% of the farmers understand the necessity of controls in relation to certification. The same survey indicated that two third of them dislike the controls.

A significant positive utility is attached to the degressive control system, which indicates that farmers would welcome a change in this direction. The degressive control system is favourable from farmers' point of view because the farmer can save both time and costs in the future. The farmers will thus try harder to reach the 100% compliance level, resulting in a positive effect in the short run. Furthermore, by concentrating their efforts on the weakest elements in the system, the effectiveness of the third party controls will further increase, resulting in a better quality image for the scheme and reduced monitoring costs.

4.4.5. Minor Musts compulsory

Nowadays, measures indicated as 'minor musts' in the FlandriaGAP standard are 80% compulsory, i.e. at least 8 out of 10 measures should be fulfilled. The 'major must' measures reside at a 100% compulsory level. The 'shoulds' in the standard are considered as recommendations for the farmer, i.e. not mandatory, and these are not actively controlled by the inspectors.

This attribute is integrated in the choice experiment to capture (a part of) the evolutionary potential of certification books, together with the social component (see section 1.5.5.7). From researchers' point of view, it is argued that the measures indicated as 'minor musts' will be the first to evolve, to a 'major must' level, hence uplifting the compulsory level of the minor musts is considered as a good proxy for evolution of the current standard. As indicated by Vandenbergh (2004), on average, approximately 90% of the minor musts are fulfilled by the market gardeners following FlandriaGAP. The certification standard encompasses 55 minor must rules, compared to 68 major musts and 25 shoulds. The following levels of compliance were incorporated in the CE: 80% mandatory (base scenario), 90% and 100% mandatory. The 90% level has a (small) negative measure, indicating that farmers do not perceive too many difficulties in attaining this level, as confirmed by Vandenbergh (2004). The 100% level on the contrary is perceived as highly disadvantageous, mainly due to the loss of degrees of freedom for farmers. During the focus group sessions, farmers indicated that approximately 5 to 10% of the measures in the instruction book are perceived as too restrictive, and not adapted to practical considerations. The measures obtained in the CE confirm this perception.

4.4.6. Time for administration

Administration is one of the major transaction costs associated with certification. The administrative burden caused by certification books is a major source of complaints by farmers. It is probably the largest

cost factor induced by certification. The CE results confirm the negative utility farmers experience when administration time increases. In section 1.5.5, corresponding Willingness to Accept levels are calculated.

The auctions have taken several actions to ease this administrative burden, f.e. by making crop registration available in an easy computer format and by subsidizing the purchase of computers. Farmers acknowledge that the administrative process becomes less cumbersome once they are used to the system.

4.4.7. Social component

The attribute social component may not seem directly linked with certification books (in the Flemish context it should perhaps better remain within the legal prescriptions), but major retailers (mainly from Great Brittan) are now asking for specific social (labour) measures included in the 'cahier de charge'.

The auction representatives question whether these issues should be dealt with in a certification book, they argue that social regulations and welfare issues reside within the FPS Employment, Labour and Social Dialogue, not within a GAP. They further argue that the market gardener as employer has the end responsibility. EurepGAP has chosen to integrate some of these rules, those which are still controllable by the same person responsible for controlling pesticide and fertilizer use, although these are two totally different disciplines. EurepGAP, as a generic standard at international level, has opted for this choice due to the problems of child labour and fair trade.

Three levels were integrated in the CE: absence of a social component, a limited social component and an extensively elaborated social component. The latter refers to a situation in which the farmer has to document all additional information concerning wages and other labour conditions, hours of work, number of contemporary employees etc. Wages should be in line with the legal prescriptions. For a limited social component, the farmer has to document how he creates a socially desirable working atmosphere (f.e. by providing a lunch area, by allowing labourers to question their situation etc.). In the CE, a significant positive utility is attached to the case in which no social component is added. The extensive social component however receives a highly negative utility, indicating that farmers prefer to avoid this situation.

4.5 WILLINGNESS TO PAY (WTP) AND WILLINGNESS TO ACCEPT (WTA) MEASURES

The concept of utility is not easy to grasp. What does a utility measure of -0,8 mean? To facilitate the interpretation of the modeling results, one can convert the utility measure into a monetary value, which is a concept familiar to all of us. The necessary condition however is to incorporate a measure for the monetary value in the experiment. With both the variable of interest and the monetary variable expressed as utility measures, the ratio will yield a monetary value for a change in the level of the other variable.

In calculating a measure of WTP, it is important that both attributes used in the calculation are found to be statistically significant (Hensher, 2005). In CE 1, the price attribute is highly significant, as well as the other attributes except for 'Communication'. WTPs can thus be calculated for these attributes, based upon the formula:

$$-\beta_x / \beta$$

with β_x the marginal effect of the x^{th} attribute (in utils per unit of attribute x) and β the marginal utility of the premium (in utils/unit of premium). This calculation is quite straightforward for continuous variables. However, as indicated in paragraph 4.4.3 (see Table 7.9 also), the price component has a nonlinear nature, hence a single price taste parameter β is absent. The non-linearity is situated around the zero percent change level, as confirmed by the Wald test statistic.

The utility decrease for a price decrease is much larger compared to the utility increase for the same price increase. As suggested by Figure 7.4, both the slope and the intercept of the price decrease differ from these of the price increase. To calculate the WTP, we should therefore better use the taste parameter (slope) of the line between 0 and -0,5. The WTA on its turn can be approached more accurately by using the slope coefficient of the trend line between 0 and 1,5%. Thus:

If $\Delta p < 0$: $\beta_1 = 2{,}28$
If $\Delta p > 0$: $\beta_2 = 0{,}30$

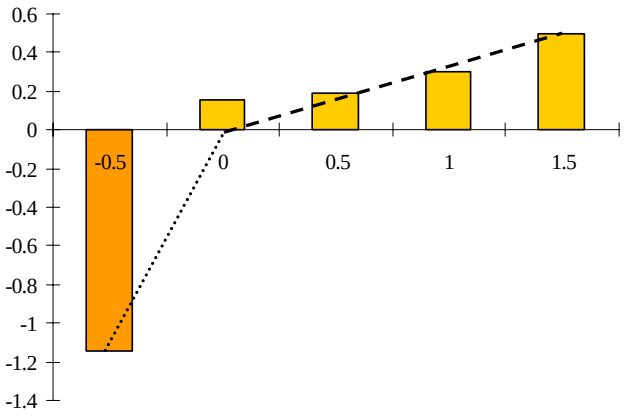


Figure 7.4: Nonlinear price - utility relation

Figure 7.5 indicates how price changes associated with utility level changes can be deduced graphically. Initially, a farmer has no incentive for requesting a price increase. However, when for example individual certification becomes obligatory, the farmer experience a negative utility change (see left hand side figure) compared to the current equilibrium situation, which can only be compensated by a positive price increase. A positive price increase has a smaller utility change compared to a negative price decrease, as indicated before. The correct slope coefficient to be used is thus the 0,30. The equation than becomes:

Δ (Group certification → Individual certification) = - β_x / β_2
= - (- 0.55 / 0.30)
= 1.83% price compensation

In case of a positive utility change, the equation becomes:

Δ (1 control/year → degressive control system) = - β_x / β_1
= - (0.42 / 2.28)
= - 0.18% price deduction

These results are in line with what one could expect when farmers are considered as 'negative price change adverse' decision makers. A change with a negative utility will only be accepted when a rather high price compensation is given (high WTA), while the WTP for a change with a positive utility is rather low.

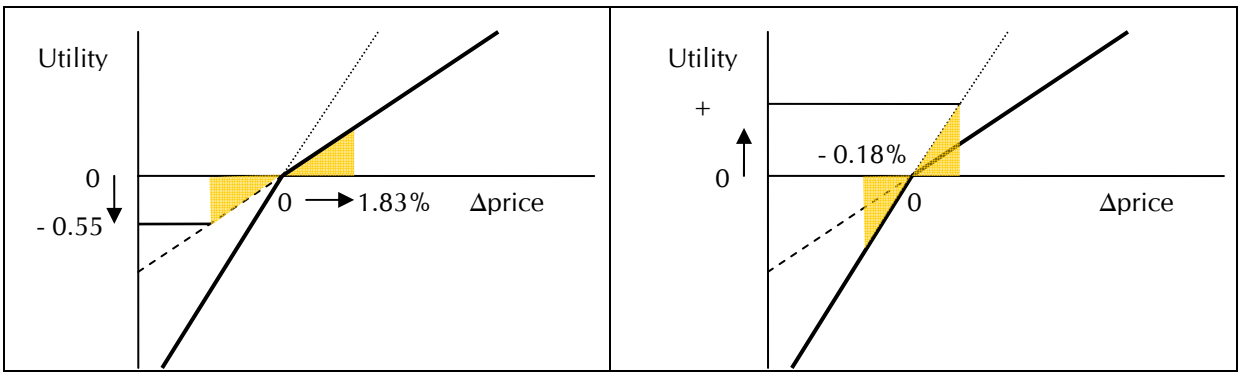


Figure 7.5: Relative price change in case of utility decrease (left) or increase (right)

For categorical variables, we opted for the calculation of a WTP based upon the change from one attribute level to another, as exemplified in Table 7.10 for the 'Social component':

Table 7.10: WTP calculation for categorical variable

Utils for 'Extensive social component' (U_E)	Utils for 'Limited social component' (U_N)	WTA = - (U_E – U_N) / β_2
-0.74104	-0.01199	2.43%

With marginal utility of the premium: β_2 = 0.30

How should the measure of 2.43% be interpreted? For a change from a certification book with no social component to a certification book with an extensive social component, the surveyed farmers on average expect a financial compensation of 2.43%, the latter meaning the upward change in price for the end product. Table 7.11 shows WTP and WTA measures for CE 1.

First, it is worthwhile noting that one should be cautious with extrapolating these findings beyond the upper and lower levels of the attributes in the experiment. The WTA for the attribute 'Minor Musts compulsory' for example should be interpreted between the boundaries of 80% and 100%.

Table 7.11: WTP and WTA measures (% change of end product price) for CE 1

Attribute (level)	WTP measure	WTA measure
• Minor Musts compulsory		0.18% per 1% increase
• 2 controls versus 1 control		0.80%
• Degressive controls versus 1 control	0.18%	
• Administration (30 min/1h → 1h30min)		4.74%
• Extensive social component (versus limited)		2.43%
• No social component (versus limited)	0.33%	
• Individual certification versus group cert.		1.83%
• Only Flemish farmers allowed	0.15%	
• Everybody allowed		0.84%

(1) per % change in level Minor Must
(2) per minute increase in administration time

Second, the calculated price changes vary between -0.5 % and + 5%, which is considerable, given that the farmer's margin is under high pressure. However, over the years, seasonal price variations can be much more substantial. If we compare product prices for 2004 (a year of disaster for vegetable growers) with these for 2003 and 2005 (see Table 7.12), variations easily exceed the 25% level (taken into account that supply was more or less constant, data from (MV Info, 2006). Within the CE, farmers were asked to imagine an end product price occurring in an average year.

Table 7.12: Price variations for tomatoes and lettuce

Crop type	2003	2004		2005	
	Price	Price	Price change*	Price	Price change*
Tomatoes	0.92	0.60	-35%	0.76	+26%
Cabbage lettuce	0.38	0.28	-26%	0.38	+35%

* compared to previous year

A farmer expects for a 1% increase in the minor must level (i.e. instead of scoring 80 to 100 on the rules identified as minor musts, a farmer should at least obtain a score of 81, to receive his certificate), an increase in the product price (at auction level) of 0,18%. EurepGAP, contrary to FlandriaGAP, has fixed the Minor Must level at 95%, an increase in the minor must compulsory level of 15%, which corresponds to a WTA of 2,7%.

Farmers clearly favour the degressive control system, they are on average willing to forgo 0,18% of their products' market price to obtain this system. This system has several advantages. First, the control costs decrease (because each control has to be paid separately) and second, the risk of loosing the certificate decreases. Third, time loss (both for preparation and during the controls) reduces. Fourth, given that the certification books evolve continuously, this system can give the farmers some extra time to do the necessary investments and adaptations.

5. Choice experiment 2 – pesticide reduction

5.1 EXPERIMENTAL DESIGN

The attributes and their levels as presented to the farmers were selected based upon the focus group outcome and discussion with the phytotechnicians participating in this research project. They imply a further restriction on the pesticide policy within the cahier the charge of the FlandriaGAP certification standard.

It should be acknowledged that a further restriction of pesticide use is not warmly welcomed by the majority of the farmers, given the already limited freedom of movement in this area for the gardeners. In Table 7.13 the selected attributes and their corresponding levels are listed. A discussion of the relevance of these attributes with respect to the pesticide issue is given in the following paragraph.

It might be important to remark that both actors in the field (experts consulted in the interviews and the focus groups) and ecoscientists gave the advice to remove the attribute 'Number of active ingredients (AI's) allowed in the end product', because it was considered as unrealistic. The term unrealistic both refers to the fact that retailers will not impose this and that it is scientifically difficult to determine the effect of combined AI's (and hence determine a threshold level). Recently however, both Colruyt and Lidl have informed themselves over the possibilities of imposing an upper boundary on the number of AI's in fresh produce.

Table 7.13: Certification initiative attributes and attribute levels in choice experiment 2

Attributes	Attribute levels
• Calculation of dose/ha	*current system (dose and area)* / driving speed and application pressure incorporated
• Crop rotation	*Not compulsory* / compulsory if technically feasible
• Training session	*Not compulsory* / half a day per year
• Pesticides allowed	Only SRC* list / *SRC list and positive list, subject to motivation*
• Propagation material	Plant passport compulsory / *current level (recommended)*
• Choice of pesticide	Strictly follow colour code of SRC / *motivation of choice sufficient*
• Choice of crop variety	Minimal dependency on agrochemicals / *several criteria*
• Treatments with highly noxious pesticides	Halving of the number of treatments / *current level*
• Relative change in price	*0 %* / 0,5 % / 1 %/ 2 %/ 3 %

* SRC: Service for Residue Control

Terms in italic correspond with the current level

The full factorial (i.e. all possible combinations of attribute levels) results into $5 \times 2^8 = 1280$ alternatives. To reduce this number, an orthogonal main effects plan was constructed, which contains a minimum of 16 alternatives for this design.

The alternatives in the resulting orthogonal plan are randomly combined without replacement into a choice set of 3 profiles (a base scenario, reflecting the current situation, and 2 hypothetical scenarios). Participating farmers were asked to choose their preferred alternative in each profile set. For the general experiment, 16 profile sets were constructed. To reduce the cognitive burden for the participants due to a high number of choice tasks (16), the design was split into blocks of 4 choice sets per respondent. Because each respondent only contributes information corresponding to part of the overall design, the sample had to be increased. The resulting choice set is comparable with the one shown in Figure 7.1. The farmer was asked to choose amongst A, B, and C, after comparing the different attribute levels.

5.2 GENERAL MODELLING RESULTS FOR CE 2

Before reporting the estimates for the taste parameters obtained for the attributes, we first calculate whether the model with parameters for the attributes is a significant improvement compared to the model with constants only (the Base model), with the help of the LL Ratio test. This is indeed the case (see Table 7.14). Table 7.15 reports the estimate for the attribute levels in CE 2. In CE 2, we made use of dummy coding, hence the current situation is considered as having a zero utility (no negative nor positive utility).

The table represent the alternative (more restrictive) attribute levels. The significant utility estimates all have the correct sign.

Opposite to CE 1, the status quo coefficient is significant in CE 2. This coefficient should be interpreted as a 'learning by doing' coefficient. After several choice tasks, the sampled farmers identify the C-alternative as the current situation. When risk (or change) averse, they opt more quickly for the C-choice, resulting in a significant status quo coefficient. For future experiments, this process might be avoided by switching the position of the alternatives. However, this makes the processing afterwards very difficult.

Table 7.14: LL ratio test for the model CE2

LL estimated model	LL base model	LL ratio $-2(LL_{base} - LL_{estimated})$	χ^2 statistic (9 – 3 = 6 df)	Sign.
-197,91	-217,76	39,7	1,63	yes

Table 7.15: Modelling results for CE 2

Attribute	Coeff.	Std.Err.	P-value	WTA
Calculation of dose/ha	-0.976	0.285	0.001	2.31
Crop rotation	0.224	0.259	0.386	
Pesticides allowed	0.341	0.264	0.196	
Propagation material	-0.725	0.283	0.010	1.71
Choice of pesticide	0.225	0.249	0.366	
Choice of crop variety	-1.033	0.273	0.000	2.44
Treatments with noxious pesticides	-0.451	0.271	0.096	1.07
Relative change in price	0.423	0.125	0.001	
Status Quo	1.049	0.365	0.004	

Remark: the attribute levels represent the alternative situation

5.3 INTERPRETATION AND DISCUSSION OF THESE RESULTS

5.3.1. Calculation of dose/ha

Currently, the gardeners participating in FlandriaGAP have to calculate the applied pesticide dose by multiplying the dose per hectare with the area of treatment. Aimed at a more balanced application, gardeners could also take the driving speed and application pressure into consideration. The advantage is that the dose, when correctly calculated and applied, can be further reduced, because excess application due to irregular dispersion is no longer needed. This measure is currently already incorporated in the certification book of Charte Perfect and was rated highly by the experts consulted by the agro-environmental scientists (see Chapter 3).

The measure has the following implications for the gardeners:

- administration will increase and the calculation will become more difficult;
- application will be more demanding (speed and pressure control).

Due to the effects on action and administration level, farmers attach a significant negative utility to this measure.

5.3.2. Crop rotation

In the cahier the charge of FlandriaGAP, crop rotation is recommended, but not compulsory. In CE 2, crop rotation was integrated because experts judged this measure as highly effective with respect to a further reduction of pesticide application. One of the major drivers for pest incidence in the current crop variety is, besides temperature and humidity, the crop variety in the previous period, because pests and varieties are inextricably linked. A logic but not always easy applicable measure is then variation in the crop variety, because pests loose their preferred host and thus perish more easily.

However, in some production systems, crop rotation is not an option (or irrelevant). This is the case in greenhouse gardening, in 2 cases:

- if the greenhouse infrastructure is only suited for one type of crop (f.e. the height of a leaf vegetable greenhouse is generally lower compared to a fruit vegetable greenhouse);

- if hydroponic cultivation is applied (where the substrate is replaced frequently).

For this reason, crop rotation in the CE was only considered obligatory when technically feasible. Because the majority of farmers questioned either applied hydroponic cultivation (55%) or greenhouse gardening in solid ground (33%), this attribute was not taken into consideration during their choice process, resulting into an insignificant coefficient.

5.3.3. Pesticides allowed

Within Flandria (and FlandriaGAP), the list of legally allowed pesticides is further restricted to fully comply with the principles of environmentally concerned agriculture. The farmers have to comply with the principles as outlined on SRC advice cards. The SRC is a non profit scientific institution founded by the LAVA auctions, VBT, the Belgian Farmers' Union and the Province of Antwerp. Per type of pest, the SRC advice cards outline the pesticides allowed, the dose, the active ingredients, the waiting period before harvesting and the maximum number of treatments. For greenhouse gardening, the cards first recommend use of biological treatments and natural enemies and only in a second step the use of corrective chemical pesticides. For outdoor production, the cards are based on the POCER-indicator (Vercuysse & Steurbaut, 2002) with different colour codes depending on the toxicity level of the chemical pesticides.

Within the certification book, the farmer is given the freedom to use products allowed by the Belgian government (www.fytoweb.fgov.be), when no other options within the list of SRC pesticides are applicable. Whenever this situation occurs, the farmer has to motivate his choice of pesticide and obtain a (written) approval. In the CE, the latter option was removed. This attribute should be considered as a proxy for the further restriction of pesticides allowed within the certification standard. The model indicates a non significant utility change, indicating that the group of questioned farmers does not feel further restricted by the introduction of this item. This may seem counterintuitive, but based upon the survey sample, it is explicable. The extension of the list of pesticides beyond these allowed within FlandriaGAP is mainly of importance for the (small) group of farmers with niche products (such as parsley), because they have, for reasons outlined before, only a limited number of treatment options. This group is within the current sample underrepresented, resulting in an insignificant coefficient.

5.3.4. Propagation material

In the FlandriaGAP certification book, a plant passport (which documents the origin and treatment of the propagation material) is recommended, though not compulsory. Experts judge the use of reliable and pest free propagation material as a must for further reduction of pesticide application, for the obvious reason that contaminated material will evidently lead to higher pest application in the longer run. A considerable part of the questioned gardeners already comply with this rule, because they use propagation material from Dutch breeders. In such a case, documentation is provided and can easily be added to the rest of the registration material.

Given this, the gardeners do judge the current situation as more advantageous compared to the more restricted, as proposed in the experiment. The coefficient associated with the attribute 'plant passport' is significant and negative. The question remains why farmers attach a negative utility to this optimisation, given that the burden of documenting the propagation material mainly resides with the breeder. Besides this, plant material from unquestionable origin further protects the farmer from the expensive use of corrective measures (whether biological or chemical) in later production stages.

5.3.5. Choice of pesticide

In the experiment, the attribute 'Choice of pesticide' was integrated, to measure whether farmers are sensitive to a restriction of the order in which pesticides should be applied. Currently, farmers can divert from the preferential ordering (which is indicated by the colour code Green – Yellow – Red), if they motivate why. In the experiment, the latter option was banned, meaning that farmers strictly have to follow the recommended ordering. This restriction can have some significant economic drawbacks from farmers' point of view. First, the pest development pattern (sometimes exponential) can urge the farmer to treat the crop with the best (often the most noxious) pesticide available. If the farmer first has to try less intrusive treatments, crop damage can become significant and quickly exceed the economic threshold level. Second, the use of a treatment that probably not fully eradicates the targeted pest is costly and economically inefficient, because the most effective pesticide will probably be necessary as well. Then

why include this proposition? The measure could urge farmers to further increase their crop monitoring efforts (i.e. to intervene more timely), which will, in the end, prove to be both environmentally and economically advantageous, because less harmful pesticides are applied and crop damage (or the use of expensive pesticides) is reduced.

However, the coefficient in the experiment is not significant, which indicates that, for the farmers in the sample, the restriction does not decrease (or increase) utility. Given that the majority of the sampled farmers are greenhouse gardeners, the following of the preferential ordering as indicated by the SRC-cards is a necessity, to preserve the populations of natural enemies in the greenhouses. To start and maintain these populations is not straightforward (and costly), hence greenhouse gardeners will consider all options to reduce adverse effects on these populations. The latter is not the case in open air gardening, where building up populations of natural enemies is not practically feasible. Within this group, this attribute would probably proof to be significant.

5.3.6. Choice of crop variety

Nowadays, the choice of the crop variety within FlandriaGAP is subject to several stakes, which are, as outlined in Chapter 6, the crop performance, the exterior product features, the shelf life, the yield and the scoring in taste panels (with consumers and experts). The ecoscientific experts in the panels (see Chapter 3) attached a very high score to the rules aiming at a choice of crop variety based upon pest resistance. In the CE, the attribute level 'Choice of variety based upon minimal dependency on agrochemicals' was included, as an alternative for the current situation.

However interesting from ecoscientific point of view, for the farmers (and other chain players) this change is not advantageous. It is even the most restrictive adaptation of the instruction book incorporated in CE 2, as confirmed by the magnitude of the coefficient. In the literature, the negative correlation between crop resistance and crop yield (and quality) has been widely discussed.

5.3.7. Treatments with highly noxious pesticides

Another option for a decrease in the pesticide pressure on both soil and product is a further reduction of the number of treatments with the most dangerous chemical products (those labelled red on the SRC-cards). The drawback of this measure is that farmers will probably increase the dose per treatment. However, maximum dosages are now already fixed.

This attribute reflects a situation in which more attention is given to the pesticide contamination during the product life cycle (and not only at the final product level), which is, up to now, a gap in the (European) legislation. The main drawback is the scientific foundation of the reduction of treatment numbers. Now, the treatment numbers (in combination with the dosage) are based upon the economic efficiency (how many treatments are necessary to stay below the economic threshold level) and the effect on ecology. In CE 2, the utility measure has the correct sign, but the coefficient is not significant, indicating that the surveyed farmers in general do not disfavour a further reduction of the treatments with red (i.e. the most harmful) pesticides. Again, it is worthwhile stressing that the Green – Yellow – Red colour code is mainly of importance for outdoor producers, and this group is largely undersampled in the current experiment.

5.3.8. Price

With respect to an increase in price, the associated utility is positive, as one could expect. A unity increase in price (in %), results into a utility increase of 0,423. This number is used to calculate the Willingness To Accept (WTA) for the remainder of the attribute levels (see Table 7.13). This value is lower compared to the Price attribute in CE 1, which can be declared by the absence of a price decrease in CE 2. As indicated in Chapter 6, farmers attach a larger negative utility to a unity decrease in price compared to the positive utility associated with a unity increase in price.

6. Individual specific effects

Individual behaviour can largely differ from collective behaviour due to individual specific characteristics. In the Flemish market garden sector, the following individual (or farm) specific factors might capture a considerable part of the variance in the decision process across individuals:

- farmer's age;
- farm type (open air or greenhouse) and crop type (fruit vegetables versus leafy vegetables);
- number of different crops;
- farm size.

To capture the influence of these individual specific factors, the general model should be extended with Socio Demographic Variables. The model and the accompanied results are beyond the scope of this text.

7. General conclusions

Conclusions for this chapter can be drawn for the applied methodology as well as for the obtained results.

7.1 THE CHOICE PREFERENCE METHODOLOGY

The strengths of this methodology for measuring farmers' attitude towards changes in the certification book are multiple. The most important advantage is the possibility to do ex ante policy analysis, both by private or public actors. If new measures are to be constructed or introduced, this tool can offer the means to verify the attitude of the involved players and to make appropriate adaptations if necessary. The experiment and, by extension, the technique can be easily repeated for the different stakeholder groups involved in the certification process, which could yield quantitative measures for opposite and mutual stakes in the chain and give indications of possible states of equilibrium between these stakes.

Furthermore, the method enables researchers to yield various models which can all be tested for their significance and possibility to grasp individual and collective decision behaviour. Based upon these models, the researchers can derive utility measures and utility ratios, interesting for policy conclusions. In addition, WTP and WTA measures can be obtained, enabling the translation of the rather abstract concept utility to a more concrete monetary value. Furthermore, researchers can make, based upon their initial estimates, simulations for modeling decision behaviour outside the scope of the experiment. Another advantage is the possibility to estimate changes in the probability of accepting alternatives when changes are made to the levels of the attributes, both at individual and collective level.

Given these options, another major advantage of this technique is the possibility to decompose the studied goods or services into their principal characteristics (or the characteristics of interest), more formally identified here as the attributes of goods or services. This decomposition enables the researcher to obtain both estimates for the utility (or value) of goods as a whole and for the attributes (and their levels) of these goods incorporated in the experiment. Certification books are complex constructions, with multiple attributes which can all vary independently. If we want to measure farmers' attitude towards changes in some of the attributes of such a certification book, the technique of choice preference is ideally suited. For those working in the field of certification books, the use of this methodology might prove extremely helpful in determining the preferences of their supporters (or opponents). One could argue that, by using one dimensional questions (f.e. 'Score this attribute level on a 1 to 7 scale'), comparable results could be (far more easily) obtained. This is untrue, for several reasons. First (and above) all, one dimensional questions will automatically yield overestimates of the attributes, because the interviewee does not have to make considerations between different attribute levels. Secondly, the measurement of probabilities (and changes herein) is than impossible, as well as simulations and marginal effects based upon these probabilities. Furthermore, the good as a whole cannot be evaluated (in our experiment the status quo effect captures the farmers' preference for the current certification book). Finally, interaction effects cannot be measured (which is possible with CE, although not performed in this study for reasons of simplicity).

In our experiment, we restricted ourselves to a single certification book, to avoid choices based upon the certification book name as such. However, the technique can also be applied to measure preference differences across different certification books (f.e. FlandriaGAP versus Biogarantie). The constant associated with one of these two alternatives than reflects the sample's preference (or rejection) for the certification book in question.

However, some drawbacks can be identified as well. The technique necessitates balanced attributes and levels, otherwise the experiment will be diverted towards one of the attributes (the strongest restriction),

making the model useless. This drawback can be countered by presurvey discussions with key stakeholders and pretesting of the survey (both performed in this research).
The second drawback is the complexity of the choice task for the interviewee. It is not straightforward to choose amongst several alternatives which are more or less the same. This is, on the other hand, also the power of this technique, because true preferences will automatically emerge after repeated choices by multiple interviewees. An automatic consequence is the reduction of the number of attributes in the choice set (preferably below 8), to simplify the choice task. Evaluation of the total number of certification book rules in one experiment is hence impossible. Several subsequent experiments can prove useful to this end. The technique is not only complex for the interviewee, it is also not easy to implement by practitioners. An extensive literature with regard to Choice Preference Models (and the alternative possibilities) needs to be mastered before the technique can be applied in a proper sense.
The necessity to maintain orthogonality places the researcher for difficulties, because this characteristic is hardly ever maintained, although it is one of the cornerstones of the technique. However, appropriate tests exist to measure whether the possible loss of orthogonality endangers the usefulness of the obtained results.
Another possible drawback of this particular research is the absence of interaction effects in the model. These could still be incorporated to improve the current results. An example of such an effect could be the interaction between the attribute 'Communication' and the attribute 'Origin' in CE 1 (a combined effect of 'Only Flemish farmers allowed' and 'Communication towards consumers' could then possibly be identified, because a communication strategy could be built around product origin).

The majority of drawbacks can thus be countered, making this technique robust and extremely useful for ex ante measuring preferences for changes in the certification book equilibrium.

7.2 CHANGES IN THE GENERAL EQUILIBRIUM – CE 1

From CE 1, we can remember that farmers do not favour changes further restricting their degrees of freedom. They, on the other hand, welcome changes that might improve the current certification book. They are extremely sensitive to changes in the administration time associated with certification and to incorporation of a social component in the certification book. Furthermore, they encourage the introduction of a degressive control system and prefer the initiative to remain restricted for Flemish gardeners. The sampled farmers clearly prefer group certification over individual certification. Finally, they are rather insensitive whether the initiative is communicated towards the consumer or towards the buyer.

7.3 CHANGES IN PESTICIDE POLICY – CE 2

From CE 2, it became clear that farmers generally strongly advise against changes in the pesticide policy within the certification initiative, probably because they currently already feel under high pressure from government, society and buyers. In this context it is worthwhile repeating that the resource base of farmers has been narrowed over the years, which is especially true for certified farmers, while the demands have become increasingly stringent. To maintain production in such an environment is only possible when the farmer is able to evolve from a producer to a production manager, which is not always easy.

Based upon the estimates for CE 2, the most adverse modification to the certification book from farmers' point of view seems to be the demand to use the crop variety which minimally depends on agrochemicals. Taking into account that this measure is the one that most affects crop yields, this outcome is logic. The other alternative measures are not welcomed either, with recalculation of dose per hectare and documentation for propagation material as most significant ones. The fact that some of the proposed changes result into non significant coefficients is mainly due to the sample constellation, which predominantly constitutes of greenhouse (substrate) gardeners. A more extensive sample will probably yield more significant coefficients. By incorporating individual specific effects (such as farm type) one could even measure utility differences between different groups in the sample.

Chapter 8 Technical impact of greenlabels on the farming system level.

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CODA-CERVA

Introduction: objective of the chapter

This chapter concerns the impact of certification book prescriptions on production techniques used by farmers and is based on the rankings of the prescriptions by experts (see Chapter 3).

The aim of this research is to assess how labels can encourage the farmer to diverge his choices and methods from the conventional methods through prescriptions that contribute to environmental sustainability.

The chapter is devoted to the analysis and discussion of the impact of specific rules. Only the most effective rules will be discussed here in terms of their environmental impact and in terms of their impact on the different levels in the farming system.

1. Methodology

For this study, we start from the same material used for analysis in Chapter 3, i.e. the rules in the certification books of the eight studied labels, classified by experts according to their positive effect on twelve aspects (or objectives) of environmental sustainability.

Furthermore, for the sake of simplicity, we decomposed the farming system into 18 subsections (denoted here as levels), such as Crop protection, Energy Management or Traceability. The levels emerge from the subsections in the certification books (see Table 8.2). Each certification book rule was than allotted to one of these farming system levels.

Furthermore, each rule was classified by the consulted experts according to predefined ranks. The number of ranks is specific for each classification. The rules of the highest rank in a classification have the best impact on the corresponding aspect of environmental sustainability.

The experts also classified the twelve objectives of sustainability according to their priority for sustainable development (see Table 8.1). We will approach the discussion in the same order.

Among the classifications, we arbitrarily retained the highest quarter of the ranks, i.e. the best classified rules for discussion. They have consequently the best effect on the objectives of environmental sustainability. Table 8.1 enumerates the ranks retained for analysis in the twelve classifications corresponding to the twelve studied aspects.

Table 8.1: Studied ranks in the classifications for the 12 objectives of sustainability.

Objective of sustainability, by order of priority	Retained ranks for analysis	Not retained ranks
1. Water Protection	9-7	5-4-1
2. Air Quality	20-19-16	15-14-12-10-8-7-6-5-4-3-2-1
3. Climate Conservation	8-(6)	5-4-3-2-1
4. Rare Ressources spillage	8-7	6-5-4-3-2-1
5. Soil Fertility Conservation	15-12	11-8-6-5-4-3-2-1
6. Biodiversity	15-14-12-(11)	10-9-8-7-6-5-4-3-2-1
6bis. Landscape	6-5	4-3-2-1
7. Food safety	20-19-18-17-16	15-14-13-12-11-10-9-8-7-6-5-4-3-2-1
8. Waste reduction and management	8-7	6-4-3-2-1
9. Pest Pressure reduction	21-20-19-16	14-13-11-10-8-5-4-3-1
10. Worker Safety	13-10	9-8-7-6-5-4-1
11. Noise quantity reduction	7-6	5-4-2-1

For the other ranks which have a positive impact on the objectives of sustainability, but to a lesser extent, we refer to the complete classifications which can be found in Annex 3.2.

2. Discussion

Table 8.2 gives an overall picture, before going into detail, of the rules of the specifications studied in this chapter. The figures indicate the number of rules studied in each box. We study thus, for example, six rules which have a positive impact on "Air Quality" and which relate to questions of "Crop protection". The last column indicates the total number of distinct rules for the concerned farm level. This number does not correspond to the sum of the row because the same rule can appear for various objectives. The last row indicates the total number of distinct rules in the higher quarter from each classification.

This table makes it possible, in particular, to locate the levels of the farming system which have the highest positive impact on sustainability, thanks to the requirements introduced by the labels. Either these levels are concerned by a higher total number of distinct requirements, or the number of aspects considered on this level is larger.

We see that all the levels of the farming system are not concerned by the most effective rules towards objectives of sustainability. Then, the majority of the most favourable rules concern the aspects of "Crop protection" and "Nutrient management". Finally, the levels "Wildlife and landscape management" and "Soil and substrate management" have a broader influence on sustainability because they address a higher number of themes than the other levels.

We can also estimate the general importance attached by all the labels to the twelve themes through the number of different rules in every summit of classification. In the first instance, we notice that labels pay much attention to Food Safety and Water Quality. The experts also attributed the highest priority to Water Quality. On the other hand, the labels attach more importance to Food Safety than the experts.

In the first part of this discussion, it seems necessary, for a good understanding of the numerous approached problems, to remind certain elements and to try to answer three questions:
1) What is the relation between the studied objective and sustainability?
2) What is the theme's composition and which relation has the agriculture with it?
3) How can agriculture contribute to this objective?

In the second part, we discuss the impact of the best rules of labels on sustainability and on the farming system, objective by objective. We try to answer the following questions:
1) What are the best classified rules and how do they contribute to sustainable development?
2) Which efforts do these rules require from farmer?

Table 8.2: Number of best rules in the Labels for the twelve studied objectives of sustainability, classified by level of the farming system.

Sustainability objective / Farming system level	Air Quality	Bio-diversity	Landscape	Climate conserv.	Food safety	Noise reduc.	Pest pressure	Rare ressour.	Soil fertility	Waste reduc.	Water quality	Worker safety	TOTAL
	Rank 16 to 20	Rank 11 to 15	Rank 5 and 6	Rank 6 and 8	Rank 16 to 20	Rank 6 to 7	Rank 16 to 21	Rank 7 and 8	Rank 12 to 15	Rank 7 and 8	Rank 7 and 9	Rank 10 and 13	
Organization of the farm structure													0
Crop protection	6				39		12				43	11	**77**
Crop quality													0
Energy management													0
Farm management													0
Harvesting					11	1						1	13
Nutrient management					6			18	6		37		**52**
Produce handling					13						4	3	14
Record keeping and self-inspect.					1			3			3		5
Site history and management							2		1				3
Soil and substrate management	1			3				4	3	1	3		9
Traceability													0
Transportation cautions					4	2		2					7
Varieties and rootstocks					1		2						3
Waste and pollution management, recycling & re-use										1			1
Water management											4		4
Wildlife and landscape management		8	6	1		2		1	1	1	1		12
Worker health, safety and welfare												12	12
TOTAL	7	8	6	4	**75**	5	16	28	11	3	**95**	27	*212*

2.1 DURABILITY OBJECTIVES AND AGRICULTURE

2.1.1. Objective n°1 : Water protection

1) It is very important to protect water because it constitutes the habitat of many living species, it is the source of the water we drink, it is useful as a factor of production in agriculture and in other economic sectors and it takes part in our leisure. Preserving water is one of the bases of a sustainable development because it represents ecological, social (health) and economic stakes.

2) The "water protection" relates to the protection of ground water and surface water. Ground water is water which, by infiltration, is under the surface of the soil and moves more or less quickly through geological formations called aquifers. The surface waters include the rivers (e.g. river, channel) and the water surfaces (e.g. lake, damming or pond). Their quantities and their chemical and microbiological quality must be preserved. Three categories of pollutants are to be fought in priority: the nutrients (e.g. nitrates), the micropollutants (e.g. pesticides) and the bacteriological pollution.

Agriculture today has various types of impacts on surface and underground water and on the aquatic environments. These impacts are more or less important according to the applied practices and techniques. By using water for crop irrigation, the agricultural activity has a quantitative impact on this resource during periods of low water level. It can also be at the origin of the disturbance, even disappearance, of certain remarkable natural environments drained for their exploitation. Lastly, some agricultural practices (intensive agriculture, monocultures, use of fertilizers and pesticides, etc.) cause multiple damage (contaminations, eutrophisation, stranding...) in the aquatic environments and consequently compromise the activities depending on the same resources.

We can distinguish "point" losses which go directly into surface waters (leaks of effluents from livestock buildings, leaks of plant protection products during their handling in particular the filling or the cleaning of the sprayers) and "diffuse" pollution which is related to the use of fertilizers and pesticides in the fields. In Belgium, direct losses can be considered as the main entry source of agricultural pesticides to surface waters (Beernaerts et al., 2001).

3) The improvement of practices can significantly reduce the negative impact of agriculture on water. So, to reduce the used quantities, it is necessary to reduce the irrigation or to improve the irrigation techniques. To improve the quality of water, the farmer has several options: limit the use of pesticides, store and handle them in a safe way, avoid to pour leftovers in a sewer, use bio-filters for the sprayer rinsates, improve the storage and the spreading of animal effluents, limit the use of manure, limit soil erosion, use methods applied in organic agriculture, withdraw certain surfaces from production...

2.1.2. Objective n°2: Air quality.

1) What is the relationship between air quality and sustainable development? The air contains oxygen which is essential for many forms of life but it also conveys other molecules which determine its quality because they have an influence on the health of men, animals and plants. Polluted air is not sustainable because the population cannot endlessly be maintained in good health. It also influences the quality of life. Air quality can have effects on water, soil and climate. Air pollution can cause damage to crops and decrease the yields. There are thus often economic repercussions with the negative influences on health and productivity.

2) For recall, the main types of compounds affecting the air quality are :
Sulphur compounds :
SO_2 (fossil fuel combustion**,** sulphuric acid manufactures),
H_2S (anaerobic putrefaction of organic matter**,** paper mills, oil refineries, ...)
Nitrogen compounds: NOx (especially NO and NO_2) but also N_2O, NH_3, HNO_3 and HNO_2.
The transport means are responsible for 55 % of the emissions of NOx.
Ozone (secondary pollutant depending on NOx, Volatile Organic Compounds (VOC's), sun).
Carbon monoxide CO

Organic compounds : VOC's, benzene, toluene, ethylbenzene, xylenes, HAPs, dioxines, furans, pesticides.
Dusts from 0.02 to 100 μm diameter (combustion products)
Metallic compounds : heavy metals (combustion of fossil fuels, metallurgy, incineration of waste...)
Fluorinated compounds: fluorides (production of phosphates, power stations, glass manufacture)

Let us note that these compounds (particularly H_2S and NH_3) may cause an olfactive pollution in the vicinity of their emission (e.g. pig and poultry industrial breedings, application of fertilizers).
The acid rains (HNO3 and et H2SO4 in rainwater) are also one of the consequences of the air pollution by sulphur dioxide and nitrogen oxides, NOx mainly.
Agriculture suffers from ozone pollution because it causes drops of yield and quality deteriorations in the crops.

3) Agriculture is responsible, either directly (e.g.: tractor exhaust gasses) or indirectly (e.g.: phosphates production) for the emission of a part of these pollutants. The terms that concern agriculture are written in fat.

With regard to the acid rains, agriculture takes directly part in the NOx emissions via its fuel combustion, the use of electricity and by stimulating industry. On the other hand, agriculture contributes to the production of SO_2 only indirectly, by stimulating industry (coal combustion, production of cast steel). Agriculture produces the greatest part of the NH_3 emissions (manure) which also contribute to the acidification.

Any action that makes it possible to reduce one of these emissions contributes to improve air quality.

2.1.3. Objective n°3 : Climate conservation.

1) Life adapted to given climate conditions and history showed the vulnerability of any form of life to a change of these conditions. Preserving our climate aims at guaranteeing favourable living conditions on earth.

2) Climate is the whole of the weather phenomena (temperature, moisture, sunning, pressure, wind, precipitations) which characterize the average state of the atmosphere in a given place. In a broader way, it is the whole of the circumstances in which one lives.

The principal danger which weighs on climate is its heating. This is related to the excessive emission by man of greenhouse gas (GhG) which retains the infra-red radiation of the soil. The heating currently in progress will involve the rise of the oceans level and will increase the frequency of extreme weather phenomena.
Another global problem is the thinning of the stratospheric ozone layer which protects the living beings from the harmful ultraviolet cosmic radiations. This phenomenon relates also to the climate in a broad way and it is caused by the action of certain gases emitted by the human activities.

Table 8.3 classifies rejected gasses according to the extent of their impact and the nature of the generated problem.

Table 8.1: Gaseous pollutants and generated problems.

Space scale	Time scale	Encountered problems	Main concerned pollutants
Local	Hours	Urban pollutions	SO_2 / NOx / CO / COV ...
Regional (> 100 km)	Days	Acid rain	SO_2 / NOx
		----------	----------
		Photochemical pollution	NOx / COV / CO
Global	Years	Hole in the ozone layer	CFC / NOx
		----------	----------
		Greenhouse effect	CO_2 / CH_4 / N_2O / CO / COV etc.

Source : http://www.ademe.fr/lorraine/air_tra/emi_lor.html

The origin of global warming lies mainly in the emission of CO_2, CH_4, N_2O and the fluorinated greenhouse gases (HFC, PFC, SF_6). Belgian agriculture produces 9% of the Greenhouse gases (GhG) in Belgium (http://www.climat.be/fr/diminuer.html). However, if one considers the upstream and the downstream of the agricultural sector, this contribution will be higher in particular by taking account into the manufacture of inputs, the foodstuffs transformation processes and the transports.

Belgian agriculture contributes only modestly to the **CO_2** emissions on the scale of the country. It takes part in it by its consumption of energy (fuels, heating of livestock buildings, irrigation, consumption of electricity, etc.) and by the destocking of soil carbon due to intensive agricultural practices (ploughing).

With regard to **CH_4** and **N_2O** gases, agriculture is the most important emission source.
Methane (approximately a third of the agricultural GHG emissions) is produced primarily by animal husbandry and it relates thus to the systems of plant production that we are studying in this report only through the application of organic manures. The principal sources of methane are the enteric fermentation of the ruminants as well as the manure storage and handling.
N_2O (approximately 60% of the agricultural GHG emissions) is emitted mainly by the spreading of fertilizers and manure, the process of degradation in the soil of the nitrate fertilizers, the soil compression by intense ground work, the combustion of organic matter and fossil fuels. It is the most important GHG with regard to the farming systems.

The **fluorinated** greenhouse gases are artificial products which can be found mainly in aerosols (propellant gases), in cold generating installations (cooling gases), in plastic foams, in double glazings and in electric transformers. The forecasts of these gas emissions from now on to 2010 are approximately about 3% of the greenhouse gas emissions foreseen for this period. These gases are extremely persistent in the atmosphere.

The gases responsible for the ozone layer destruction are mainly the following gases: Bromochloromethane (BCM), Chlorofluorocarbon (CFC), Carbon tetrachloride, Hydrobromo-fluorocarbides (HBFC), Hydrochlorofluorocarbides (HCFC), Methyl bromide, Méthylchloroform, halons.

Some of these gases relate to many branches of industry because of their use in current applications (gas in fire extinguishers, cooling gases, solvents...) but only Methyl bromide (CH_3Br) is specifically used in intensive agriculture.

Methyl bromide is a powerful plant protection gas, which enables it to act simultaneously as a nematicide, an insecticide, a rat poison, a fungicide and in certain cases, as a bactericide, without leaving traces neither in harvests nor in the soil. It was used for soil fumigation (in Belgium, for vegetables under greenhouse) but also on harvested products. Since end 2004, its production and its importation are only possible with a derogation for critical uses (EC n°2037/2000).

When it reaches the stratosphere, methyl bromide starts a process of photo-oxidation which releases bromine atoms, which are one of the depletion factors of the ozone layer. Today, 30 to 40% of the stratospheric ozone depletion is allotted to the bromine radicals, 30 to 60 times more powerful than the chlorine radicals.

3) The objective of climate conservation is to stop the emission of gases affecting the ozone layer and to reduce greenhouse gas emissions or, at least, to avoid the use of the most harmful ones.

The reduction of the agricultural emissions will be carried out in particular by the following measures:
- Control of the nitrogen fertilization, input saving practices;
- Development of new crops (leguminous) and new cultivation methods (simplified soil work, rotations);
- Fuel consumption reduction, adjustment of tractors, rational use of energy, and integration of renewable energies.

Let us also note that planting trees or hedges contributes to absorb CO_2 from the atmosphere. Moreover, the cultivation of "bio-fuels" in the future will contribute strongly to decrease the fossil CO_2 releases in the atmosphere.

It is also necessary to stop the use of fluorinated GHG and to eliminate waste which contains some via the good treatment channels.

With regard to methyl bromide, it should be substituted. For the moment, it seems that the best substitutes are chemical or physical or a combination of both. The best long term solutions are undoubtedly biological, in partnership with a judicious use of less hazardous agrochemical substances.

2.1.4. Objective n°4 : Rare resource spillage.

1) The spillage of non-renewable resources jeopardizes the capacity of the future generations to also use them in sufficient quantities for their needs. There is thus a direct link between the use of these resources and a sustainable development.

2) The non-renewable resources exist in limited quantities and their stock is not renewed or too slowly to compensate for their consumption.

A first class of non-renewable resources are the fossil fuels (oil, natural gas, coal), used as sources of energy. Once exhausted, we will have to turn to other alternatives. Their combustion will have generated air pollution and will have contributed to the global warming, which reinforces the need for reducing their consumption. In agriculture, we can distinguish the fossil energy used directly in the activity (e.g. gas oil used by the tractor) and that used indirectly by consuming inputs (e.g. production of manure, gas oil, tractors, electricity resulting from fossil fuels).

The primary forests are not renewable either. Using their wood is equivalent to destroying a global resource of biodiversity and a common inheritance. Agriculture is likely to use wood for certain activities or certain equipment (Pallox, building materials...).

Certain natural manures are limited too, for example rock phosphates or guano. Nevertheless, the use of these manures is less polluting than the use of synthetic manures since they don't need to be produced.

But there is also the quality of soils. The cultivation of a soil without maintaining its balance involves the loss of its fertility after several years and it is thereafter very difficult to restore it in the short term. The preservation and the improvement of the agricultural soil quality is thus of primary importance. The intensively exploited soils are depleted in organic matter but the latter provides essential nutrients for plants and soil micro-organisms. Organic matter improves the soil's structure and cohesion which are favourable to the plants and reduce erosion. It is also a "well" for the atmospheric CO2.

In the same way the quantities of available fresh water are renewed only slowly. The intensive irrigation tends to overexploit this resource. Their quality is also threatened by nitrate or pesticide contamination and that makes this resource unavailable for a time as it depends on natural decontamination.

3) Being tributary of non-renewable fossil energies, the farms must seek to optimize the used energy resources and to reduce their wasting. While waiting for the availability in large quantities of "green" energy, the choice of less consuming machines, the application of the best available technologies, the maintenance and the good adjustment of the equipments constitute the solution to reduce the fossil fuel wasting.
In the same way, to develop natural methods of fertilization, using sustainable labeled wood, irrigating sparingly or not at all, as well as limiting water pollution contribute to the preservation of the non-renewable resources.

2.1.5. Objective n°5 : Soil fertility conservation.

1) The soil is a natural resource used as a factor of agricultural production. A badly cultivated soil is very quickly degraded and this jeopardizes the possibility for exploiting it in the future. In the short term, the fertility has a direct relation with the profitability of the farm. Preserving a sufficient soil production ability is thus equivalent to preserving agriculture which is one of the bases of economy in Belgium. There is a direct link between the safeguarding of soil fertility and sustainable development.

2) Soil fertility means the ability of the soil to constantly ensure the growth of the plants and the harvests, by means of a good delivery of nutritive elements and water, and ensuring to the roots the favourable conditions to their development. Soil fertility is the resultant of chemical (nutritive elements), physical (structure, aeration, moisture) and biological (fauna and micro-organisms) components which depend on the medium (soil, climate) and on human actions (soil work, water control, use of soil conditioners and fertilizers).

The threats on the soils because of intensive agriculture are, in particular, the increase of wind and hydric erosion, the reduction of the amount of organic matter, the reduction of nutritive elements contents, the disturbance of life in the ground, pollution, salinisation, compaction, batance... Let us note more particularly that when the organic matter content falls below a threshold, the structure of the soils deteriorates, rainwater warps their surface, infiltration decreases, runoff and erosion start, then accelerate. All these effects involve a fall of fertility of the ground. Adequate agricultural practices can maintain and improve it.

3) Among the many practices which improve the impact of agriculture on soil fertility, we can quote:

- The reduction of soil work.
- The extension and diversification of farming rotations and the inclusion of leguminous plants in them.
- The adoption of permanent cover practices.
- The direct sowing in the straw without ground preparation.
- The effective control of irrigation.
- The cautious use of manure and pesticides.
- The keeping of crop residues on the ground.
- Protections against wind erosion.
- The plantation of soil coverings at the end of the summer.

2.1.6. Objective n°6: Biodiversity.

1) Why preserve biodiversity? Besides the fact that each living being merits respect and besides the emotional bond between man and nature, we are responsible for transmitting the future generations the best natural resources as inheritance. Biodiversity is at the centre of systems which contribute to maintain the life on earth, like the purification of water, the recycling of oxygen and carbon, the production of food and drugs, the renewal of soil fertility and the origin of genetic resources farmed for crops and cattle improvement. In addition, it is also an indicator of environmental health.

Let us note that biodiversity is in close link with other environmental aspects like soil quality, desertification, climate changes.

2) One defines biodiversity as "the variety of life in all its forms, on all levels and in all its interactions; it includes the diversity of ecosystems and species and genetic diversity ".

Agenda 21 defines biodiversity conservation as the conservation of the animal and vegetable species as well as the protection of the genetic material.

In our countries, there is a generalized observation of a regression of the rare and specialized species and of an extension of the common species. There is thus a homogenization and a trivialization of the animal

and vegetable communities. Habitats change quickly too. They become increasingly small, simplified, split up and young.
The causes of this loss of diversity are primarily the human pressures such as: demographic growth, industrial technologies, transport and the intensive exploitation of the natural resources by industry, agriculture and fishing.

The agro-pastoral activities had the effect to increase the biodiversity until the intensification of the agricultural and forestry practices. These reversed the trend (grubbing, regrouping, correction of rivers, excessive use of manure and plant health products, air and water pollution, selection of the most productive varieties/species,...). The use of GMO's or species for biological crop protection can also influence biodiversity.

3) The farms constitute the habitat of a series of animal and vegetable wild species that agriculture must try to protect.

Agriculture can contribute to natural biodiversity by preserving, maintaining or creating uncultivated surfaces (trees, hedges, edges of woods, slopes, banks, grass strips...). Beneficial effects for the farmers relate to the environmental premiums or the action of natural enemies of parasites which take refuge in these elements.

The crop can also contribute to biodiversity, being itself the habitat of certain species. The diversification of the cultivated species thus also plays a part in it.

2.1.7. Objective n°6bis: Landscape.

The landscape has an aesthetic value and constitutes a common patrimony. It influences the feeling of welfare and the quality of life of the inhabitants. It can also constitute an economic motor if it attracts tourists and generates leisure. The quality of landscape is often the reflection of the environmental quality and biodiversity. Sustainable development goes thus hand in hand with its protection.

A landscape is composed of natural (relief, vegetation) and human elements (roads, constructions, crops, meadows). The farmer is one of the principal actors in the modelling of the natural and rural landscape. Its activities and its practices have a direct impact on it.

2.1.8. Objective n°7: Food safety.

1) Food safety is at first a matter of public health. The tolerance of foodstuffs that are unsuitable for consumption on the market is a threat to human life and is likely to be expensive for the community. It is thus a necessity for the collective welfare and for the economy, both in the short and in the long run.

2) The consumers implicitly require a high hygienic quality of foodstuffs. By hygienic quality, one understands the absence of biological, chemical or physical contaminant in amounts likely to jeopardize public health.

Agriculture can be the source of natural or anthropic contaminations:
- Natural plant substances, undesirable for men (e.g. nitrate, phytotoxins).
- Mycotoxins, i.e. chemicals produced on the crop by fungal pathogens or by moulds during the storage of foodstuffs (e.g. aflatoxine, ochratoxine A, déoxynivalénol, patuline, zearalenone, fumonisines).
- Residues of plant protection treatments remaining on the plants.
- Undesirable substances coming from the soil, the air or the water which were in contact with the crops or food products. Are concerned: heavy metals, like lead, cadmium and mercury, but also organic substances such as PCB or dioxins. The pollution of the environment can thus have an impact on the quality and safety of the food chain via agriculture (e.g. via combustion residues).

Other contaminations do not relate to the agricultural practices themselves. They occur at the time of transformation and distribution of foodstuffs.

- Products formed during food processing, e.g. under the influence of heat (acrylamide, HAP, furan) or under the influence of acid substances (3-MCPD).
- Substances which migrate from packing materials (e.g. tin, phtalates, bisphenol A,…).

3) Agricultural practices, as well as those upstream and downstream to production, can contribute to a better food safety. At first, for any type of agriculture, the choice of the crop sites according to their history is important to avoid that industrial contaminants are taken up by crops near historically polluted sites.

The choice of the crop plants can have repercussions on the phytotoxin contents. These may be present in higher concentrations in varieties privileged for their resistance properties against pests.

There is a direct relation between the applied amounts of fertilizers, their quality and the nitrate contents of the foodstuffs. Food safety thus relies on a suitable fertilization, in particular by controlling the applied quantities, by preferring composted organic matter (more progressive release of the nutritive elements) and by giving more weight to the natural defence strategies of the crop. Organic foodstuffs contain fewer nitrates than products obtained with the conventional methods (Pussemier, 2006).

Reducing the use of pesticides or using less harmful or inoffensive pesticides reduces their residues in the food products. However, the importance of pesticide residues must be relativized: in 2000, the exceeding percentage of MLR's for pesticides was of 4.5% for Belgium.
Several studies show a lower presence of pesticides residues in the order "organic agriculture < IPM < conventional (intensive) agriculture". Note, however, that products of natural origin are not necessarily totally innocuous for man or environment (Pussemier, 2006).

For mycotoxins (especially for Fusarium toxins), the most important elements for preventing contaminations are linked to agricultural factors in the field and the use of good practices in the farm (elimination of mouldy goods, good preservation conditions).

The practices that will help reducing the risks of contamination due to Fusarium infection in the field are: long crop rotations, obligation to plough the soil (as a weed control technique), absence of maize as preceding crop, no use of growth regulators and better lodging. The choice of the cultivated varieties is also important to reduce the risk of contamination by the mycotoxins. Some varieties are very sensitive to fungi attacks (ex. fusarium on cereals). A judicious use of fungicides may help to limit mycotoxin contaminations significantly but it is unfounded to assert that the absence of plant protection products systematically leads to a higher mycotoxin contamination (Pussemier, 2006).

Contaminations by mycotoxins during storage are independent of the mode of agriculture or the use of fungicides during crop period. Bad storage conditions are mostly responsible for that. The control of moisture, insects and heat in stocks of food products is crucial for food safety.

Some good practices influence food quality in various ways such as, for example:

- Water and soil analysis to prevent the risks of environmental contaminations or contaminations by nitrates;
- Prohibition to use sewage and industrial sludges in certain circumstances in order to avoid chemical or biological contaminations. If allowed, a better control of these matters through analyses and appropriate use (see advice of the AFSCA scientific committee SCI COM 2002/14).
- Seed treatment to decrease the pressure of diseases, and thus pesticides and mycotoxins residues;
- Analysis of the harvested food products and implementation of a traceability system for the traded batches to be able to withdraw the dangerous goods from sale;
- Strict hygiene of operators and systematic cleaning of the harvest and transport machines.

2.1.9. Objective n°8: Waste reduction and management.

1) Belgium produces more and more waste. If it is not managed in a suitable way, the quality of life and the environmental quality (soil, air and water) will very quickly degrade. It becomes impossible to continue to hide waste in the ground because of a lack of place. To bury or burn wastes constitutes a great spillage of matter and energy and it generates pollution. It becomes thus vital to break the spiral of their production and to manage them better, in the context of a sustainable development.

2) Waste is any matter or object that his holder wants to get rid of. Waste can be very variable in nature and in dangerousness

Figure 8.2 illustrates the priorities of sustainability concerning waste management.

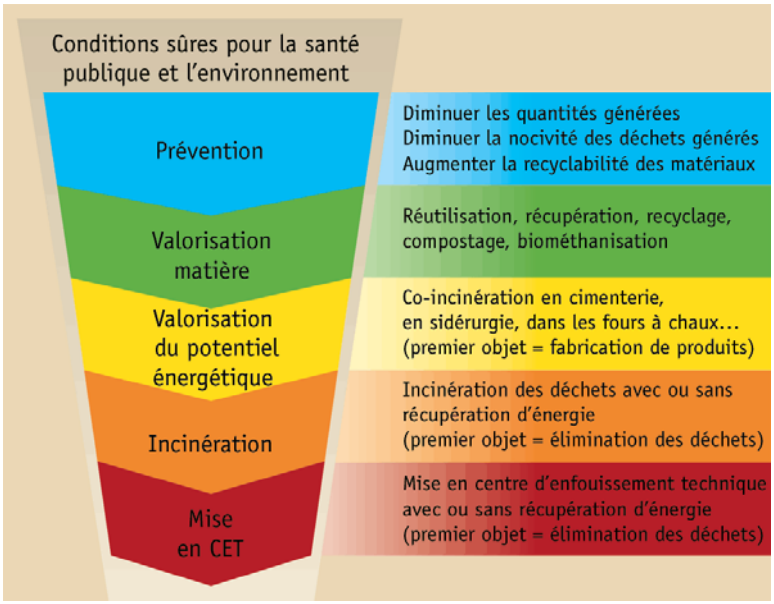

Figure 8.1: Scale of priorities concerning waste management. Source : Tableau de bord de l'environnement wallon 2004.

What does the main agricultural waste consist of?
Substrates after use, harvest wastes, emptied pesticides barrels and cans, pesticide spray tanks leftovers, plastic bags for manure or seeds, plastic films and covers, worn oils and lubricants, machine elements (belts, batteries, motors, tires...), small dangerous waste: neon tubes, energy cells, aerosols, paperboard and wood packaging, cleaning and rinsing waters, cooling gases...

3) What can the farmer do with his waste?

First of all, he must tackle the problem at the source in particular by refusing over packaging in his purchases, by preferring reusable materials or recyclable materials, or by choosing less harmful matters.

Once the waste is produced, the first stage is to sort it according to the existing channels of recovery. The sorting is essential to be able to recycle/valorize a waste. Let us recall that some practices are illegal, like burning waste or pouring it with a sewer.

The environmental impact of the used technology for the valorization or for the treatment must also be evaluated. Indeed, to recycle a substrate (e.g. polyurethane) with steam needs much energy and thus this technique is not necessarily durable. Nevertheless, recycling the substrates has a positive impact on the produced quantities of waste.

2.1.10. Objective n°9: Pest pressure reduction.

1) The parasitic pressure causes important losses in crop yield and in foodstuff quality. If nothing is undertaken to control it, not only the farmer loses money but the consumer loses in food quality and safety. Moreover, without control, the parasitic pressure is increased. The plant protection is thus necessary for the perenniality of the agricultural system but the practices must try to be most sustainable i.e. to preserve the environment, the health of the consumer and the farmer's income. On a global scale, it is an important objective to manage to feed the world population.

2) Through this objective, it is a matter of fighting diseases, weeds and pests in order to maintain their populations at a rather low level so that the damage is economically tolerable.
The used means comprise of 4 axes:

- improvement of the cultivation practices (fertilization, soil improvement, rotation, water and climate control)
- suppression of transmissions by seeds and seedlings (by disinfection or sanitary selection)
- improvement of the seedlings resistance (physiologically or genetically)
- direct fight against parasites (biological, physical or chemical way).

The chemical means of plant protection induce risks for the environment and for the consumer health (via their residues). This way of plant protection is thus regularly questioned. Genetic manipulations are confronted with socio-economic problems of acceptability.

Conventional production, integrated production and organic production approach these four aspects differently. One can thus distinguish the chemical, the integrated and the biological plant protection. The integrated plant protection associates all the existing means and consists of the rational application of a combination of biological, biotechnological, chemical, cultural or plant-breeding measures whereby the use of chemical plant protection products is limited to the strict minimum necessary to maintain the pest population at levels below those causing economically unacceptable damage or loss (91/414/CEE). The biological plant protection considers the control of crop diseases, weeds and parasites in an essentially preventive way, by using their natural pathogens, predators, parasites, or products of them.

3) To reduce the use of pesticides and their harmfulness and to rationalize their use are thus the priority ways to make the plant protection more sustainable. A short history of pesticide use makes it possible to note this tendency and this need.

The first steps of modern chemical plant protection occurred before the 50s.
Usage of Inorganic products with high toxicity, DDT and other organochlorinated insecticides.
The boom of chemical plant protection took place between the 50s and the 70s.
Usage of preparations containing organic or organomineral compounds.
Progressive introduction of the generalized and intensive chemical plant protection (weedkillers, insecticides, preventive fungicides).
Appearance of the adverse effects (intoxications, resistances, biological disturbances). Emergence of good agricultural practices.
Maturity of chemical plant protection: reactions to the challenges and emergence of rational plant protection (70s to 90s)
Taking into account the problems and development of new products (effectiveness,
anti-resistance strategies, better behaviour of the active substances in the environment, selectivity)
Putting forward new hazards (e.g. carcinogenic effects) and environmental pollution.
The contemporary phase
Drastic reduction in the number of authorized active substances;
Implementation of pesticides reduction programmes;
Assistance and promotion for alternative or environmental production methods.

Thus, the following question arises: how to protect plants in a sustainable way? The tendency, in addition to the entirely biological way, is the development of an "integrated" plant protection (or IPM, Integrated Pest Management) in particular through labelled cultivation systems.

The IPM is a compromise between the exclusive use of chemicals and their absence of use. It is based on a limitation of pesticides and on the use of more natural crop protection methods than those applied within the framework of intensive agriculture. For example, the farmers can reduce the use of insecticides by sowing varieties which are resistant to certain parasites and by regularly modifying the crop rotation system. In practice, integrated agriculture also requires a better planning and the respect of good practices.

Other examples of natural protection methods are: the destruction of crop residues and soil work aiming to cleanse the plots, the preservation of the hiding places for natural enemies, the introduction of pheromones (as a method of sexual confusion or as baits integrated in a warning system for the determination of treatment thresholds).

2.1.11. Objective n°10: Worker safety.

1) It is unacceptable to expose a worker to some risks if it is possible to reduce or suppress them. The lack of safety at work has social repercussions since man is the direct the victim. Safety preserves its physical integrity and allows him to work serenely. For a sustainable development, safety at work is an element to take into account.

2) The agricultural worker is exposed to various dangers. For each hazard, the farmer can implement preventive actions in order to reduce the risks. Here are some examples:

Table 8.3: Risks incurred by the worker and preventive actions

RISQUES ENCOURUS	ACTIONS Préventives Nécessaires
Risque d'origine mécanique : coincements, enroulements, écrasements, chute d'objets...	Mise en place de protecteurs d'arbres de transmission, de carters pleins ou grillagés,...
Risque d'origine chimique : produits phyto, produits de nettoyage (stockage, préparation, épandage)	Local de stockage ventilé et fermant à clé, port d'équipements de protection individuelle, prise en compte des conditions climatiques (sens du vent, forte chaleur)
Risque d'origine électrique : fils dénudés, défauts d'isolement	Maintien en bon état de l'installation, vérifications périodiques par organisme agréé
Risque incendie : stockage de carburant	Isolation des stockages, interdiction de fumer, mise en place d'extincteurs adaptés au risque et vérifiés tous les ans
Risques liés aux manutentions manuelles : charges lourdes, manutentions répétées, postures inadaptées, coupures aux mains	Mise à disposition de matériel d'aide à la manutention (bande transporteuse, diable, transpalette, chariot de manutention, formation gestes et postures) Port d'équipement de protection individuelle.

Source : Guide de l'employeur et du salarié agricole de la Vienne.

It can be necessary to assess the risks before implementing the corrective measures intended to reduce them. Certain hazards can indeed present no risk and thus require no action. One can distinguish the actions for collective protection (organization of work, safety of the machines) and the actions for individual protection (worker equipment (shoes, masks...), worker training). In addition to the practical provisions (e.g. helmet, pictograms) and the worker's training (e.g. knowledge of pesticides) which are direct solutions to reduce the risks, let us note that the change in agricultural practices can suppress certain hazards (example: biological vs. chemical plant protection).

2.1.12. Objective n°11: Noise quantity reduction.

1) Noise has an impact on man and animal welfare when its intensity or its repetition is too high. The human being cannot easily remain in an environment polluted by noise. In the short term, he's likely to have physical or psychological disorders. In the same way, wild animals will not find a suitable place any more for a normal existence and for their reproduction. Noise can thus have local effects on human health and on animal biodiversity, which are factors of a sustainable development.

2) The general problem of noise is especially related to the urban and industrial contexts. In these zones, agriculture is mostly absent. The responsibility of agriculture is thus negligible with regard to the noise harmful effects. Noise is to be found within automobile traffic, industry, airports, trains or construction sites. It is thus necessary to relativize even more the priority granted to this sustainability objective with regard to agriculture.

In the same way, in rural context, besides the harvest periods, the harmful effects generated by agricultural noise seem rather reduced. The low population density around the crops and the farms accentuates this claim.

Nevertheless, agriculture can cause noise disturbances with respect to wild fauna. Moreover, certain agricultural activities (harvests) often happen at night and are thus more strongly felt by the vicinity. Let us note that the impact of noise on the agricultural worker is more a question of worker health and safety than an environmental problem.

Which are the noise types met in agriculture?
Temporary or occasional noises are due to the use of machines like tractors, to the loading and unloading of machines, to tools for the maintenance of machines...
Permanent noises are due to the functioning of the installations such as ventilators, pumps, cooling systems, electric motors, gears, compressors, crushers, conveying belts, conditioning equipments...
Impulsive, specific noises or shocks are caused by the handling of containers, loading and unloading, manual workshop activities...

We can also make a distinction between the noises coming from the activities on the field (not frequent and temporary noises in often isolated places) and the noises of the farm and installations (repeated, continuous or impulsive noises with a closer neighbourhood).

3) How can the farmer reduce his noise impact? Here are some hints:
- absence of noise production or stopping of noise (application of another technique);
- quantity reduction of produced noise (less noisy machines, correctly regulated and maintained machines...);
- reduction of the dispersion of the produced noise (placement of screens between the source and the receiver, absorbing panels, closed doors and windows...).

2.2 DISCUSSION OF THE SELECTED BEST RULES

2.2.1. Labels and Water Protection

Impact of the best rules on the durability item and on environment
All the labels are represented in the best measures for Water Protection but with a greater proportion for Charte Perfect then in the case of FlandriaGAP and EurepGAP.

The high number of selected rules reflects the number of possibilities to reduce the impacts of conventional agriculture on water, mainly through requirements dealing with the use of pesticides and the fertilization practices.

First, the alternative methods to pesticides and to the intensive fertilization must be considered to suppress water contamination.
Some labels require putting forward the use of biological means of plant protection, in particular in greenhouses, using mechanical weeding as substitutes to weed killers and applying other integrated techniques.
The improvement of soil fertility without chemical fertilizers needs the implementation of Integrated Crop Management systems after advice or training. So, it is necessary to support in priority the natural fertilization methods within a multiannual rotation program such as, the cultivation of legumes, green manures and deep-rooting plants.

In a general way, for each application, it is necessary to minimize the quantities of manure as well as chemicals against pests, diseases and weeds.

For that purpose, it is asked to limit the fertilizers quantities to what is strictly necessary in order to avoid useless and polluting overdoses. Therefore, fertilization must consider the plant needs (according to the growth stage) and the contributions already present in the soil.
It is thus important to carry out analyses of nutrients in soil (or water, in hydro culture) to adjust the amounts. The reports of analysis must be available to guarantee the transparency.
In potato crops in particular, it is required to establish the profile of nitrogen contents of the soil before the crop and to measure the nitrogen residues in the ground after harvest, (less than 50 kg N/ha). The applied quantities are not only minimized but one also checks in addition that the soil is not likely to release too much nitrate in the groundwater during the intercrop period.
The residues should be measured more particularly when organic matter has already been applied over the year or if one cultivates several vegetable crops in the same year. Actually, the soil already contains nitrogen and it is necessary to know the quantity to add for the following crop. In the same way, from one year to another, it is essential to consider the previous crop and in particular to prohibit organic manures before and after a legume crop or to reduce the amounts if the straw was ploughed in.
The crop guides impose the maximum fertilizer quantities not to be exceeded. They should be followed because it is a guarantee for the water quality.
Having to measure the nitrate content of potato tubers relates to public health but this content also reflects that of the soil. Requiring that it should be lower than 200 mg/kg imposes restrictions of fertilization and thus reduces directly the transfers towards water.

To avoid an over-fertilization involving water pollution, the person who is in charge to determine or helps to determine the required amount of fertilizers must be well educated. To determine these quantities, it is essential to know the N, P, K composition of manures through analyses. All the label instructions of pesticides must be respected. The amount of mixture to be applied must be calculated, prepared and recorded in a precise way, by following these instructions. The surface to be treated, the speed and the spraying pressure are included in the data to be taken into account. In this manner, one reduces over-doses and, consequently, the concentration in water. Thanks to that, one also avoids mixture surpluses and their possible wrong elimination. It is also important to rely on equipments and installations for the weighing of products and the correct preparation of mixtures. In any situation, it is necessary to follow the label instructions for their handling. The spraying and fertilization material must be regularly maintained. This ensures that the estimated quantity of mixture or manure will so be applied, without wasting due to dysfunction.

The **frequency** of use (number of applications) of pesticides and fertilizers (therefore also their transfer to water) is also decreased thanks to certain requirements. So, it is necessary to treat only when the harmful organism is really detected or after information by the warning systems. The improvement of fertility by the practice of integrated farming systems reduces the use of fertilizers.

The **harmfulness** of the used pesticides and fertilizers can be controlled to reduce the impact on the aquatic environments.

A judicious choice of pesticides makes it possible to avoid water contamination with illegal or harmful products.

In a general way, it is necessary to prefer products with low persistence. They will so remain little time in water or in the environment thus reducing the transfers towards water.
The choice of the product must be done according to recommendation cards which hold account of several requirements: the product must be approved in the country, it must be useful for the crop and its harmfulness should be evaluated by the Pocer indicators of risk. If a product isn't selected in these lists, it must be approved, it is necessary to obtain the written authorization of a designated advisor or a competent organization and to apply integrated farming techniques.

The use of products registered in the Appendix II of the European regulation N°2092/91 only at the time of an imminent threat has a very positive effect on water quality because their harmfulness is very low and because they are used only if really necessary.
The choice of pesticides is a decisive stage to control the nature and the toxicity of the used substances. In all cases, the person who is implied in this choice must be qualified.

The person in charge to determine or advise the fertilizers to be used must be qualified and must be able to prove it. This precaution makes it possible to avoid the inappropriate uses of fertilizers involving water pollution.
Manures should be analyzed to get to know their composition. At the time of purchase of organic manures in particular, like compost or sewages, the farmer must have the analyses as well as the agreement of the provider.
These analyses, before the application of manures, must help to evaluate the risks by taking into account the characteristics and the origin. There are indeed great risks of water pollution related to the presence of unwanted and harmful elements in these matters.

In a general way, it is necessary to limit all the potential **losses** of pesticides and manure starting from the installations, the crops or during the agricultural activities.

For the fertilization, some periods of the year are unfavourable for the water protection because they involve more losses. So, the application of organic fertilizers must be done only during a definite period (July to September). It is also necessary to respect the prohibition to apply rapid acting organic fertilizers in winter, from October to February.

For manures and pesticides, the application must take place under good weather conditions and one should never spray in windy or rainy weather.

Organic manures are prohibited on flooded and on snow-covered soils. Organic manures with fast action (e.g. poultry liquid manure) are prohibited on frozen or bare grounds, except if they are incorporated the very same day.

Losses can take place starting from pesticide and fertilizer storages and they can generate large chemical and microbiological water pollution since the quantities are high on small surfaces. Their management is thus crucial.

The storage conditions of pesticides must be controlled. The storage room must be allotted only to this function and have an impermeable soil. The pesticides and fertilizers must be preserved in their original package to be able to identify them permanently and not use them incorrectly and one has to protect stocks from degradations.

To avoid discharges towards surface waters or ground waters, the capacity of organic manure stocks must be sufficient and stocks must be protected from the rain. The liquids coming from stocks must be collected. Organic fertilizers storages located close to the farm must be placed on a sufficiently large and water-tight concrete surface, equipped with collectors and with a cistern without overflow.
For the liquid animal manure, it is necessary to foresee a water-tight tank, without overflow and of sufficient size, i.e. a storage capacity for a 6 months production, corresponding to the duration of application prohibition.
On the field, storages of poultry manure containing less than 55% d.m. are prohibited and for the other manures it is necessary to avoid all liquid emissions.
The storage period of manure must be limited to 12 months and to maximum 3 months for the poultry manure in order to avoid excessive stocks generating proportional risks on waters.
The farmyard and poultry manures storage area must be located at 10 meters from the previous year storage location. Indeed, a soil saturated with nitrates causes a greater pollution by leaching.

The integration of some agricultural practices allows limiting the losses of nitrates and other elements towards water starting from the crop. In a general way, it is necessary to avoid a bare ground because it is then more vulnerable to the natural phenomena.

So, to limit nitrogen leaching in the intercrop period, it is necessary to take measures like sowing a winter crop or a nitrate-trap after the application of organic manures or incorporating immediately the poultry manure after its application. Minimizing erosion by suitable techniques also allows reducing the losses towards water.

A special attention must be given to the water catchment areas, water bodies as well as to the sewers which are entrance doors towards the aquatic environments.
In a radius of 10 m around a water abstraction, it is forbidden to use pesticides. Within less than 35 m, there should be no cesspools and no pesticides or fertilizers deposits. Between 100 and 1000 m around a water catchment, only the above-ground fuel tanks are tolerated, with a capacity higher than 500L and located in a tight container.
The application of organic manure is prohibited at less than 4 m from any water body.
Organic and inorganic manure storage areas must be located far from water courses, sewers and water abstractions (10 meters for the farmyard and poultry manure).

Human behaviour and the lack of some habits can be at the origin of voluntary or involuntary pollution.
It is important to rinse the spraying equipments as well as the empty pesticide containers after use. They must be clean to present no risk of later contamination. The rinsates of these containers must be collected or returned to the sprayer to be sprayed. Then, one has to store, identify and handle correctly the empty containers, because even when rinsed, they can still contain residues.
For the spraying surpluses, one must pass by the legal channels of treatment. In absence of regulation, the diluted surpluses of mixture must be applied on a fallow land or a still untreated crop, at high speed and without exceeding the recommended amounts.

Some labels clearly banish the irresponsible acts which generate "point" pollutions. It is so prohibited to throw any liquid waste, pesticide tank washing and mixture surpluses, into a sewer, in the sub-soil, into water courses, on a yard or into a ditch. This kind of practice is an important cause of water pollution. It is obligatory to get rid of this kind of waste by the channels of dangerous waste processing. Recording all the pesticide treatments, even the dispersions of surpluses and rinsings, and identifying the operator who carries out the applications allows to give him a sense of responsibility and to identify him in case of problem.

Risks of chemical water contamination also exist through the use of **substances for the treatment of harvested food products** (biocides, waxes and plant protection products). The professional skills of the person responsible for the post-harvest treatments, the farmer or the operator, are a guarantee to know the risks and minimize them for a correct and justified application. The respect of the label instructions is of primary importance.

Lastly, it is necessary to treat the **water used for rinsing** of the products on the farm. Such waters are thus not rejected with their polluting load.

Impact of labels on the farming system, via the best rules for the item
There are 7 levels (27 under-levels) in the farming system which relate to the best assessed measures of labels for "Water Protection":

- Crop protection - *Basic elements of crop protection ; Choice of chemicals; Crop protection products storage and handling; Disposal of surplus application mix; Records of application; Application machinery; Empty crop protection product containers;*
- Nutrient management - *Advice on quantity and type of fertilizer; Fertilizer application; Fertilizer purchase; Fertilizer storage; In general; Organic fertilizer; Analysis of soil or water in case of hydroculture; Application machinery; Nitrate contents analysis; Nitrogen management;*
- Produce handling - *Post-harvest treatments; Hygiene;*
- Record keeping and self-inspection - *Post-harvest treatment; Training; Analysis of soil or water in case of hydroculture;*
- Water management - *Water catchment;*
- Wildlife and landscape management - *Waste and pollution action plan;*
- Soil and substrate management - *In general; Soil cultivation practices; Soil erosion*

Thanks to the requirements of the labels, the farmer contributes effectively to a better water protection. He must, on the other hand, modify his conventional practices in various ways. First of all, the labels require reconsidering the habitual use of pesticides and synthetic fertilizers to steer towards an integrated or biological system. The farmer must integrate a maximum of new techniques and natural pest management strategies and develop other crops. That represents thus an obvious extra load of work which generates labour costs but, on the other hand, the costs related to the inputs decrease. When dealing with fertilizers and pesticides, the farmer's professionalism must be reinforced in order to limit the contamination of the aquatic environments.
The fertilization must become a skill which should be practised scrupulously and rigorously, by holding account of the soil, the plant and the fertilizers. All the stages going from the preparation to the application must be controlled and carefully executed. The farmer must rely upon external help for all the decisions concerning the quantities and the nature of the used materials. He must systematically ask analyses of soil, manures or foodstuffs, and he must refer to the technical documents or get help from external advices.

He must adapt the fertilization to the crop successions and to the seasons and that requires to plan the operations more precisely, to be able to store matters, but at the same time he must be flexible with respect to the weather conditions requiring sometimes to defer an activity to a later date.
Precision does not cost anything except rigour. The organization and the management of the analysis results require more office work. On the other hand, the farmer has to pay for each external assistance but again this aims at generating inputs savings.

The pesticide treatments must be prepared with more precision and the farmer must ask for advice about the danger of products. In all cases, he should no more apply in a systematic way or without justification for the application time or the nature of products. He must observe the sanitary status of the crops or be informed when it is useful to treat. The epidemiologic forecast services require a financial contribution (not always) but they reduce the number of interventions and the expenditure in products.
At the end of each treatment, it is necessary to observe some "good practices" methodically and be able to contribute financially for a waste collecting service. The labels require to not easily yield to the temptation of getting rid of waste. The farmer must also hold a full recording of the treatment operations and that requires office work.

At the recruitment of the personnel, it is asked to take skilled people, they ask higher wages but they are more competent with regard to fertilization and crop protection.

The farmer should not haggle over the quality of the equipment necessary to fertilize and protect the crops. He must invest larger amounts in their purchase and maintenance. A rigorous management of the pesticides and manure stocks on the fields and on the farm also require investments in storage equipments. Some labels require investment in a purification system for water used for rinsing harvested crops.

The farmer must clearly identify the catchment areas, the water bodies, the sewers and take notice of certain prohibitions in these zones. This does, however, involve a local decrease in productivity.

2.2.2. Labels and Air Quality

Impact of the best rules on the durability item and on environment
The label which dictates the most effective measures for the air quality is Organic farming. The best measures of the other labels are less powerful. Fruitnet, GIP and Charte Perfect appear more often in these.

The rule with respect to the use (only in case of a direct threat) of **products of Appendix II** of the regulation EU 2092/91 (Organic farming) occupies the top of the classification of air quality improvement. Indeed, these substances are (almost) not harmful. Moreover, they are used as a last resort, thus not frequently.

The combination of natural **alternative methods with chemical plant protection** is also very favourable when it is applied almost exclusively (Organic farming). Examples are: the choice of appropriate species and varieties, crop rotation, protection of natural enemies, mechanical cultivation techniques and the flame weeding. They are positive for the air quality as regards pesticides because they make it possible to avoid them but some practices are not completely clean because they contribute to pollutant emissions by the combustion of energy necessary to their realization.

These measures allow to suppress the drift of harmful products in the environment close to the fields. Moreover, reduction of the pesticide use means a reduction in the industrial consumption of energy for their production and thus results into less industrial air pollution.

In a general way, respecting the **ICM and IPM principles** has a positive effect on air quality because their goal is to reduce the applications of pesticides to the strict minimum and to support other plant protection strategies. A framing (formation or advice) is necessary to set up the IPM techniques effectively.

The **prohibition to use chemical soil disinfectants** is also important for air quality. It especially designates methyl bromide, which is very toxic when inhalated and very harmful for the ozone layer.

Impact of labels on the farming system, via the best rules for the item
The measures of labels which have the most positive and durable impacts on "Air Quality" locate at 2 levels (3 under-levels) of the farming system:
Crop Protection – *Basic elements of crop protection; Choice of chemicals*
Soil and substrate management - *Soil cultivation practices*

The labels require beneficial practices for air quality which are principally linked with crop protection. They ask to reconsider the conventional use of pesticides.
Using only products of Appendix II (EU 2092/91) requires that the farmer should shift towards organic agriculture. On the other hand, if he keeps the possibility of using pesticides, he moves towards an integrated agriculture. To have the best effect on air, the farmer must thus be prepared to reorganize all his plant protection management.

2.2.3. Labels and Climate Conservation

Impact of the best rules on the durability item and on environment
Within the studied labels, Charte Perfect has the most powerful measure for Climate conservation by asking to realize an **environmental audit**. The purpose to do such an audit is, in particular, to control the energetic efficiency of the installations and the overall energy consumptions and to make an inventory of the pollutant emissions. The auditors will draw up a series of proposals to save energy and to directly decrease the release of carbon dioxide. It will also highlight the faults in the management of waste containing greenhouse gases and harmful gases for the ozone layer (aerosols, refrigerating gases). It will possibly point agricultural practices which undermine the climate like the use of manures (CH_4) or the practice of ploughing (N_2O). It will advise to undertake actions of nature conservation and, so, to create carbon wells. The audit thus analyzes the total impact of the farm on the climate.

Another positive requirement is the prohibition to use **soil and substrates chemical disinfections** by several labels (GIP, Fruitnet, Charte Perfect, Terra Nostra). One of the used products, methyl bromide, is very aggressive for the ozone layer. For the substrates, Charte Perfect suggests the **steam disinfection** as an alternative. Let us note, however, that this technique requires much energy and thus takes part in the CO2 emissions.

The maintenance or the increase of both the fertility and the biological activity of the soil in the first instance by cultivation of legumes, green manures or deep-rooting plants in an appropriate multi-annual rotation programme (Organic farming) is also very beneficial for the climate. By preferring the **natural fertilization methods** one indeed uses fewer industrial or farm fertilizers. That reduces thus the CH4, N2O and CO2 emissions. Moreover, these techniques are more and more associated with the absence of ploughing, which reduces the destocking of the soil carbon.

Impact of labels on the farming system, via the best rules for the item
Among the measures of labels which contribute positively to the "Climate Conservation" and which were chosen by the experts, the best ones are located at 2 levels (3 under-levels) of the farming system:

- Wildlife and landscape management - *Waste and pollution action plan;*
- Soil and substrate management - *In general; Soil cultivation practices.*

To call upon consultants to carry out an environmental audit requires an investment in time and money. The audit will invite the farmer to reconsider his most harmful practices.
To find alternatives to chemical disinfection obliges to turn to natural soil decontamination strategies.
To apply the natural methods of fertilization is accompanied by a reduction of the use of fertilizers.
In all the cases, the conventional system is to reconsider more deeply. The farmer must thus turn to more natural techniques to decrease his impact on the climate.

2.2.4. Labels and Rare Resource Spillage

Impact of the best rules on the durability item and on environment
The majority of the best measures concerning the "Rare resources spillage" are attributed to the label Charte Perfect.

Several **restrictions to apply fertilizers** with a "rapid" nitrogen release directly aim at preserving the water resources because certain conditions accentuate their leaching or losses by run off. So, Charte Perfect enacts restrictions for the use of mineral or organic manures rich in nitrogen, in particular the liquid and the poultry manures:
They are prohibited on flooded soil, on frozen soil if incorporation is impossible, on snow-covered soil, at less than 4 meters of a water body, on a bare ground if incorporation is impossible the very same day, from November 1 to January 31, with bad weather or after a legume crop.
Let us underline the importance to perform the immediate incorporation of the poultry manures.

To pay attention to keep the label instructions on fertilizers **readable** Charte Perfect makes it possible to avoid confusions of products or useless overdoses. Water pollution would be the principal consequence of such errors but wasting manures also represents a waste of fossil fuels necessary for their manufacture.

Another important point to avoid water contamination is to **store correctly** the fertilizers rich in nitrogen and/or liquid. For Charte Perfect, it is therefore necessary to foresee cisterns of sufficient capacity, which are water-tight and deprived of overflow system, tight storage surfaces with a juice collection system, located sufficiently far from water courses (10m), water catchments or sewers.

The practice of **natural fertilization methods** (cultivation of legumes, green manures or deep-rooting plants in an appropriate multi-annual rotation programme) makes it possible to do without direct contribution of manures (Organic farming). The latter pollute water and, in the case of synthetic manures, require fossil fuels for their manufacture. Moreover, these methods are more appropriate to preserve the quality of soils in a balanced way and to avoid using machine burning fuels.

The incorporation of organic material composted or not, from holdings producing in accordance with the rules of Organic Farming guarantees that the production of these matters have a limited negative impact on water and on soil quality. Organic agriculture is indeed better for these points. On the other hand, fossil fuels are consumed to incorporate the organic matter.

To **minimize erosion** by adopting some practices (in several labels) preserves the physical quality of soil and reduces the transfers of nutrients towards water. The water and soil resources are preserved. The same applies to the application of measures limiting the nitrogen leaching during the intercrop period.

Charte Perfect limit the **quantities of applied fertilizers** (in average 120 kg/ha of annual organic nitrogen inputs). It is equivalent to reduce proportionally the contamination of water. In nitrate "vulnerable zones" or in "Zones subjected to particular environmental constraints", it is appropriate to limit even more these quantities (80 kg/ha) because the risks are higher.

By doing **analyses** of soil or substrate water, measures of nitrogen soil residues or complete soil analysis once every three years at least or before each crop in horticulture, one controls fertilization better (in several labels). It is indeed important to precisely know the nitrogen contents of soil and substrates in order to limit the amounts to the strict minimum. That reduces the consequences (already mentioned) of overdoses on water and on fossil fuels.

Among all the wastes, it is necessary to pay particularly attention to **liquid wastes** because they present more risks to pollute water. It must obviously be prohibited to throw any liquid waste, pesticide tank washing or surplus of application mix, into a sewer, in the sub-soil or into water courses (Charte Perfect). The "point" losses of pesticides are an important cause of pollution of the water resources.

The **soil and substrates disinfection products** can pollute water and soil. Several labels ask to record the date and place of sterilisation, the dose, the type of chemical, the method of sterilisation and the name of operator. It allows to make the operator responsible for a suitable application.

Fuel, oil or engine coolant **leaks** must be avoided to prevent direct pollution of water and soil (Charte Perfect).

Inside warehouses, it is preferable to **stop motor engines** (Charte Perfect). Every action that stops the emission of exhaust fumes also avoids the useless wasting of fossil fuel.

Impact of labels on the farming system, via the best rules for the item
The best measures of labels against the "Rare resources spillage" relate to 5 levels (12 under-levels) of the farming system:

Nutrient management - *Fertilizer application; Fertilizer storage ; Analysis ; Nitrogen management ; Site management ;*
Soil and substrate management - *Soil cultivation practices; Substrates; Soil erosion ;*
Wildlife and landscape management - *Waste and pollution action plan ;*
Transportation cautions - *Loading and transportation equipment;*
Record keeping and self-inspection - *Soil cultivation practices; Plant propagation material.*

The relatively high number of good measures shows that there are many possibilities at various levels in farms to reduce the use or the deterioration of nonrenewable resources in an effective way. A majority of them concerns nevertheless the nutrient management and the chemicals.

All in all, the best measures of labels for this item require to adopt rigorously certain practices like cutting off an engine or clogging the leaks, a systematic observance of certain prohibitions (no application, no pouring) but also to undertake larger changes in agricultural practices as regards fertilization (natural strategies, reduction of the quantities, incorporation of manures) or soil protection, to invest in storage installations (for manure and waste) and to pay for laboratory analyses and waste collecting. All these measures require reorganization, work time and money.

2.2.5. Labels and Soil fertility.

Impact of the best rules on the durability item and on environment
The best rules towards "Soil fertility" belong to the certification books of Charte Perfect, FlandriaGAP and EurepGAP. One can also distinguish Organic farming with a bit less powerful measures.

The most effective measures of labels to preserve the soil fertility in a durable manner, i.e. those which preserve the quality (physical, chemical and biological) of the resource "soil" and which minimize the impact of the practices on the environment, mainly water (nitrates) and climate (CH_4, N_2O,...), relate to the erosion and the control of fertilization.

It is of primary importance to **minimize erosion** by agricultural practices (FlandriaGAP, EurepGAP, and Charte Perfect). As examples, we can quote the installation of a vegetation screen, the simplified work of soil (e.g. no tillage), the maintenance of the organic matter level in the soil or the permanent covering of

the soil (e.g. winter coverings). One reduces so the losses of fine elements and organic or mineral matter, and one avoids physical phenomena like soil clogging. Thus, by reducing erosion, one also reduces water pollution.

It is also important to fertilize according to recommendations. Those must be based on the **crop needs** which depend on the growth stage (FlandriaGAP, Charte Perfect) and must hold account of the **contribution already present in the soil** (Charte Perfect). A soil will not be more fertile for a given crop if it contains more than the real needs of the plant. If those are ensured in a precise way, the yield will be optimal and there will be no fertilizer spillage involving greater water and air pollution.

To maintain a sufficient organic matter level in the soil and to preserve its structure while importing nutritive elements, the use of **matters resulting from organic agriculture** is preferable because those come from more sustainable systems towards environment.
The organic matters which must be spread consist of **animal effluents** with a maximum of 170 kg/ha. a year or **other organic matter, ideally composted** (Organic Farming). It is necessary to incorporate them to limit losses and pollution. Charte Perfect tolerates **green waste composts** (20 mm-sieved) provided making them analyzed and having the necessary authorizations. It is indeed important to control the quality of the organic matters from heterogeneous origins. The use of these matters must not be accompanied by soil or water pollution through unwanted and/ or harmful elements.

In a broader way, one must know the N, P, K **composition** of compost (Terra Nostra) as well as the composition of the other fertilizers (flandriaGAP). It is necessary to succeed in bringing the nutritive elements in a balanced way and to be able to calculate the exact amounts according to the needs and the availabilities.

In a general way, it is necessary to prefer the practices involving a "natural" fertilization to a direct contribution of fertilizers because they are less aggressive for the environment, they make it possible to exploit the available natural resources as well as possible, they reduce the use of machines which degrade the soils and generate pollution and they reduce the use of inputs with high energy cost.
The pillar of these practices is a **rotation program** (Charte Perfect, Organic Farming) including ideally **legumes, green manures and deep-rooting plants** (Organic farming). The effects of such a rotation on the soil are multiple: it brings back the leached elements towards the surface, it exploits the horizons and the soil elements differently from one crop to another, it enriches the soil in nitrogen and organic matter, limits erosion...

Let us note that mowing the vegetation strips in orchards and **leaving the greenery on the spot** (GIP, Fruitnet) also improve the fertility even if the first goal is to support beneficial fauna. The herbaceous bands protect from erosion and the mowing enriches the soil in organic matter.

Impact of labels on the farming system, via the best rules for the item
4 levels (5 under-levels) of the farming system are concerned with the best measures of labels concerning the "Soil fertility conservation":

Soil and substrate management – *Soil erosion; Soil cultivation practices;*
Nutrient management – *Fertilizer application;*
Site history and management – *Site management;*
Wildlife and landscape management - *Wildlife and conservation policy*.

The farmer must introduce various practices of natural fertilization and erosion management into his conventional system. That involves reorganization and a diversification of his crops. New works are added or some must be carried out differently and he must limit the use of organic and mineral fertilizers to the bare essential.
He must see to preserve the organic matter rate of his parcels by a regular organic matter contribution. He must pay attention to the origin and the quality of organic matter and other manures by having them analyzed.
He must invest in soil analyses and in fertilization recommendations but logically, it is for a saving in manure. In the long run, thanks to the introduced practices, the soil will remain fertile and the productivity will be assured. All in all, the asked measures will lead the farmer to save fertilizers but he will have to work more.

2.2.6. Labels and Biodiversity

Impact of the best rules on the durability item and on environment
The labels which dictate the most effective measures for the biodiversity are Fruitnet and GIP. Follow then EurepGAP and FlandriaGAP.

The establishment of a "**conservation management plan**" (EurepGAP) on a individual or regional basis (including the management of fauna, the minimization of impact of the agricultural activity, an evaluation of plant and animal diversity, the safeguarding and the valorization of habitats, the increase in biodiversity) and the start up of a "**policy of nature management**" (Fruitnet) are between the best measures. Such plans directly aim to preserve, restore or create natural elements contributing to biodiversity on the farm.

The label GIP asks to **preserve at least 5% of the farm surface** as ecological surface. This measure is very well classified because devoting a minimum space to nature is the first step allowing to preserve or increase biodiversity.

FlandriaGAP requires of the farmer to take at least **3 practical measures** of nature management and it makes it possible not to confine oneself to the good intentions of a management plan.

Other requirements (Fruitnet and GIP) illustrate the most important concrete measures which can be taken within the framework of a nature management plan and which can contribute to the preserved surface:

- to take care or to create natural and artificial hiding-places for the beneficial organisms (birds, bees, arthropods). It is a natural strategy making it possible to reduce the use of pesticides and it has a direct positive effect on biodiversity.
- to divide the large crops (width > 100m) into sub-parcels by means of natural fences. That amounts to make the reverse of what was made to intensify agriculture i.e. regrouping. It creates new natural elements used by species as habitats and as "green corridors".
- to plant a hedge close to the residential zones and water courses in order to trap the harmful drifts of pesticides and to reduce their damage among the sensitive plant and animal species. As secondary effect, a hedge constitutes a profit in biodiversity (flora), a natural refuge (fauna) and it embellishes the landscape.

Impact of labels on the farming system, via the best rules for the item
Measures of the labels which have the most positive and durable impacts on «Biodiversity» locate at 1 level (1 sub-level) of the farming system:

Wildlife and landscape management - *Wildlife and conservation policy*.

It is requested from the farmer to have a comprehensive view of the conservation of the natural component on the farm, to be coherent with the eventual regional policy and integrate into it.
Such a plan can have a positive repercussion on the farm economy (for example; thanks to natural predators) but it is not the starting objective. It initially asks the farmer to make an effort of preservation and to undertake certain actions which will ask him time and money.

The farmer must take interest in the practices and decisions of his region concerning the preservation of environment. He must thus make an effort of opening, cooperation and collaboration with regional policies. In this context, the farmer can apply agro-environmental measures.

To dedicate a proportion of the farm to nature reduces the intensity of the exploitation. The factor "soil" is not carried to its maximum. It may concern unproductive grounds (slopes, banks, edges of ways, wetlands...) but one can also decide to give up the exploitation of certain parts of the cultivated soils. The farmer must in this case renounce to the productivity of a part of his resources which amounts to paying for biodiversity.

2.2.7. Labels and Landscape

Impact of the best rules on the durability item and on environment
All in all, the best measures for "Landscape" are the same as those selected for "Biodiversity". The natural elements which contribute to biodiversity have altogether an impact on the landscape quality.

In the first place comes the setting out of a "**nature management plan**" on an individual or regional basis (Fruitnet). With such a plan, the landscape will be more homogeneous on the whole of the farm and the regional integration will also be taken into account. The landscape is indeed made up of elements outside the farm and some measures must be taken in harmony at a broader level for the regional landscape homogeneity.

In the same way, it is obvious that to **preserve at least 5% of the farm surface** as an ecological surface improves the landscape quality by contributing to the natural aspect and to the "green grid" of the area.

In practice, the measures which influence the best the richness of the landscape by generating new natural elements are:
- The division of the great parcels (width > 100m) into sub-parcels by means of natural **fences**;
- The planting of a **hedge** close to the residential zones and water courses to trap the drifts of pesticides;
- The preservation an '**unmowed' band** of 1m along orchards (at least on a side).

Impact of labels on the farming system, via the best rules for the item
The measures of labels which have the most positive and durable impacts on "Landscape" locate at 1 level (1 sub-level) in the farming system:
Wildlife and landscape management - *Wildlife and conservation policy*.

The impact of these measures on agricultural practices is similar to the one described for Biodiversity.

2.2.8. Labels and Food Safety

Impact of the best rules on the durability item and on environment
All the labels contribute to some of the best classified measures for "Food Safety" except Organic farming. Terra Nostra and Flandria are weaker than the others in this contribution. With regard to pesticide issues, it is logical that no rule appears coming from Organic Farming because of the quasi total absence of harmful products in this production system.

Among the measures enacted by the labels, those which contribute more to food safety relate in majority to residues of plant protection products.

Certain practices are required by the labels to reduce the frequency of use and the quantity of pesticides. That directly contributes to decrease their presence in food.
To reduce harmful treatments, it is necessary to apply **integrated crop protection techniques**. Therefore, it is useful to be **assisted by training or by advice** in order to understand well the various strategies and to apply these techniques correctly, otherwise they could be ineffective.
To treat only in the event of real plant health risk and to suppress the useless treatments and thus the residues which they generate, it is necessary either to subscribe to an **epidemiologic forecast service**, or to treat only after a **detection threshold**.
The post-harvest products have to be used only in the **event of significant risk** of spoiling (fruits) and only on **sensitive cultivars**.
By using **treated seeds**, the crop develops fewer diseases and requires thus fewer treatments. Hence, this practice involves indirectly less residue and less mycotoxin in food.

At the time to choose the pesticides, various requirements have positive effects on food safety. So, requiring of the farmer to use a **registered** plant protection product, with the **minimum impact** on human health and on environment (evaluated with POCER), with a **low persistence** and really **useful** for the crop

limits the harmful residues and their impact. An additional guarantee to make a correct choice for the use of a product outside of the **recommendation cards or cropping forms** is to obtain a **written authorization** of a technical agricultural service or an advisor.
In all cases, the operators who choose the pesticides must have the necessary **knowledge** and competence.

To impose a strict respect of the pesticides and post-harvest products **label instructions** for the dose calculation and the preparation as well as the recording of the operations make it possible to eliminate the contaminations by overdose, by mixing error or by bad use. For that purpose, it is necessary to have an appropriate weighting and mixing **material**, distinct from the material used for the harvested products.

The purchase of safe and efficient **spraying equipments** makes it possible to control the applied quantities as well as possible. Any excessive quantity is indeed a useless source of residues.

The **record** of all the pesticide applications makes it possible to evaluate the risks of residues in a batch of foodstuffs. This also pushes the operator to use the pesticides adequately.
The respect of the **pre-harvest intervals** and their recording is one of the most fundamental rules to reduce pesticide residues in food.

Residues analyses aim at not commercializing foodstuffs which exceed the Maximum Residues Levels of pesticides. So, it is necessary to check regularly, by accredited laboratories, the residues in food products, with a frequency based on a **risk assessment**. In case of positive analysis, a **corrective action plan** must be carried out to withdraw batches from trade and to stop the contamination source. These measures also relate to the food products which are treated after harvest. All the residues analyses must remain **available** to guarantee transparency and to avoid frauds.

With regard to nitrates, the control of the contents in the risky harvested food products as potato is a priority to avoid commercializing them.

A serious management of the storage, handling or packaging facilities of food products makes it possible to simply suppress contamination risks by foreign bodies, gases, chemical substances or harmful liquids. In these buildings, there should be no boiler, no cistern, no storage of organic and inorganic fertilizers, no mixture preparation, no domestic animals, and no pesticides storage. One must even suppress direct connections with the pesticides storages to move away even more the contamination risks. The lamps there must be unbreakable or provided with protections to avoid glass breakings in the foodstuffs.

The storage conditions of food products must be controlled. They must be protected from sun and rain and be maintained at an appropriate temperature to avoid moulds, which are sources of mycotoxins.

The operators must follow instructions or respect a code of hygiene. Basic rules like the prohibition to smoke, crackle, urinate close to the food products as well as having an access to toilets and clean hand washing equipments close to the working place (even with the field) remove many potential causes of chemical or microbiological contamination by the personnel, in particular for manual harvests.

Transport should cause neither damage nor stains to the products thanks to the control of temperature and moisture, the type of packaging and the delivery speed. It is also necessary to take precautions at the time of loading and unloading because the wounds constitute entrance doors for moulds. The packaging materials for the harvested food products must only be used for this use.

The prohibition to use certain fertilizing matters which present more risk because of their origin makes it possible to avoid chemical and microbiological contaminations. Among these matters, we find compost from domestic waste, sludge from septic tanks, untreated waste water, urban sewage sludge even treated, sludge from the pharmaceutical, chemical and petrochemical industry as well as sludge from cleaning out and dragging.

The harvest operations can also be the source of physical, chemical or microbiological contaminations.
First of all, an elementary measure is to respect the necessary interval between the application of the pesticides and the harvest in order to reduce the residues in food. The use of sludges, not mentioned

above, still presents risks and it is thus careful to also respect a period (6 months) between their application and harvest.
During harvest, it is necessary to pay attention not to collect extraneous material (stones, carcasses, wood...). Before their use, the harvest machineries must be emptied of the previous harvest residues. After their use, one must clean them and check the number of little accessories. It is necessary to use the crop produce containers only for this produces.

Impact of labels on the farming system, via the best rules for the item
The best measures of labels for the "Food safety" relate to 7 levels (24 sub-levels) in the farming system:

Crop protection- *Basic elements of crop protection; Choice of chemicals; Crop protection products storage and handling; Crop protection products residues analysis; Pre-harvest intervals; Records of application; Application machinery;*
Harvesting – *Hygiene; Post-harvest treatments; In general; Machinery; Packaging/harvesting containers on farm;*
Nutrient management - *Fertilizer application; Fertilizer storage; Nitrate contents analysis;*
Transportation cautions – *Hygiene; Loading and transportation equipment; Transportation conditions;*
Produce handling - *Post-harvest treatments; Hygiene; Buildings; On farm facility for produce handling and/or storage;*
Record keeping and self-inspection – *Post-harvest treatment;*
Varieties and rootstocks – *Choice of varieties*.

With regard to the inputs, the labels require an effort to reduce the use of pesticides. This is economically positive if one does not hold account of the cost of the techniques to compensate for this reduction. It is also forbidden to use risky fertilizers.

At the technical level, the farmer must develop integrated strategies, he is asked to be serious in the choice of the least harmful pesticides and in their preparation as well as to be able to justify each application. He cannot act any longer for simple prevention but only in case of real threats.

The labels encourage not to act alone and to regularly resort to some external help (IPM training, advice in pesticide choice, epidemiologic forecasts, analyses of residues and contents).

The farmer must invest in the quality of the necessary material and develop the sanitary facilities.
For the personnel, he must take qualified people and it is necessary to give them specific training (hygiene, IPM techniques). The staff management takes thus more importance.

Administratively, it is generally asked to hold a book-keeping of the applications and analyses. With regard to management, it is necessary to establish action plans for the contamination cases and to build a traceability system for the food products. The organization of agricultural work has to be based on plannings holding account in particular of harvest delays.

The organization of the installations must privilege the safety of the food products storage for which an increased vigilance is required. The farmer must accentuate his professionalism concerning the conservation and carriage conditions of foodstuffs and pay attention to the cleanliness during the harvest operations.

2.2.9. Labels and Waste reduction and management

Impact of the best rules on the durability item and on environment
The best measures for Waste reduction and management are attributed to Charte Perfect and Fruitnet.

The best rule to improve the question of waste is to carry out an **environmental audit** (Charte Perfect). Indeed, such an audit analyzes the entering and outgoing flows of the farm, identifies the various wastes and their origin, detects the management problems and the bad practices, identifies the pollution sources and proposes improvements or alternatives which start with the minimization of waste. An audit

establishes the basic report to manage waste in a better way and, in particular, to determine the possible waste channels and the actions to be undertaken. An audit will also point the illegal operations.

Then comes the drawing up and the implementation of an **action plan** (Fruitnet) to reduce and / or valorize waste in a **recycling programme** for neutral substrates (Charte Perfect). This action plan can be the logical continuation of the audit.

Impact of labels on the farming system, via the best rules for the item
The measures of labels which have the most positive and durable impacts on "Waste reduction and management" locate at 3 levels (3 sub-levels) of the farming system:

Waste and pollution management, recycling and re-use - *Waste and pollution action plan;*
Soil and substrate management - *In general;*
Wildlife and landscape management - *Waste and pollution action plan.*

Carrying out an audit not only requests an investment in time for the accompaniment but also in money except if possibilities of free studies exist. On the other hand, the audit can be a source of savings thanks to the suggested actions (for example by the re-use or the sale of waste). The set up of an action plan requires working time and a reorganization effort within the exploitation (to sort, to negotiate contracts for waste collects...).

2.2.10. Labels and Pest Pressure Reduction

Impact of the best rules on the durability item and on environment
All the labels are represented in the best measures described here below. Nevertheless, GIP and Fruitnet appear more than Charte Perfect, Terra Nostra, Eurep GAP and FlandriaGAP while Organic farming and Flandria are less represented.

Measures considered as the best ones in the labels relate to the respect of a minimal **intercrop period** (3 years for potato in Terra Nostra) and to the adoption of **crop rotations** (Charte Perfect, Organic farming). This practice gives less chance to the diseases and to weed to survive by varying the plants (many diseases are specific to only one host) and the physical environment necessary to their development. It makes it possible to decrease the use of pesticides which have a repercussion on air, water, climate, food and worker.

Almost with the same impact on pest pressure, the labels require to apply **IPM techniques** which reduce the use of pesticides and, in particular, a combination of **natural preventive measures**: choice of species and varieties, protection of the natural enemies of crop parasites (hedges, nests, predators), and also **curative ones**: mechanical cultivation processes, flame-weeding. They all make it possible to reduce the use of pesticides and their misdeeds but some are not inoffensive. Indeed, the curative techniques need energy and contribute to the air pollution and the climatic change.
In a general way, the respect of the basic **ICM concepts** contributes to a more effective and more sustainable fight against pests.

One of the requirements to reduce the quantities of used products is to cultivate **resistant or tolerant varieties** to the commercially important parasites and diseases. These are excluded with the source without having to resort to the use of pesticides. The choice of a crop must thus be based on a **minimal dependence** on plant protection products.

Another way to reduce chemical plant protection is to use "**plates" or pheromone traps** to capture insects. This method makes it possible to reduce the insect population but also to detect their increase which allows to use insecticides only in a justified way.

With regard to pesticides, it is asked to subscribe to an **epidemiologic forecast service** in order to apply only when there is a real threat for the crop and give up unjustified treatments. This measure does not compromise the health of the crop but decreases the harmful effects of pesticides.

The use of pesticides, when it is justified, must be correct and it is necessary to avoid overdoses and bad uses of the products. So, it is necessary to **calculate the amounts** of pesticide according to the surface, the spraying speed and pressure. The calculation, the preparation and the recording of the amounts must refer to the **label instructions**. The advisors for the choice of the plant protection products must be **qualified**.

The resistance phenomenon related to the use of a plant protection product induces to increase the amounts for a same effect or a loss of effectiveness which leads to use more harmful products. To avoid this escalade, the labels require to follow **anti-resistance recommendations** in particular by observing an **alternation** in the used active substances.

A logical measure to reduce any probability of inoculating a plot or of worsening an infection in potato crops is not to spread **soil and tubers resulting from post harvest operations** on fields where potato was cultivated the previous year.

Impact of labels on the farming system, via the best rules for the item
The most effective and sustainable measures which are proposed by the labels to reduce the pest pressure have an impact on 3 levels (5 sub-levels) of the farming system:

Crop protection – *Basic elements of crop protection; Choice of chemicals;*
Site history and management – *Site management;*
Varieties and rootstocks – *Pest and disease resistance; Propagation material.*

All in all, to make the crop protection more sustainable, it is requested from the farmer not to yield to the facility of a pure chemical plant protection in monoculture. An effort is thus really required to diversify the cultivation techniques and practices. This asks more work. The choice of the varieties is no more solely based on the yields and the farm management is more rigorous and planned. Inaccuracy is banished as regard to pesticides. The external interventions are also more numerous (forecast service, advisers). As advantages, there are reduced expenses in pesticides but these are probably and unfortunately compensated by the cost of the new requested techniques.

On the whole, the labels require to integrate "biological" practices and especially preventive natural strategies in the farming system and to practise the chemical plant protection in a reasoned way.

2.2.11. Labels and Worker Safety

Impact of the best rules on the durability item and on environment
The label which can be distinguished for its greater contribution to the best measures for the “Worker safety” is EurepGAP. Thereafter, principally come FlandriaGAP, Fruitnet, GIP and Charte Perfect.

The majority of the best measures for this item relate to the chemical risks. The labels reduce these risks by the control of their frequency and by the control of the human and technical factors. Let us note that Organic farming doesn’t appear here because it limits the use of pesticides only to products with low toxicity and only in exceptional cases. But one must not conclude that this label is more unsafe than the others at chemical level. It simply has no measure to edict against harmful products.

The person (farmer, adviser or technical person in charge for the produce? handling process) who chooses the pesticides, the biocides or the waxes as well as the exposed operator must be qualified. They must have the necessary **knowledge**. Training and information sessions must regularly be organized (2h, 3x/year), individually or collectively.

The worker in contact with the pesticides must respect the **label instructions** of the plant protection products in particular with regard to the use of protection clothing and equipments as well as for the calculation, the preparation and the recording of the applied amount of pesticide. It is a guarantee of safety.

After using pesticides, he must have some **habits** at his return in the farmyard: he must remove his contaminated clothing, wash his hands, disinfect his wounds, and clean his work/ protection clothing. These operations remove the risks of residue contamination.
The protective clothing and the equipments must be stored separately from the pesticides because they can cause contamination of the personnel.

To eliminate ways of direct absorption, it is necessary to **prohibit** eating, drinking or smoking during the use of pesticides and to pay attention not to rub one's eyes or mouth (Charte Perfect).

Every reduction in the frequency of the chemical applications equally decreases the risks incurred by the personnel. The subscription to an **epidemiologic forecast service** (Fruitnet, GIP, Terra Nostra) makes it possible to limit the number of treatments to the bare essential and thus reduces the exposure frequency of the worker. If it is not the case, pesticides should only be used after **detection** of harmful organisms or after information by the authorities (FlandriaGAP).

It is considered important for the worker safety to observe the **pre-harvest intervals** (EurepGAP). If there are fewer pesticide residues in the crops at harvest time, the personnel will risk a lower contamination.

The quality of the used material can influence the direct exposure of the worker to the chemicals. One should thus not hesitate to buy the **most effective and the safest spraying equipment** (GIP, Fruitnet). The probability of a technical hitch or a faulty operation will so be reduced.

The training of the workers must also relate to the equipments when their operation is dangerous or complicated (FlandriaGAP, EurepGAP).

In a general way, the introduction of all new practice, machine or product must be framed. So, the implementation of an Integrated Pest Management system must be assisted by training or advice (EurepGAP, Fruitnet, GIP). It reduces the chemical, mechanical and handling risks at the same time. For each new technique the personnel must be trained to carry out the requested operations correctly and safely.

Impact of labels on the farming system, via the best rules for the item
There are 4 levels (11 under-levels) in the farming system which are concerned with the most "making safe" rules of labels. They are in descending order of number of proposals:?

Worker health, safety and welfare - *Crop protection product handling; Protective clothing/equipment; Risk assessments; Training;*
Crop Protection – *Basic elements of crop protection; Application machinery; Choice of chemicals; Worker safety; Pre-harvest intervals;*
Produce handling – *Post harvest treatments;*
Harvesting – *Hygiene.*

Through labels, efforts to instruct the personnel are overall required with regard to the safety of use of the chemicals and the machines. Part of the working time is so devoted to training and the farmer must thus possibly pay instructors.

It is also asked to invest in good material and not to neglect the quality to save money. The manpower must be qualified and this is more expensive than to employ labour without competence.

The subscription to an epidemiologic service is an investment which should be profitable because it makes it possible to reduce the pesticides quantities. The observance of pre-harvest intervals requires rigor in the follow-up and in the work planning.

2.2.12. Labels and Noise Quantity

Impact of the best rules on the durability item and on environment
The best rules come from Charte Perfect. It explains partly in Chapter 3 the good score obtained by this label for Noise Reduction in comparison to the other labels.

The most significant rule among the labels is **to turn off the engines** when the machines aren't working, in particular at the time of loading/ unloading in the hangars. This rule is initially designed to reduce the contamination of the foodstuffs by residues of combustion but it reduces at the same time a useless source of noise. Moreover, it makes it possible to save fossil fuel.

It is also necessary **to regulate and maintain** the harvest machinery and the transportation engines in an optimal way. The bad adjustment of a machine can indeed generate more noise than with a normal operation. It is sometimes necessary to regulate the machines according to the field or the variety.

Impact of labels on the farming system, via the best rules for the item
The rules of the labels which have the best positive and durable impacts on the "Quantity of noise" locate at 2 levels (3 under-levels) of the farming system:

Transportation cautions - *Loading and transportation equipment; Transportation conditions;*
Harvesting - *In general*.

The rules of the labels which limit the noise require mainly discipline during the use of tools and machines, motorized or not, and some working time for the maintenance. Broadly, the costs are recovered since, in parallel, it increases the lifespan of the machines, it saves rare resources and it preserves the quality of the foodstuffs. Thus, it simply demands to devote attention and time to it.

2.3 TRANSVERSAL CONCLUSIONS

We have analyzed the higher quarter in the ranking of specification rules of 8 labels with respect to 12 objectives of durability, which are in close connection with environment. We can say that, compared to conventional agriculture, the studied labels bring a real progress to the durability of agriculture, paying a more detailed attention to the issues of Water Quality and Food safety.

The levels of the farming system which are the most concerned with these environmental improvements are "Crop protection" and "Nutrient management". This is not surprising since the use of pesticides and fertilizers is at the source of the greatest part of agricultural pollution.

The most positive effects on the studied objectives are also summarized through the following levels in the farming system, classified by decreasing abundance of concrete rules:

Produce handling;
Harvesting;
Wildlife and landscape management;
Worker health, safety and welfare;
Soil and substrate management;
Transportation cautions;
Record keeping and self-inspection;
Water management;
Site history and management;
Varieties and rootstocks;
Waste and pollution management, recycling and re-use.

The efforts of change and improvement which are required of the farmer through these rules can be summarized as follows:

All in all, the labels clearly require to adopt integrated or biological practices. The philosophy of exploitation is thus deeply altered. The purpose of the integrated practices is particularly to minimize the use and the harmfulness of the pesticides while resorting with "biological" methods/ strategies for plant protection. More natural methods are also introduced as regard to fertilization. The latter must adapt to the real needs. In addition, the natural elements must be preserved on the farm.

On the level of the practices themselves, a series of good practices is introduced (e.g. to clean/ maintain the machines, record the treatments, place pesticide powders above the liquids, respect personal hygiene), there are new farming techniques (e.g. mechanical weeding, alternation of active substances, use of insect traps, analyses of soil, foodstuffs and manure, adoption of measures against leaching and erosion, incorporation of manures), new crops (e.g. resistant/ tolerant varieties, leguminous plants, green manures, diversification of rotations) and improvements in some practices (better calculation of the doses, more judicious choice of products, strict respect of the pesticides instructions, better waste management, improvement of the conditions of storage/ transport of food products).

The farm organization is influenced too, in particular with regard to the pesticides, manures and foodstuffs storage facilities (they must be specific and located far from the water resources) or for the preparation tasks of chemical products (they must be done in separate buildings).

The framing, training, information and competence of the personnel are bases of the labelled systems.

On the level of management, the "procedurisation" is reinforced (e.g. to work out an action plan in the event of residues, a nature management plan, a code for hygiene, a waste reduction and recycling plan) as much as the planning of the crop successions and agricultural works (e.g. to observe a rotation plan and intercrop periods, to hold account of pre-harvest intervals, to respect periods of prohibited fertilization, to maintain regularly the machines).

From the administrative point of view, some tasks are added, like the management of documentation and analysis results.

On the other hand, we observe negative financial repercussions via some investments to realize (e.g. the best sprayer, a scale to weigh pesticides, storage equipments, toilets), by the increase of the workload (e.g. rinsing the empty pesticides recipients, planting a hedge, sowing a winter coverage), by the call to external services (e.g. forecast service, analytical laboratories, environmental auditing desk, recommendations for pesticides and fertilization) and by the employment of a more skilled manpower.

In a general way, more precision and discipline are asked (e.g. switching off engines near foodstuffs, no spraying near water catchments). Every act must be justified. Innovation in techniques demands an open mind for changes.

There are nevertheless advantages "to label» the production system.
The end product is commercially better valued and the additional costs described before can partially be caught up by savings of inputs.
Certain practices improve the durability of the crops notably via the preservation of the soil quality or via the strategies against resistance.
Finally, by contributing to the improvement of the environment as well as to the protection of the workers and the consumer, the farmer increases his brand image and his satisfaction for a cleaner work.

Chapter 9 Conclusions and recommendations

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Introduction to the chapter

During the preceding chapters, the contribution of certification systems to the different sustainability pillars has been discussed into depth. This concluding chapter, constructed around three different parts, brings the main lessons learnt and the recommendations together. In a first part, we formulate conclusions (the lessons learnt) regarding the contribution of certification to the overall concept of sustainability, hereby aggregating and revising the conclusions of the three different pillars studied. The second part consists of recommendations, both for private and public actors. In a third part, we identify those research areas and questions which have not been addressed in this research, although they are relevant for a full understanding of the link between sustainability and certification systems.

1. Interaction between the 3 sustainability pillars

To recapitulate, the two general questions posed in this research try to capture the link between sustainability and private voluntary certification systems:
1. Do these certification systems contribute to an increase in sustainability of the production process?
2. Are these certification systems sustainable (viable) constructions?

Both questions depart from the concept of sustainability being comprised of an ecological, an economical and a sociological part, each of which is of importance and interacts with one another. A more popular representation of the concept sustainability is the People – Planet – Profit triangle. Generally, the contribution of each of these three pillars to the holistic sustainability concept is considered equally important. Given the qualifications of the different teams involved in this research, we opted for an assessment of each of these pillars separately. However, with sustainability being a single concept encapsulating all three of these pillars, an aggregation exercise is necessary. This chapter tries to link the economical, social and ecological conclusions of this research and tries to identify to what extent these pillars are mutually enforcing or counterproductive. Apart from this, the question whether the systems themselves are sustainable is further addressed.

Following Meul et al. (2004), **ecologically sustainable agriculture** can be defined as agriculture in which the agroecosystem is functioning optimal, in which the negative impacts on the environment remain within acceptable limits and in which the positive contributions to the quality of the environment are maximal. Based on a review of Flemish and international literature performed by Dessein et al. (2004), the **social aspects of sustainability of agriculture** are categorized into four dimensions: 'social justice', 'social capital', 'culture', and 'health and safety'. **Economic sustainable agriculture** on its turn should create added value which is sufficient to remunerate all resources in an adequate way, both today and in the future (Van Passel et al., 2004).

These definitions, although still rather vague, address the question 'what is the reference?'. Apart from this, several related questions can be identified when analysing sustainability in a holistic manner. A first pertinent question when considering the different pillars simultaneously is: "Is the whole more than the sum of the parts?" aiming for possible interaction effects between the three sustainability items. Furthermore, the question rises how the three sustainability topics relate to each other, which, on its turn, boils down to several other questions: "Are they positively or negatively related towards each other?" and "Is this depending on the levels they take?"

Within this research, the topics summarized in Table 9.1 have been selected for the analysis of the different sustainability pillars. To score the contribution of a particular system to sustainability in general, a single assessment tool could be developed, which is not the subject of this research. Several other studies, both at the Belgian (f.e. Stedula) and European level, are trying to address this question.

The different chapters (and predominantly Chapter 3) clearly show the positive contribution of all the studied certification books towards (ecologic) sustainability. However, the question whether the systems themselves are sustainable constructions still remains. Two necessary conditions were identified to maintain sustainable certification systems:

- the evolutionary potential: internal dynamic to counter external competition
- the balance in stakes and power within the initiative: internal competition versus coopetition (cooperation and competition simultaneously)

Table 9.1: Sustainability items included in the assessment of the certification schemes

Ecologic sustainability	Economic sustainability	Social sustainability
• Noise quantity reduction • Food safety • Water quality • Pest pressure reduction • Air quality • Climate • Biodiversity • Landscape • Soil fertility • Worker safety • Waste reduction and management • Rare resource spillage	• Information asymmetry • Actors involved • Stakes (and power) of the actors • Institutional embeddedness • Strategic objectives • Product and market characteristics • Drivers for change and stakeholders' preferences • Monitoring and control • Benefit/cost effects	• Product quality criteria and final product certification • Supervision • Link with nature • Role of involved stakeholders • Link with consumer • Origin of equivalent products

1.1 EVOLUTIONARY POTENTIAL: NECESSARY CONDITION 1

Since their initiation, certification books have evolved continuously, by introducing optimizations and further restrictions. This evolutionary and adaptation potential of certification books is their strongest asset for survival (sustainability) in the long run. As indicated by involved stakeholders, certification books without added value compared to the legal reference, have in the long run no economic reason for existence. They only create further diffusion in an already overlabelled market. It than becomes difficult for marketeers to create a unique selling message when the product is mainstream. Some further remarks regarding the viability of certification systems can be made:

- the success of an evolving certification book is largely dependent on whether the optimization/adaptation process is democratic and third party monitored (avoiding the danger of dependency);
- The adaptation pace should be balanced: too swift and the participants won't follow, too slow and the system will be maladjusted to the ever changing market. Evolutions can not be imposed, the adaptation speed should allow the majority of participants to make the transition smoothly (and hence avoid exclusion);
- over time, one can note a convergence wave between the different certification systems. The common basis grows, creating possibilities of modularity[30] not only within but also across certification schemes. This process is partly due to the pressure from a key stakeholder group, the (often international) buyers; in their continuous search for cost reduction and profit maximisation, they strive for systems which are in line with their own strategy. Another driver is the optimization process within certification schemes itself, which is partly based upon learning from other similar schemes, again accelerating convergence between systems.
- Certification books also have to be innovative; otherwise they do not offer any added value compared to other schemes. The innovative character can be product or process based, or even encompass the social construct of the scheme.

[30] Modularity: subparts of products can easily be interchanged between different but similar products

- The adaptation should be suited for practice, hence technically and economically feasible within the field. It has for example no use to impose mechanical weeding when this is not possible within the rows.

Based upon our study, we can conclude that all kinds of combinations between the different levels of the sustainability pillars can be identified (and thus might be viable) in our market place. Figure 9.1 illustrates environmental certification as an innovation process, balancing between socio-economics and ecology. For the innovators, both environmental and economic performance is of major importance. The number of participants (and the consumer expenditure) in these certification schemes (such as organic farming) remains small. Their principal merit lays in the facilitation of the introduction of new techniques and visions for the second group (the early and late majority). They thus put ecology on the agenda. For the second group, economics remain the primal farming motivation, but whenever possible, they take ecology into account. The third group, the laggards, are primarily economically inspired. With the reference level evolving, this group might be most vulnerable for exclusion in the future. Furthermore, a negative correlation exists between increased environmental focus, the number of participants in the scheme and the consumer expenditure. In the special case of the Belgian fruit and vegetable sector, we further ascertain that the highest number of participants is not situated at the reference level, the law, but the majority participates in more demanding systems, indicating that the market has reacted proactively.

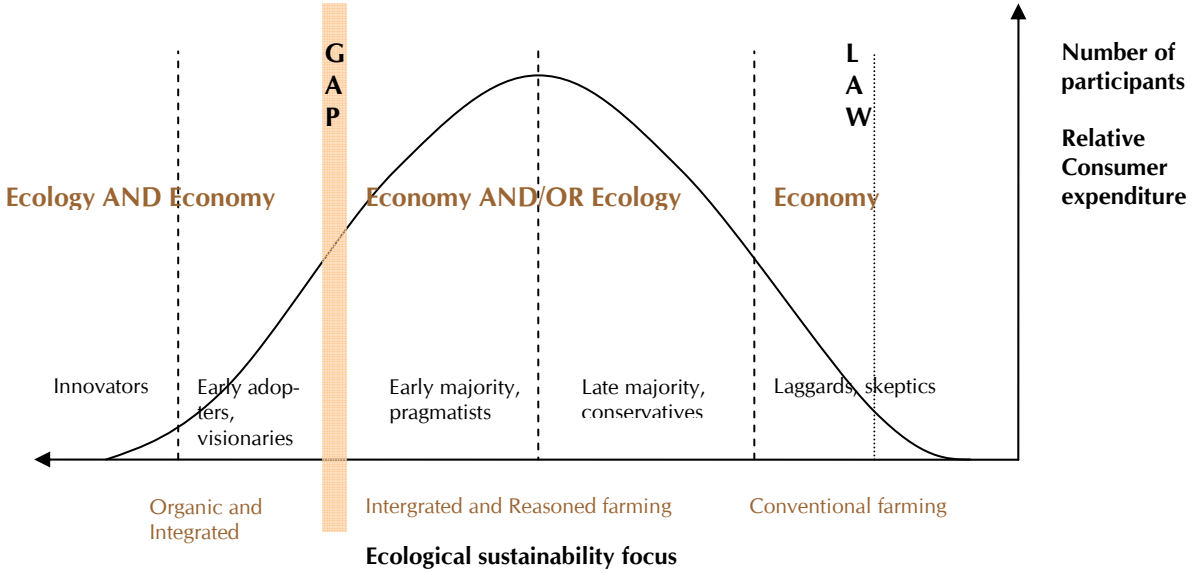

Figure 9.1: Environmental certification as an innovation driven process

As indicated in Chapter 4, certification books as social construct can widely differ. One clear message is however that a certification book as such can not be considered separately from all the additional extension services provided under a label. Some certification books might seem more open to several interpretations compared to other, much stricter cahiers de charges. However, these systems normally fill in this lack of clarity by providing more personally adapted support and extension services.

The three sustainability pillars are thus strongly interrelated, meaning that an increase of one sustainability item triggers the decrease or increase of another item. Up to now, the solutions we could identify in the market carefully balance between the pillars and aim at increasing them simultaneously. Traceability, the use of bumblebees, the choice of crop variety and the use of protective clothing are only some examples.

In classic economy, a positive correlation exists between increased environmental focus (narrowing the available resource base) and product price level, ceteris paribus (i.e. a balance between environmental and economical sustainability). In the real market however, this only seems true between certification systems, not within. Products from organic origin for example generally have a price premium of 50% compared to the conventional substitute. Reduced (synthetic) nitrogen input, absence of chemical pesticides etc. reduce the available resources, increase the costs and thus increase the end product price. Within systems over time, a price premium is however absent. The price for Flandria/FlandriaGAP-

products has not increased over time, although the certification book has evolved dramatically. When a certification book is further optimized (this normally means the introduction of further restrictions) generally no price premium will be offered.

In those systems where the available resource base is under pressure, the participants are triggered to find alternative solutions. This process on its turn stimulates innovation and increased involvement of the participants. In the specific case of certification in agriculture, with many actors bundling forces under the umbrella of one initiative, the latter also encompasses knowledge sharing and dissemination, which on its turn results into networking, being an important part of social sustainability. 'Knowledge' is the only resource that actually increases when it is used and shared (although it is also not free of costs). A typical property and driver of certification systems is thus the ever increasing knowledge base.

In Chapter 3, an assessment was made of the positive contribution of the studied certification books towards environmental sustainability. The applied procedure is mainly based upon the scoring of each of the possible certification book rules (as currently encountered in the market place) for its marginal contribution to the different environmental sustainability pillars. By aggregating the scores for all the rules of a specific certification book, one can pass judgements on the contribution of this specific certification book towards environmental sustainability and its pillars. Because each rule has obtained individual scores for each of the (relevant) sustainability pillars, one of the major advantages of the methodology is the possibility to measure the effects on environmental sustainability of adding rules to a specific certification book. One (f.e. certification book editors) hence obtains an idea of the possible beneficial effects of incorporating the rule in the certification book in question.

However, introducing 'new' rules in a certification book is not that straightforward, given the economic impact on the implementers (the farmers). Measuring the direct economic impact of a new rule at farm level (f.e. by means of a cost-benefit analysis) is merely impossible, because it influences many aspects simultaneously (the need for registration, action, investment, control …) and it is, amongst others, time, region, farm and farmer specific. Another option however is the measurement of the 'disutility' the farmer experiences when the new rule is introduced. This disutility can then be recalculated into a Willingness To Accept (WTA) measure. This WTA measure functions as a proxy for the cost of introducing the new rule. By means of a Choice Preference experiment (see Chapter 7, CE 2), utility and WTA measures were obtained for changes in the pesticide policy of the FlandriaGAP certification book. The adaptation of the FlandriaGAP-rules in the experiment is on the one hand based on rules already implemented in other certification books and on the other hand on the input of the focus group cycli (see Chapter 6).

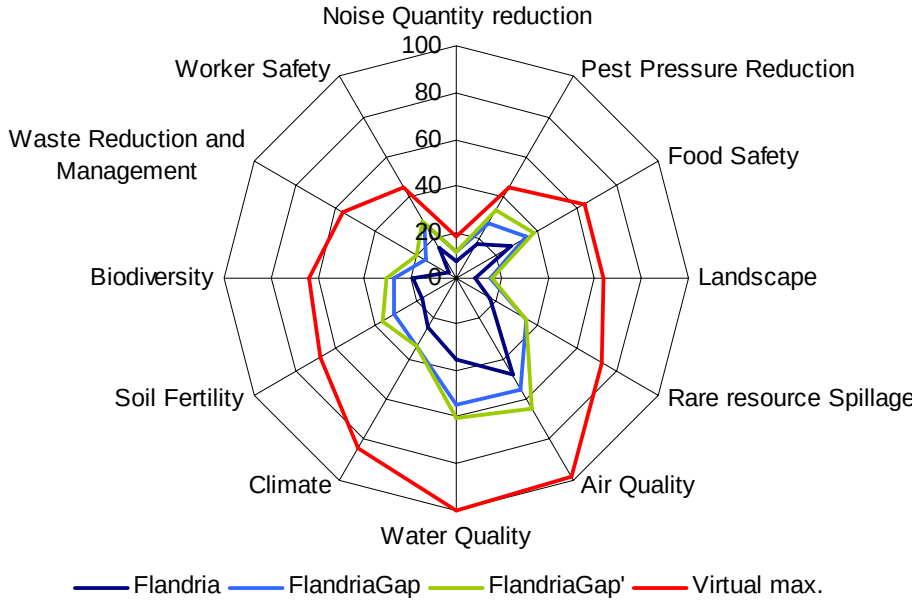

Figure 9.2: Performance of the Flandria, the FlandriaGap and the FlandriaGap' standard for ecologic sustainability

As mentioned in the preceding paragraph, one of the key features of (the viability) of a certification book is its evolutionary and adaptation potential to an ever changing environment. Chapter 3 clearly shows the positive environmental contribution of certification books compared to conventional farming. Chapter 3 further shows, by means of the Flandria – FlandriaGAP case, that in evolving certification books the beneficial environmental effects further increase, clearly indicating that our market is characterised by a **drive towards ecology**.

By using the scores from the expert panels for the rules integrated in Choice Experiment 2, we are able to calculate the increased beneficial effect on ecology of the introduction of these extra rules. For those rules in the choice experiment that were not integrated in the general checklist of Chapter 3, we used the scores of closely related rules (proxies). It should thus be clear that the conclusions drawn from this exercise are to be interpreted with caution. In total, seven FlandriaGAP - rules were changed. Figure 9.2 shows the score of FlandriaGAP' (the hypothetical situation) as well as the scores for Flandria and FlandriaGAP. Again, the positive contribution towards ecology can be noted. Although CE 2 focuses on those measures in the certification book related to pesticide reduction, beneficial effects can be noted for several other environmental sustainability pillars as well. **Thus, by changing one certification rule, effects resort for different sustainability items simultaneously**.

As an example, Figure 9.3 shows the effect on FlandriaGAP's scores of adding the rule '*for the calculation of the pesticide dose, driving speed and application pressure should be taken into account*'. This measure is not that effective for pest pressure reduction, but, unexpectedly, it contributes highly to the 'Waste reduction and management'-pillar (black arrow). With the 'orange and white'-parts in the graph being the contribution of the hypothetical rules, we see that this particular rule (the white area) almost solely contributes to the extra score for Waste reduction. Furthermore, the graph shows that the score of the hypothetical FlandriaGap' on Pest Pressure Reduction nearly reaches the virtual maximum score (see the orange arrow). Furthermore, the pillar 'Air Quality' receives the largest contribution from the 7 adapted rules jointly (see dotted arrow).

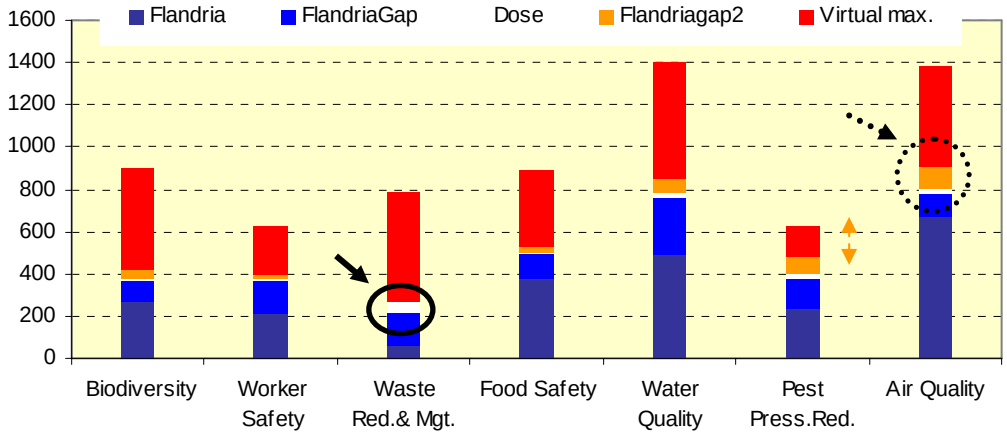

Figure 9.3: Effect of dose recalculation on environmental sustainability score of FlandriaGap

The following graph, Figure 9.4, combines the ecologic and economic effects of introducing the new rule regarding dose calculation. The ecologic contribution is clearly positive and covers different ecologic sustainability fields. From farmers' (economic) point of view however, the new rule seems disfavourable, as indicated by the negative WTA. This negative WTA covers different economic motivations simultaneously. First of all, as indicated by several other researches, farmers are in general change averse. A new rule means the alteration of familiar practises. Secondly, the new rule demands a learning effort from the farmers: how does it need to be applied in practice, what should be calculated, etc. Thirdly, there is a need for investment in the appropriate spraying equipment (whether this is new or adapted equipment). Fourthly, the rule demands extra labour in the field, not only for the calculation of the new doses, but also during application (maintaining the previously calculated speed and spraying pressure). Finally, the rule also increases the registration efforts associated with certification.

It is furthermore important to stress that not only farmers are affected by introducing new rules. As indicated in Chapter 4 and 6, certification books are socio-economic constructs resulting from negotiations between the stakes of the involved actors. At the organisational level, new rules trigger new

costs. The certification books have to be rewritten, and consensus must be reached within the group of editors, within the supervising committee and between the stakeholders in general. This process might turn up difficult and lengthy, with lobbying at different levels. Once agreement is reached on the rule's content, its compulsory level and its formulation, the new certification books have to be distributed to the relevant stakeholders, accompanied by an information campaign. Proper extension services have to be organised to create maximum compliance. This might be in the form of reunions, personal farm level advice, field trials etc. Furthermore, the crop consultants and the controllers have to be retrained and the controls adapted.

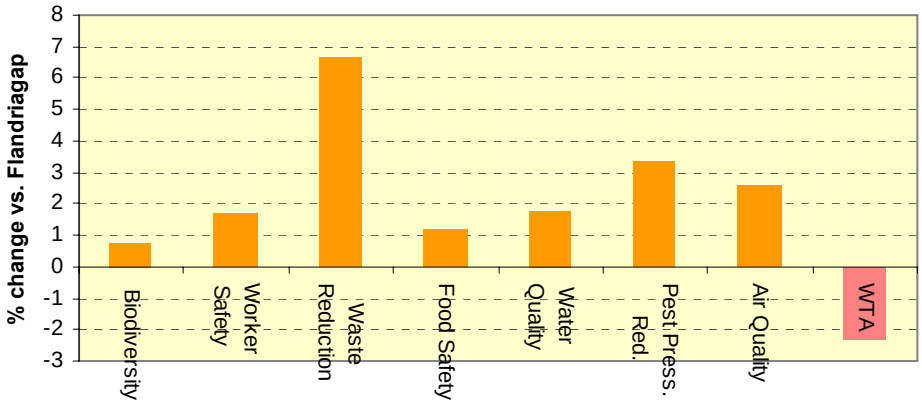

Figure 9.4. Impact of the new 'Calculation of dose/ha'- rule on ecology and economy

So, why do players decide upon introducing new rules, given that they result into increased costs for the involved actors? The drivers might be:

- The necessity in a viable economy to innovate, by continuously creating and increasing the added value. With basic product quality attributes converging, consumers seem more and more sensitive to additional quality attributes of products, which opens a range of possibilities for competition based upon environmental quality attributes.
- We currently live in a (globalized) knowledge based economy, in which, at a continuous pace, technical improvements of the farming practises are introduced, facilitating an economically viable transition to more environmentally sound production practices.
- The public policies are increasingly redirected towards improved environmental performance. To capture some economic rents from environmental quality, private actors prefer to act proactively.
- Some parties in the labeling equilibrium might take advantage of the innovation (whether this is risk reduction, standardization or differentiation). Other parties co-evolve to retain their preferential positioning (price and market access);

1.2 BALANCE: NECESSARY CONDITION 2

The latter point opens the discussion regarding the second driver for viable certification systems: the balance between stakes and power of the involved actors. The following paragraph describes the tension between competitive pressures and the sources for cooperative gain in certification systems as multi-stakeholder constructions. We hereby primarily focus on certification schemes restricted to the farm level.

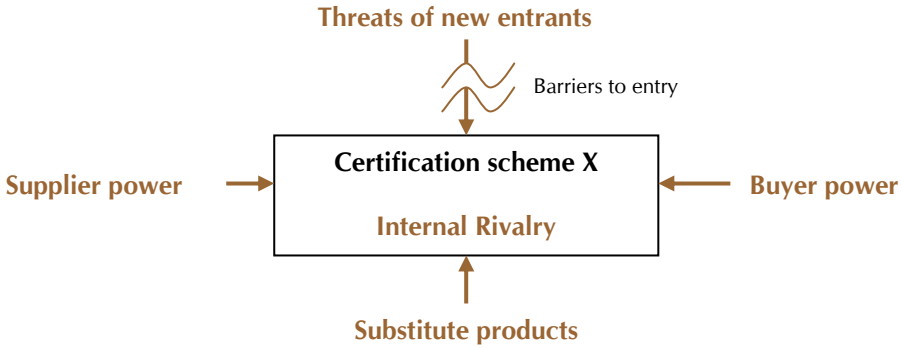

Figure 9.5: Competitive forces for actors in certification schemes (adapted from Sanchez and Heene, 2004).

Figure 9.5 summarizes the competitive forces exerting competitive pressure on certification schemes. First of all, one can distinguish **internal rivalry** between the farmers participating in a certification scheme. Although united under the certification (or farmers' union) umbrella, they are in fact all competing for access to the same preferential sales channels. The certification book hereby offers the framework for competition, the rules and terms under which competition can start. A first condition is thus to secure that all the actors remain within this framework, hence avoiding **free rider behaviour**, which necessitates an independent, watertight monitoring, control and penalty system. This framework, by stipulating all the product and process requirements, further limits the possibility for farmers to differentiate their product offer from their fellow farmer competitors on non-price dimensions, shifting competition to price. The remaining option for farmers to gain competitive advantage over their competitors is thus to lower operating costs which is achievable by reaching economies of scale. As is the case for agriculture in general, we can see a shift towards a smaller number of larger scale firms. Small scale firms competing under the same (certification) conditions as these more cost efficient large scale firms thus risk the danger of **exclusion**.

The certification book further acts as a **barrier to entry** for new competitors. Both farmer unions and buyers prefer schemes in which sufficient supply at all times can be guaranteed, necessitating a sufficiently large number of farmer participants. The farmer unions also link unlimited access with increasing supplier power. The risk of slipping into mainstream bulk production is however imminent, eroding the preferential position of the certification scheme. It furthermore increases the internal competition within the scheme, which might explain the rather negative attitude of farmers towards unrestricted access.

Substitute products in this context should be regarded as competing certification schemes. Due to the convergence wave between the different certification schemes, the switching costs for buyers (and customers) is decreasing substantially. This process might further trigger the price competition and downward prices for the farmers.

Although not investigated in this research, it is clear that the threat of **supplier power** increases when certification schemes are put in place. Because these schemes aim at narrowing the available resource base in combination with stricter end product demands, the input options for farmers are limited, opening the doors for supplier power at the input level. The concentration wave at supplier level further increases this power. This process increases the danger for **dependency**.

The main threat for the viability of certification schemes seems however to come from the increasing **buyer power**, triggered by the (international) concentration wave at the retail level. These retailers operate more and more on international markets. This possibility to source from different markets, together with the close contact with the end consumers, also creates a situation of information asymmetry, further increasing retailer power. They use this buyer power to lobby for convergence between the different certification schemes, to further reduce their switching costs. Secondly, they use this power to force new demands into the certification books. Thirdly, the buyer power enables them to push prices at auction level further downward. As is the case for supplier power, the concentration wave at buyer side also increases the danger for **dependency**.

However, due to the large number of participants, certification schemes themselves can also exert buyer and supplier power, and thus counter some of the effects mentioned above.

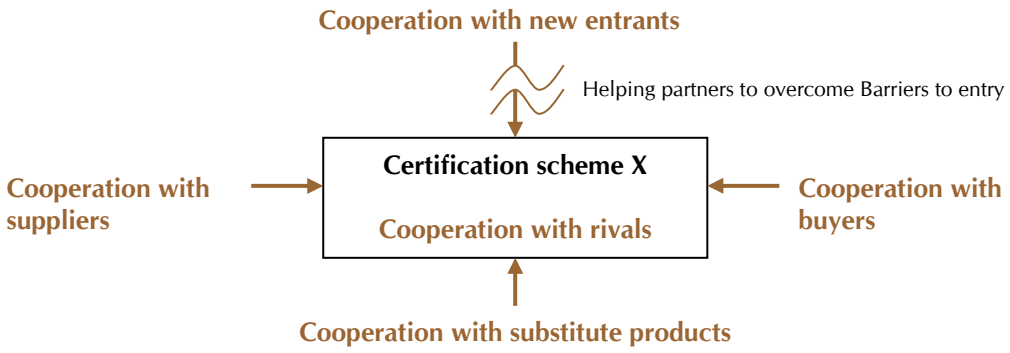

Figure 9.6: Sources for mutual gain through cooperation (adapted from Sanchez and Heene, 2004)

In fact, certification books should not be regarded as zero sum games (one organization can only benefit at the expense of another, Porter, 1979) but rather as positive sum games, in which cooperation leads to

win-win gains for all cooperating participants. This situation of simultaneous cooperation and competition is more formally termed 'coopetition'. The socio-economic construct of certification systems is one of the best examples of market players bundling forces to create mutual gains and reduce common costs.
Although internal rivalry has some negative aspects (internal competition), certification systems as multi-stakeholder constructions provide protection against some far greater dangers. Participants are now better protected against the adverse effects of food scares, mainly caused by irregularities in the group of uncertified producers. Advantages due to economic actors cooperating in certification schemes are multiple and are situated in all corners of the sustainability triangle. First, from an economic point of view, the certification (with labeling) creates higher visibility and credibility. It furthermore improves the cost position relative to substitute products (by working together to develop new methods, materials and technologies). Thirdly, the added value (environmental quality attributes amongst others) combined with the number of participants, opens market opportunities (increased market share or better prices). Fourthly, the bundling of forces with the competing farmers enables the exertion of both supplier and buyer power. From a social point of view, the stimulation of networking amongst farmers in certification schemes is regarded as beneficial (to find common solutions, to learn from each other). Furthermore, certification systems can act as advocates for the participants' interests to government agencies. From an environmental point of view, obviously, the more participants abiding by the stricter certification rules, the better.
The certification books furthermore offer an ideal negotiation base for more intense cooperation with both suppliers and buyers, without imposing the high transaction costs that occur when personal contracts have to be negotiated. At the supplier side for example, due to the participants' buyer power, they can influence the phytopharmacy industry to develop more crop specific or less intrusive pesticides. At the buyer side, the certification book is the key to unlock the preferential sales channels.
The mutual gains of cooperation with new entrants and substitute products mainly refer to increased learning effects and increased market power.

So, as a conclusion, certification systems are viable constructions if they are characterised by a will to continuously innovate and adapt and if the internal construction results from a balanced combination of the stakes of the involved actors.

2. General recommendations

This second part of the concluding chapter results from a translation of the chapters' and general conclusions into recommendations for the private and public parties involved in the field of certification.

2.1 SUSTAINABILITY AND ITS MANY DEFINITIONS

Both at the public and private level, we are currently confronted with an absence of a single standard for sustainability. Because of the broadness of the concept sustainability, it is impossible to compare the different systems' contribution to sustainability, if the term is not defined better, because each initiative has its own perception of what sustainable development should be.

Furthermore, the prevailing rules of a label are constructed in such a way that the common objectives of all the involved stakeholders are maximised while minimising the negative impacts of the label on each of them. This can explain differences among labels depending on who has been initiating the label or certificate or because of differences in power structure among the stakeholders, but it also provides reasons why labels are evolving in a certain way or are not going further although improvements could be possible. These issues however do not help to simplify the question of labels' contribution towards sustainability.

Within this research, the proposed scientific analytical methodology (see Chapter 3) allowed us to evaluate the rules in an objective manner and provided us with an appropriate tool to assess the evolution of certification standards on several environmental sustainability aspects simultaneously. Thus, public and private **actors can** rely on methods that depart from the certification book as such, and **assess the 'objective' (difference in) contribution towards environmental sustainability of certification systems**. However, the main drawback might be that this methodology is not able to evaluate the way the rules are interpreted and does not take the organizational framework, provided by the labeling initiatives, into account. The tool only looks at the rules as such and not at their application in practice.

To (partly) solve the latter problem, the systems as a whole (and not only the certification book as such) should be taken into account, necessitating an additional socio-economic approach to the question of sustainability. The socio-economic part of this research might provide a means of (theoretically) dividing certification systems into different classes based upon their socio-economic construct. During this research, three modes of operation were identified in the market place (see Chapter 4):
The first mode plays explicitly on the approach of the label (or collective brand), and therefore on a segmentation of the market, through the construction of quality standards (these labels are close to what we habitually call "specific quality"). But this quality cannot be linked exclusively to pesticide regulation; it is associated with different quality attributes, most often commercial ones linked to taste, appearance, etc. They are certifications centred on the product, the requirements for which, as in the case of Flandria, Terra Nostra, Charte Perfect and Hesbaye Carrots, have been negotiated between the distributors and representatives of the producers, and translated into private specifications. Communication with consumers is carried out within large-scale distribution and rests on the brand and the distributor as guarantor. This management method is often associated with "regional" strategies.
The second management method is oriented towards a method-oriented objective, and therefore an explicit objective of reducing the quantities of synthetic pesticides. In these cases, which include Fruitnet and Biogarantie, there is no certification of the product but rather a range of production standards and practices. The private standards are guaranteed by public regulations and international organizations. Communication with consumers is through the logo, and also through more informal means: markets, small shops and farm visits which restore the close link between producers and consumers.
A third management method has emerged more recently: EurepGAP is a certification which is not currently visible to the consumer, and which above all ensures a minimum compliance with procedures and legislation within large-scale distribution. Hence there is no certification of products or use of particular forms of farming. The guarantee offered to the consumer, and therefore the risk taken, is from the distribution companies, which put in place their own control systems and impose them on producers by making them the basic conditions of market access. This framework responds to a demand for homogenisation of standards on very broad markets in order to allow extended circulation of products.
This classification of agricultural governance systems (certification systems) might provide a means for public policy makers to better decide upon support measures (e.g. subsidy levels) for the different market parties involved.

However, **the central question of a well framed sustainability definition remains largely unsolved**. Without this definition, public parties are unable to properly assess the different systems' sustainability contribution, while the private actors lack knowledge of the public authorities' expectations. We thus recommend the development of a framework in which each of the systems can be rated upon their sustainability contribution in an objective and holistic manner. This framework can furthermore not be static, given that sustainability is a knowledge driven and thus ever evolving concept, as proven in this document.

Apart from this central issue, we further note the absence of a clear definition of what can (and cannot) be certified. All the stakeholders involved in this research stress the importance of labeling and certification systems surpassing the legal requirements, otherwise their main contribution remains limited to creating confusion. The current confusion can be further reduced when similar certification initiatives merge, thus increasing transparency and reducing the number of (look-alike) initiatives. The sustainability of the remainder of the (than clearly) different systems will then automatically improve.

2.2 INFORMATION, INVOLVEMENT AND EXTENSION

The second recommendation concerns all parties involved in certification, from producer to consumer. The concepts of information and involvement are largely correlated. During our research, we noted that those actors that are closely involved in the certification initiative are the most informed (which is quite obvious) and their attitude towards certification is also much more positive. We therefore argue here that certification initiators should strive for active involvement in the certification process of all the players (and predominantly farmers) linked to the initiative. The existence of information asymmetry between parties in the initiative might trigger a downward trend in the persistence, the adaptation potential and the power through networks of these initiatives. The studied certification systems all have developed (to a greater or lesser extent) mechanisms that enable some form of participation of the members. However, the

more members, the less individual influence remains, the more information asymmetry, the greater the danger for feelings of misunderstanding and exclusion. We therefore urge certification system initiators to maintain a strong bond with all the members, regardless of the number of members, and thus consequently develop tools to ensure maximum involvement. They will need this bond to maintain a positive and collaborative spirit amongst the participants.
This closer tie between the members and the initiators can ease the acceptance of new certification rules, because information asymmetry is reduced. If a consultation and information round is organised before each adaptation round, f.e. by means of Choice Preference experiments and focus group sessions, farmers will feel more personally involved and better informed and will thus develop a more positive attitude towards the initiative.
A second benefit results from learning effects in the opposite direction. Farmers admit that 'paper is willing', meaning that they sometimes have to make false statements in the registration forms to reach the current standards. This creates the wrong feeling that the current level is perfectly attainable (and that there is still room for further restrictions). Farmers should thus be given the opportunity to (anonymously) communicate where problems might exist in the current standard level.

Pure information gaps and possibilities to improve these still exist. At the farm level for example, this research clearly indicates that more attention should be paid to the training and education of workers with respect to hygiene, worker health and safety. Rules relating to this topic were consistently rated high by the contacted experts. These training sessions are very important not only to guarantee worker safety, but also to guarantee food safety. Governmental organizations should organize these training sessions and they should set a minimum limit concerning the number of training sessions that should be followed. Regularly two way communication meetings between management and employees should take place and records of these meetings should be kept. The government can also play a role in organizing formal trainings for all workers operating with dangerous or complex equipment. In this way one can assure that all the accident and emergency instructions are understood by all the workers.
The consumers participating in the focus group cycli on their turn rethink the approach on which the information intended for them is based – price and security – as well as the actors who convey it and who remain situated in the typical, delocalised, retail framework. They propose approaches to conveying information to ordinary consumers, opting for labels which convey a clear visual message, which is related to a production approach and which could potentially be delivered within an interpersonal relationship with producers. Space is therefore opened up by the consumers for realistic compromise between different approaches. They would place information in supermarkets as well as direct sales situations, even transposing characteristics from one type to the other (e.g. tastings and meetings with producers in supermarkets). But they also broaden the questions of information and education with concerns about training for supermarket departmental heads, supermarket managers, and both current and future farmers.
Labels could further be a strategy to involve the consumer more in the sustainability debate by providing him with a vehicle enabling him to express his preferences on sustainability issues. In practice however, either because labels are not or rather badly communicated or because the information provided is too complicated, they do not favour this role of labels. So, to make it a real instrument favouring sustainable consumption, a debate on the positioning of labels in communication strategies as well as on the content of labels is necessary. Public authorities should stimulate this debate and regulate the use of labels and the information they provide. If labels have to play a role in sustainability, their information content should be uniformed so that consumers can recognise and thus use the information provided. This does not exclude different labels (on the contrary, consumers should have the choice to enable that buying behaviour is giving signals on preferences), but means information presented in a consistent way, with a simple but reliable content.

2.3 PESTICIDE REDUCTION MEASURES

What can be the role of the public authorities in this matter? Alongside their position as sovereign regulator, they can count on self-regulation of pesticides by the market mechanisms. The use of labels – promoting self-regulation by the economic actors – is one possible means, and is the subject of the evaluation carried out in this research project. However, this method, which is in line with a whole range

of environmental policies, presupposes correctly informed consumers[31], the establishment of frameworks for mobilising producers and, in short, a means of producing correct information for all the partners in the agri-food sectors. Here the public authorities should be involved in a different way, helping both to provide this information (i.e. risk assessment) and to guarantee that the labels correspond to real efforts on the part of the producers. This is also the reason for producing a risk assessment model which, additionally, should allow public authorities to evaluate regularly the progress made (cf. the objectives of the federal risk reduction plan). Here it is also ordinary people who are called on to pronounce on the pertinence and validity of such a system, using democratic forms of expression of various kinds (sectoral councils, legislative instruments or other forms of public consultation).

Concerning pesticides, the sustainable use can only be delivered by ensuring better training of the people who use pesticides in order to adopt alternative pest control strategies and to reduce the farmers' dependence on pesticides. It is very important to define quality levels regarding the competence of pesticide applicators. Specific requirements should be set in this respect. The field of pesticide use and application is in constant evolution, with new products and methods being approved, old products forbidden, innovative application equipment, protective clothing, measures concerning waste treatment and phytostorage. The sustainable use of pesticides should be pursued by indicating to the farmers that it is very important that the farm workers who are in contact with pesticides respect the label instructions. In reality, this is not always the case. The degree of importance of following the guidelines on the labels should be communicated better to the producers. Therefore training sessions concerning good agricultural practices, Integrated Pest Management, anti-resistant strategies (choosing the varieties resistant to most of the commercially important pests), new techniques in applying pesticides (precision agriculture, computer controlled spraying equipment,…) should be organized at a regular basis. It is important that the pesticides appropriate for the target are applied - hereby taking into account the degradability and the selectiveness of the products - in the correct amount (dose calculation taking into account application pressure and speed and according to the label instructions, frequency of application adapted to the level of ecological damage caused by a certain active substance) at the appropriate time (under suitable weather conditions, when the parasites are the most susceptible,…). Preference has to be given to integrated pest management strategies, such as the use of natural enemies, the application of mechanical weed treatments,… The 'observe and alert' system should be granted further support. Measures should be taken to identify where pest populations first emerge, so that aggressive early season actions can be taken to slow population growth and spread. Active steps should be taken to avoid harm to beneficial arthropods, and to the extent possible, populations of beneficial arthropods should be encouraged through management of field borders and pesticide selection and use patterns. Workers should also be informed on the consequences of applying pesticides on human health in order to understand the importance of wearing personal protective equipment. Wearing nitril rubber gloves for example during application and picking is very effective in reducing the exposure risk of pesticides.

The government should stimulate the pesticide industry in developing new pesticides, using different adjuvants or different formulations (application of a WG instead of a WP). Phyto-pharmaceutical companies are for economic reasons (expensive and extensive research, necessary to authorize crop protection products) not interested in requesting authorization for pesticides intended for use on a crop cultivated on a restricted area. This pesticide industry consolidation, coupled with the programme of reviewers under Directive 91/414, leads to a reduced range of products. This creates particular problems for growers of minor crops in niche markets. Therefore specific research is required within the pesticide area to investigate efficacy at lower rates and degradation curves for all pesticides, with the overall aim of reducing the environmental impact of products and residues within them. In particular, research concerning the development of less persistent and less water soluble pesticides has to be stimulated. More selected and specific pesticides have to be developed. Innovation is essential to evolve to a more environmental sustainable agriculture. The development of natural pesticides based on natural pheromones, bacteria and viruses has recently been realized; development of pesticides acting on the defence mechanisms of pests is in full progress. In brief, the government should follow-up the fast modifications in the authorization of pesticides since these implicate guidance and adaptations in the cultivation methods. Another important issue concerns the harmonisation of authorization of crop protection products in order to be able to compete with foreign countries.

[31] The form(s) of this information can be co-defined with consumers, whose competence we have demonstrated through the pertinence of the results obtained in this way.

To the question of whether labels are an appropriate instrument for the regulation of pesticides, we can therefore offer the following propositions:

1. For those sectors in which the aim is to regulate usage or reduce risks without breaking away from current production methods: the labels seem to be instruments which, if accompanied by adequate supervision, can encourage more rigorous management on the part of producers; nevertheless, these labels are not particularly convincing to consumers, who see them more as economic instruments than as real progress; similar observations to this have been made in other contexts (de Buck et al, 2001);
2. The development of EurepGAP-type certifications is more in line with managing the use of pesticides in compliance with pre-existing standards, to which they only add a more rigorous form of control; consumers are not interested in this, and that poses the question of supervision by other actors, whether professional or public;
3. Organic and integrated agriculture labels differ markedly, both in the way they work and in consumers' perception of them as forms of organization which try to break away from "artificial" agri-food production; they owe their credibility not only to their more stringent requirements in terms of pesticide use, but also to the actual form of commitment made by the producers; they also make the social and environmental dimensions more tangible;

The issue of pesticides and their regulation would gain substantially from being dealt with as one of the dimensions of a food policy (as opposed to agricultural policy) where values such as diversity, proximity and sobriety have a natural place alongside mere notion of security, in order to create a common language between producers, consumers and public authorities. It is concepts such as these which would seem to be capable, in the eyes of consumers, of giving real content to the idea of sustainable foodstuffs.

2.4 GOVERNMENTAL SUPPORT

Should public authorities further increase the support measures for certification initiatives? For two main reasons we strongly recommend this. The discussion below is built around Figure 9.7.

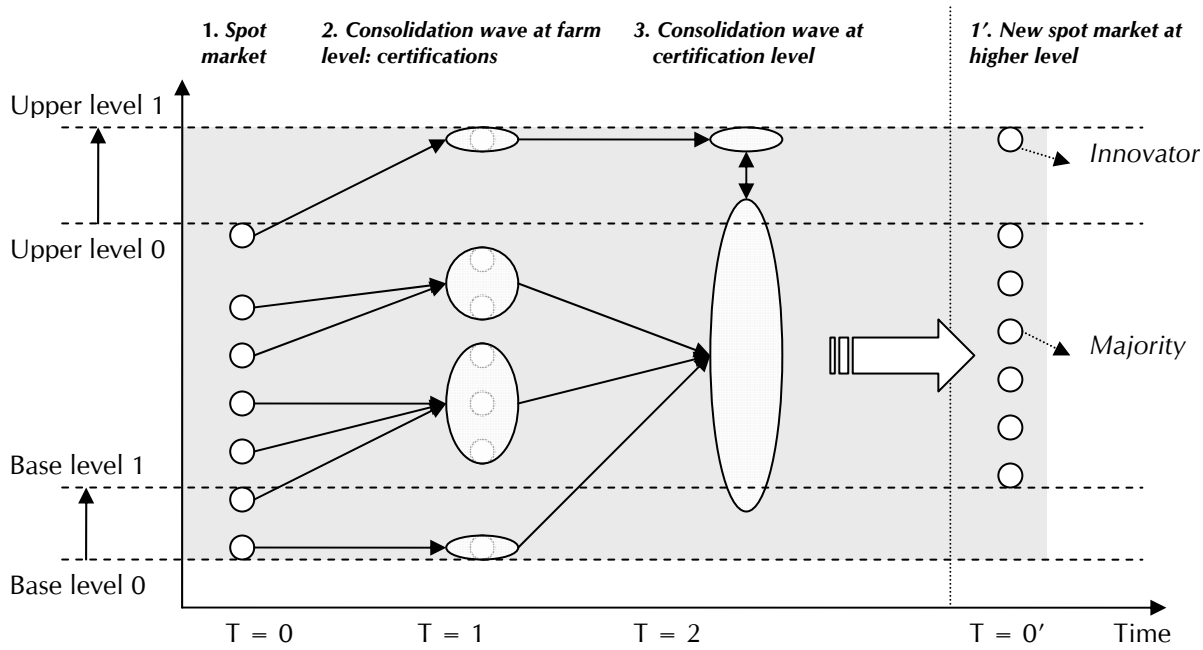

Figure 9.7: Evolution of certification systems

In a first phase, several initiators identify the potential of certification for their specific product, resulting in a consolidation phase at farm level (several farmers agree upon similar product features and/or production practices). During the maturation of these multiple certification systems, a second consolidation phase emerges, mainly driven by transaction cost economics (under retail pressure) and economies of learning at certification level (cross-adoption of modifications). This finally results in a majority of farmers participating in a single certification initiative (or several look alike initiatives), comparable with the spot market situation before the certification round started, although now at a more restrictive level. Furthermore, some innovators remain above this spot market level, and they will trigger a second

certification round, which now departs from a higher level. Governmental support can be justified for both the innovating and the majority systems, the former because they positively influence the upper boundary of certification, the latter because they influence the lower boundary. This lower boundary increase opens the door for a more restrictive government legislation, and thus enables the transition to a society in which external costs of farming are increasingly internalized. The governmental support is justified given the low prices for agricultural products at consumer level. The type of support can be oriented both at the research and development level (facilitation of the introduction of new techniques) and at farm level (to encourage participants to make the transition to more demanding systems). The support levels should furthermore be differential based upon the type of effort within the particular system. These levels can only be appropriately determined when a framework for sustainable agriculture with measurable indicators has been established (see point 2.1 of this chapter).

Currently, given the high number of participants in the fruit and vegetable sector already following reasoned farming practices, we wonder whether it is worthwhile to make these practices compulsory. The legally obliged Integrated pit fruit production practices can serve here as an example of the workability of such a change.

3. Further research

We close this concluding chapter with a question for future research on topics that emerged during the project and that could not be addressed given the time frame and the objective of this research. Although many aspects are currently underaddressed in the field of certification, we will restrict this section to three topics:

- workability of a single sustainability label;
- theoretic versus realistic contribution of certification to environmental sustainability;
- impact of the internationalization wave within certification on local producers.

3.1 A SINGLE SUSTAINABILITY LABEL

The consumers participating in the focus group cycli (as outlined in Chapter 5) launched, after several deliberative discussion rounds, the idea of a sustainability 'Camembert', a logo on the end product with indication of origin, degree of artisanality and type of farming method. Is such an approach workable in the real world? The question remains in how far such a logo reflects the wishes of the majority of the consumers, given that the participants in these sessions all experienced a learning cycle and thus no longer can be regarded as 'uninformed' consumers. Furthermore, no evidence is currently available whether such a logo will in fact be able to mobilize (create awareness and interest in) the (large) group of currently uninterested consumers.

3.2 THEORETIC VERSUS REALISTIC CONTRIBUTION TOWARDS ENVIRONMENTAL SUSTAINABILITY

Although very informative and indicative, the multi-criteria methodology developed in Chapter 3 has some drawbacks, limiting its use in a more generalized manner. The methodology is not able to evaluate the way the rules are interpreted and does not take the organizational framework, provided by the labeling initiatives, into account and can thus be regarded as a more theoretic approach (based on the certification book rules). We therefore argue for the supplementation of the current knowledge regarding environmental sustainability of certification systems with a more holistic approach.

A method able to correctly and more holistically assess the contribution of certification systems to environmental sustainability is Life Cycle Analysis (LCA). Up to now very few studies tried to determine the integrated environmental impact caused by conventional, integrated and organic crop production by means of an environmental assessment tool. The effects between different agricultural systems (organic, integrated, conventional) are currently not really evaluated and are difficult to compare due to the totally different aspects of their production system. The parameters and models which are presently used to conduct a comparative evaluation of analogous aspects (e.g. comparison of use of different pesticides) are not suitable and applicable for the comparison of totally different methods (e.g. comparison of chemical crop protection versus biological crop protection). This needs a "life cycle assessment" (LCA) approach covering all aspects involved in the agricultural production process. Environmental Life Cycle Assessment

enables a systematic investigation and a complete analysis of the environmental impacts of a production system.

In recent years a life cycle approach in policy making has been promoted through the concept of an integrated product policy (IPP), both at the EU and at national level. One of the ideas behind applying a more holistic view in the design of environmental policy is the desire to identify the environmental inefficiencies within a product chain. Life Cycle Analysis is an appropriate tool to identify the environmental inefficiencies within the different production systems. Environmental life cycle assessment enables a systematic investigation and a complete analysis of the environmental impacts of a production system and identifies the drivers of these impacts. This approach offers a degree of objectivity that enables comparison between different methods on the basis of a range of environmental impacts.

3.3 IMPACT OF INTERNATIONALIZATION OF CERTIFICATION ON LOCAL PRODUCERS

As repeatedly argued before, it became evident during this research that the different certification schemes are currently in a process of consolidation, mainly triggered by retail groups operating at the international level. One of the core questions that remained largely unsolved is the following:
"Is the evolution towards international quality assurance schemes and standards a blessing or a threat for Belgian farmers, given that on the one hand these standards may act as a barrier to market entry for producers/countries that have difficulties to comply with high private standards or on the other hand, they may provide new possibilities for foreign competitors to gain access to our markets?"

The switch to globalised private certification standards results in effects on the competitiveness of our local agricultural economy, predominantly through its effect on local certification initiatives and on farmers. New competitors can, by adhering to the prescriptions in these private standards, enter the European market more easily. These competitors operate in institutional settings unlike ours (with much less stringent local legal restrictions / requirements), with possible adverse effects on the preferential positioning of Belgian market players in the European market for agricultural commodities. Therefore research should aim at assessing how our farmers are affected by these evolutions towards international certification and quality assurance systems and how they react to this changing environment. Furthermore, differences in institutional environment and adaptation potential between Belgium and the new competitor states should be identified. The study should also try to evaluate local strategies that can be developed (e.g. increased emphasis on origin, more secure standards to keep advantage) to improve the own competitive situation. To complete the picture, evidence should be gathered whether this evolution is creating a schism in the market (both in Belgium and abroad) with respect to increasing dependency and exclusion rates within the group of most vulnerable players.

The above problem statement could be approached by analysing the dynamics within sectors which differ from each other with respect to the degree of internationalisation in the standards applied in the sector. This focus is of interest because general conclusions can be drawn with regard to effects of international standards on local competitiveness in more or less affected sectors. Likewise, conclusions can be drawn regarding the differences in pace between the cases. A valuable methodology to study the above research questions is **global value chain analysis (GVCA),** enabling more insight in the impact of governance structures on total costs and the division of these costs among actors in the chain. It has been proven to be a very useful methodology to distinguish the inefficiencies in the chain.

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none

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