20 Opponent note no. 5b: Support to organic farming and bio-energy as rural development drivers

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20.1 Summary

Given the current competitive strength of North West European agriculture, organic farming and bio-energy production will not expand without subsidies. Technical research shows that high tech agriculture can be viable in the future if it is both efficient with respect to the environment and with respect to energy input. This is a more attractive route to attain the goals of the Lisbon strategy than to bet on organic agriculture. This high tech agriculture will be competitive with respect to large-scale producers from other continents. Roughly the same applies for bio-energy. Here the value for society of producing bio-energy has to be larger than the market value of the biomass produced. This can be achieved by combining functions in rural areas. High tech conversion of various bio-energy streams will provide a competitive advantage for the rural areas in North West Europe. The overall conclusion is that organic farming and bio-energy will not contribute to the Lisbon strategy goals of 2010. However, investments in developing high tech agriculture and bio-refinery will contribute to the Lisbon strategy, although the objectives will be met at a later stage. To fulfil the Lisbon strategy we have to change directions. We do not reach the desired objectives if we focus on minor improvement of current production systems. We have to develop completely new production systems. North West European agriculture has to do what it can do best: focus on knowledge intensive production of agricultural products. The outcome of these new policies is not certain, because the competitive strengths depend also on volatile price differences in commodity markets.

20.2 Introduction

The key questions to be answered by the "Green Roads to Sustainability" project are:

"Can environmental policies underpin the EU goals of improving economic growth, environmental quality and employment – all at the same time?" - and: "What is the potential of broader structural policies in relation to environmental policies?"

The objective of this study is to analyse the potentials of Green Roads to Growth policies, enhancing organic farming and bio-energy production. The focus will be on incentives to convert agricultural production from conventional to organic production and incentives to increase the production of energy crops and biogas. The objective reduces to two research questions:

- Can production of bio-energy enhance growth, create more jobs and improve the environment at the same time? If so:
- Which incentives can be identified to stimulate this preferred situation?

The outline of this opponent paper is as follows. First a few prerequisites for sustainable growth are presented; these are used to analyse the case study paper. The opponent paper is broken into two sections with an identical set-up. Organic farming is treated first in sections 3 & 4; thereafter bio-energy is presented in sections 5 & 6. Both cases start with a summary of the case study's conclusion paper. Points on which I agree of the case study paper by Abildtrup and Dubgaard (2006) are discussed briefly. Omissions found in their study are discussed and illustrated. In chapter 4 bio-energy production in the Netherlands is reviewed and research is indicated that may suit the objectives of the Lisbon agenda. Finally, conclusions are drawn.

20.3 Short background on economic growth

In this opponent paper questions will be addressed from a spatial economic perspective (alike the Abildtrup, Dubgaard paper). First the spatial context has to be identified. To be applicable for the Danish situation we focus on North West Europe.

Economic growth in a competitive world requires competitive strengths (advantages) on competing suppliers of the identical good or service. In this opponent paper I assume that the protection of EU agriculture will decline; therefore the Green Road to sustainability has to be met in a competitive world based on international trade. On the land market, organic agriculture and bio-energy crops have to compete with other possible land uses. The yield has to be larger than alternative uses. The market mechanism is in North West Europe the most important incentive to attain the goals of the Lisbon Strategy. If externalities come into play, and they will, the market will not reach the social optimal solution and the government has to formulate environmental policies (policy measures) to achieve this social optimum.

Potential measures have to be evaluated using a Social Cost-Benefit Analysis to find out whether society's objectives are better met with these measures. The EU has formulated the Extended Impact Analysis (EIA) to evaluate potential measures on their environmental impact, their economic impact and their social impact (see for an example Kuhlman et al., 2005). This EIA-approach is suitable to evaluate measures to attain the objective of the Green Roads to Sustainability project.

To combine economic growth and improve the environmental quality can only be reached simultaneously if production factors explicitly including the environment are all employed efficiently. Efficiency can be divided into technical efficiency and economic efficiency (Reinhard, 1999). Technical efficiency can improve by movement of the production possibilities frontier due to technological change (Oude Lansink and Reinhard, 2004). It is clear that inefficient use of environmental resources will reduce environmental quality, while inefficient use of labour will increase employment (in the short run), but will reduce economic growth.

20.4 Conclusions case study paper on organic farming

Abildtrup and Dubgaard (2006) present the following conclusions on organic farming.

- There is no clear empirical evidence that organic farming is increasing rural income.
- Analyses of labour input based on Danish and European farm account statistics do not provide clear-cut conclusions on the impact of organic employment in rural areas.
- Organic farming has environmental benefits but these benefits could be provided at a lower cost than by subsidizing organic farming.
- Consequently, conversion to organic farming should be market driven. Government policies should focus on ensuring consumer confidence in eco-labelling and information initiatives (research and extension).

20.4.1 Comment

The case study paper provides us with a clear analysis of the current state of the art in organic farming. However, it does not take the future into account. The conclusions are drawn upon research based on realised production. Possible developments are not accounted for. Potential future scientific breakthroughs that will provide us with new efficient production possibilities are not described. These may be more efficient with respect to the environment and conventional inputs than the technologies applied today. In the following section the state of the art of Dutch organic farming research is presented, thereafter, new techniques are adderssed.

20.5 Organic farming

20.5.1 The Dutch experience

Recent Dutch research concluded that the objectives of the Dutch Government with respect to organic agriculture will not be met without additional measures. The Dutch government's objective of 10 % of the area of cultivated land being farmed organically in 2010, and a 5 % share of consumer spending on organic products in 2007, can be described as very ambitious. The current percentages are 2.5 % and 1.7 % respectively. Primary agriculture makes a considerable contribution in the higher costs at the consumer level. Various measures have been taken to encourage organic production. Approximately 50 % of the budget was destined for research and 25 % was intended for the stimulation of investment schemes. Non-buyers of organic food have a relatively low income. It is striking that price fixing does not come to the foreground in the researches analysed, or at least not explicitly, while the price of organic foods at consumer level are often more than 50 % higher than conventionally produced products. To reach a larger group of consumers, price reductions are necessary, or the positive characteristics attached to organic food have to be proven irrefutably (Wijnands et al., 2005).

Growth in the number of primary producers of organic products has stagnated in recent years. Potatoes, carrots, onions and cabbage represent the most important crops in turnover. Until a few years ago the economic achievements on organic arable farms were better than those on conventional farms. The physical yields are around 75 % of those of conventional farms and the costs are around 150% per hectare. This results in a product price that is twice as high. Labour is an important point for attention. More additional costs arise from extra labour. The amount of pesticide residues has fallen (organic rather than chemical, of course), more enterprises are meeting the standards for nitrogen and phosphates and the energy consumption is lower. Scientific research confirms greater biodiversity through organic farming. Organic farming has its own critical success factors, specific to each category of consumers. Competitive price and 'one stop shopping' weigh heavily for the "calculating" category whereas the intentions of organic farming are the decisive for the "responsible consumer" category.

20.5.1.1 Conclusions

Due to lower yield and higher labour input, organic products are more expensive than traditional. This price difference will limit the expansion possibilities of organic farming. Only for a relatively small portion of the consumers the intrinsic value of organic food (including the environmental value) is large enough to justify the high consumer price. While conventional agriculture has to improve its environmental performance, due to more stringent regulation (e.g. EU Water Framework Directive), the intrinsic value of organic products (compared to conventional products) will be smaller in future. A lower price of organic products will attract more consumers, but this reduction can only be achieved if labour input decreases, due to technological research after mechanisation. This does not correspond with one of the pillars of the Lisbon strategy.

20.5.2 High tech agriculture

Organic farming can be characterized as 'low tech' agriculture, based on traditional technologies. A reduction of emission to the environment can also be attained applying high tech production facilities. The application of technology can result in environmental problems, but technology can also offer the key to the solutions of those problems. After a period of 'cleaning up afterwards', these days there is a much greater focus on technology that can prevent environmental problems. Economics and ecology can go hand in hand, for example regarding economizing scarce resources as energy and artificial fertiliser. Three types of environment-technological solutions can be identified (Silvis and de Bont, 2006)

- 'end-of-pipe' solutions. Negative effects of the production process are corrected afterwards (e.g. discharge water is purified)
- Process-integrated solutions. The occurrence of pollution is prevented or reduced (example: biological pest control).

- System innovation. This involves taking an integrated look at the organization of production. This can take place at chain level or in combination with other agricultural or non-agricultural sectors (closure of cycles through the mutual use of residual products).

In the last decades technologies have been developed for greenhouses that reduce the use of water and the emission of nutrients dramatically. This is achieved by for instance recycling waste water and using biological control. These high tech solutions have consolidated the competitive strength of Dutch greenhouse horticulture. They can play a competitive role on the land market and on the EU market for vegetables and world market for flowers. Meanwhile they employ a huge labour force in the greenhouses, in the supply industry and in the food chain.

Product innovations take place on a regular basis in horticulture, such as vine tomatoes, new colours of sweet peppers, and countless varieties of plants and flowers. In arable farming and livestock production, new products emerge less frequently. Alls sectors strive for improvements in quality. The post-harvest process is also important in this: storage conditions, the effective monitoring of microorganisms that cause food to perish and/or give rise to toxicity, and transport conditions, for example.

20.5.2.1 Policy

One of the new focus points of greenhouse technology is the use of energy. The greenhouse horticulture sector wants to change to a system in which the use of fossil fuels is replaced by renewable energy sources the whole year round. Many different energy sources could be used, such as solar energy, photovoltaic power, geothermal energy, hydropower and wind power. The rate of innovation and development of demonstration projects must be increased. It is time for decisive action towards sustainability.
The Dutch Ministry of Agriculture, Nature and Food Quality (LNV) and the Farmers Organizations Horticulture have formulated ambitious goals on the theme of energy.

One of these ambitions is to create a sustainable and publicly respected greenhouse horticulture sector which will be independent of fossil energy sources within the foreseeable future (2020), and in which growers can operate commercially using safe and environmentally sound cultivation methods. Achieving such ambitious goals requires radical system innovations, and this in turn depends on collaboration between several parties. The Energy-producing Greenhouses competition is expected to produce one or more 'innovative solutions' with which greenhouse horticultural enterprises will not only produce flowers, plants and vegetables, but also supply energy all year round for their own use and for distribution.

Greenhouses in The Netherlands receive more solar heat energy than they need. In conventional greenhouses the excess heat is removed by opening windows. Recent innovative greenhouse designs store this excess heat in deep aquifers through a sophisticated system of heat exchangers and pumps. The stored heat is used for warming the greenhouse during the nights or in winter. Energy balances show that there is sufficient energy left to heat a block of houses. The 'energy-producing greenhouse' has been the starting point of a design for a self-sufficient neighbourhood that closes water and nutrient cycles at a decentralised scale.

20.5.2.2 Conclusion

The organic farming sector will not expand in the future in a competitive market, due to higher production costs. Policy to reduce the production costs are not likely, because except for a reduction in the emission of nutrients and pesticides, organic farming does not attain objectives of society more than conventional farming. Given the competitive environment of North West Europe agricultural policies should stimulate high tech agriculture, whose produce can meet the environmental objectives, social goals against a competitive market price.

This stimulation has to be in the form of R&D subsidies for developing high tech agricultural technologies and subsidies to accelerate adoption of those techniques. Agriculture based on these new economically and environmentally new techniques will also provide more employment and will be a pillar for rural development. This high tech agriculture will only flourish in regions that are very suitable for agriculture (all necessary inputs including labour are available) and near the markets. Less favoured areas are not suitable for high tech agriculture, these areas have to specialize to environmental and landscape services to attain an income from agricultural activities. Another option is to specialize on niche markets to incorporate the specific characteristics of the region (and the product) in the price.

20.5.2.3 Arable farming

The harmonization of European pesticide policy will continue. It is expected that the European standards will become more stringent; however, the Netherlands already has a stringent policy for the agricultural use of pesticides. Consequently;

this issue will have little influence on the country's arable farms. The standards for nitrogen use imposed on arable farms will be more stringent than current standards; this will ultimately result in a reduction in the use of manure. The effects on the yield will be minor, since current application levels are often excessive; however, this will increase the risk of poor seasons.

The development of new products for the consumer generally takes place in the foodstuff industry. Such products are generally aimed at consumers with greater purchasing power. The processing industry has a need for good quality starting materials, and then wishes to create the added value itself by making specific products and supporting those products with a whole range of marketing techniques.

Two technological areas are of importance to arable farming. The first relates to ICT, which has already entered into wide-scale use. Opportunities will become available for precision agriculture during the coming 15 years. Automation will boost the current trend towards increases in scale and efficiency improvements. Precision agriculture will provide for the improved tailoring of the dose, time of application, the form (or variety) of the seed, the nutrients, pesticides and mechanical weed control to the spatial variation within fields. This will result in an improved use of cultivation aids, and will make a major contribution to the reduction of use of nutrients and pesticides. Biotechnology constitutes a second important development for arable farming. Its implementation can result in higher yields and the more efficient use of cultivation aids. Biotechnology is also being used in a search for improved or new products that can open up extra sales opportunities.

In environmental terms there are high expectations of biotechnology; for example, more efficient plants that require less in the way of inputs or that are optimally suited to specific circumstances; clean plants of which all the waste is usable. One particular interesting innovation is the idea to produce vegetable food proteins directly using algae and solar energy (so-called blue biotechnology). Other innovations with such perspective include:

- Bioremediation: the biological breakdown of environmentally harmful substances using bacteria, algae, fungi and yeast or higher plants.
- Technology to add value to residual and waste flows.
- Technology to optimise agrologistics
- Ecogenomics: working towards healthier soil life.

A number of technological developments are a source of concern for consumers. Biotechnology is a salient example of this. People are concerned about food safety and there is a greater demand for quality guarantees and information regarding production methods.

20.6 Conclusions case study paper on bio-energy

Abildtrup and Dubgaard (2006) present the following conclusions on bio-energy.

- Production of bio-energy on agricultural land is not a commercially competitive land use. If energy crop production competes with traditional crops there is no evidence that energy crops imply a higher level of employment.
- Bio-energy reduces the externalities from the use of fossil fuels. Inclusion of external costs and benefits improves the competitiveness of bio-energy from a societal perspective.
- Generally, the production of crops for power generation has a positive effect on the environment due to the reduction of green house gas emissions by substituting bio-energy for fossil fuels. However, bio-energy crops may increase pollution from agricultural production through intensification of land use.

20.6.1 Comment

These conclusions are valid, but they are based upon research and assumptions that stem from the past. In the Abildtrup, Dubgaard (2006) paper bio-energy production is compared with coal production; the conclusion is that the electricity production based on biomass has identical total costs (including social costs) as that based on coal. However these studies are based on prices in the 1990s, whereas the prices for the different costs components may vary largely in the future.

The Netherlands (and North West Europe) is not a suitable location to grow bulky bio-energy crops at a large scale. Due to the large pressure on space the land price is too high to produce bio-energy crops competitively. If we approach this question from international trade perspective, the crops (or animals) grown by EU farmers have to compete with crops from abroad. The competitive power of western European agriculture is not in the bulk production of crops. Value has to be added by the farmers and this value has to be transformed into streams of money above the world price for bulk agricultural products to make it commercially interesting. Large scale production of energy crops is more likely to be in Brazil, assuming that agricultural land is not scarce in future overthere. A disadvantage of importing bio-energy is the adverse effect of the production of these crops (reduction of biodiversity, increasing food prices) in the production countries.

20.7 Bio-energy

20.7.1 The Dutch experience

A recent study of LEI (Janssens et al., 2005) analysed the prerequisites to grow rapeseed by Dutch farmers. To replace 2% of fossil gasoline by bio-gasoline 109.000 hectares are necessary (assuming a yield of 3300 kg rape seed per hectare). Rapeseed is only competitive on set-aside land, if it can be harvested using own machinery. In France and Germany production of rapeseed is more competitive than alternative crops. The changes in the CAP (including the energy bonus and lower prices for sugar beets) will not change the competitiveness of rapeseed compared to other crops. The market for bio-energy is constructed by the EU, indicating that a specific minimum percentage (5.75 %) of fuels has to consist of bio-fuel at 31st December 2010. The demand for bio-energy is likely to rise enormously. At present bio-fuel has a large tax exemption in the major EU member states. Production costs are far higher than fossil fuels, while they are favourable to combat the emission of greenhouse gases.

Current policy is a tax exemption on bio-ethanol and bio-gasoline in a lot of EU-countries. In the Netherlands the government wants to facilitate the use of bio-fuels to reduce the emission of GHGs by traffic. The transport sector currently emits 23 % of all GHG's in EU-25.

Figure 1. Production of biodiesel in tonnes

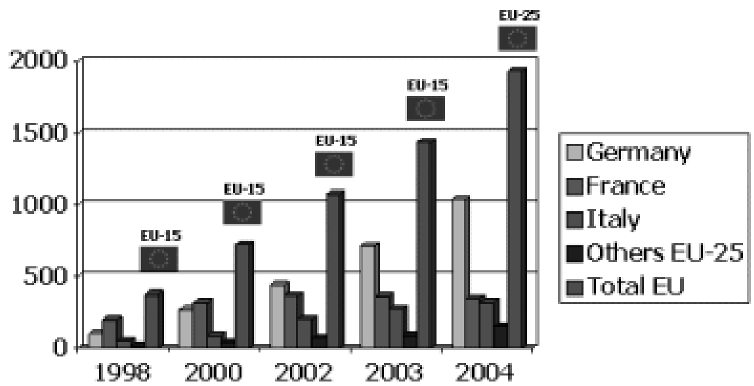

Figure 1 shows the development in biodiesel production in the EU in recent years.

To convert conventional farming into production of energy crops, the value produced per hectare should be quite high; especially compared to other competitive producers like Brazil. This value can be incorporated in the crops produced for the market (and result in direct income of the farmer) or the value can accrue to the society (without money directly connected to it). The value for the society can be a contribution to a reduction in emission of GHGs (Green House Gases), due to substitution of conventional energy sources into bio-energy. Other possible social values connected to the production of bio-energy are the improvement of soil quality or purifying water. To valuate bio-energy production in future we perform a cost benefit analysis of potential attractive bio-energy production systems (and compared to alternatives).

The externalities of growing bio-energy may warrant a policy to stimulate the production. One obvious externality is the reduction of GHG that are emitted. This externality can be internalized by CO_2 certificates and quotas of bio-energy in automotive fuel. However these mechanisms are not tied to the location of production. The current prices of these certificates are not high enough to offset the higher production costs. In the Netherlands other externalities of growing bio-energy are identified by combining multiple functions. An example is the production of green cane. Cane can be used as biomass for energy production and it also is a helophyte filter that improves the water quality. To fulfil the requirements of the EU Water Framework Directive the Dutch waterboards have to take measures to reduce the nutrient content in the water. One possible measure is to percolate water through a helophyte filter that consists of green cane that has been planted for this purpose (green maize is replaced by green cane). The value of the water purification of the cane is determined by the costs of alternative measures to attain the objective. A case study has been set-up to measure the actual water cleaning potential of the cane in this setting and to assess the value of this water cleaning function and the value as biomass. This year will be the first productive year for this cane.

20.7.2 High tech applications

The use of (ligno-) cellulose biomass, under which a large array of low value biomasses (straw, grass from the verge of a road, waste wood etcetera) but also from harvested bio-energy crops (e.g. switchgrass) offer perspectives for a large scale production of both bio-ethanol and bio-gasoline against a lower cost price and with a higher environmental turnover (more environmentally efficient). The technology for these fuels is under development now, and is often called “second generation bio-fuels”. These second generation bio-fuels can be used in combustion engines. Nowadays worldwide two pilot plants produce bio-ethanol from ligno-cellulosis at small scale. The Dutch focus on second generation bio-fuels, because they are more sustainable, although they are only available on large scale by 2015. The second generation bio-fuels (based on woody sources and waste materials) will be cheaper by then (according to experts), and they require less energy and farmland. The emission reduction will be more than 80% (Annevelink, Bakker and Meeusen, 2006).

Although the first generation bio-fuels are relatively expensive and they require a lot of farm land, steps are set to stimulate these first generation fuels. The objective is that firms can prepare themselves for the second generation bio-fuels. Improvements can be made at every step of the supply chain, and it is reasonable to expect large gains in efficiency and concomitant reductions in cost as easily implemented modification made to current systems begin to streamline commercial production (Heaton et al., 2002). Disadvantages of first generation bio-fuels are the possible negative impact on biodiversity and nature reserves and the competition with food production and a possible lock-in effect of these first generation fuels. A reduction in livestock production will affect the waste product streams in animal feed industry. More waste material will be used to produce bio-fuels instead of the current use in animal feed. The market for waste material is very dependent on small price differences, hence these developments are uncertain. For instance due to the lower wheat prices in the EU the import of tapioca from Thailand has decreased enormously the last years. Also is the development of bio-fuels strongly dependent on the price of alternative sources of energy, it is extremely difficult to predict these prices. Therefore, the market for bio-energy crops is uncertain. If the price of energy is high enough to enable economic viable production of bio-energy crops, the impact will by gigantic. Amongst others food prices will rise, this will affect developing countries most. Also will the value of organic waste material that high that it will be hardly used as fertilizer, this will increase the erosion risk.

The Dutch Ministry of Agriculture, Nature and Food Quality wants to stimulate a stepwise approach to attach value to biomass in the future. The first step consists of high venerable applications (like materials and chemicals), the rest fraction will be used for bio-fuel. Finally the waste materials are used for electricity. The government needs to support market parties optimal to stimulate the knowledge development. The production of rapeseed, grains and other crops for the production of first generation bio-fuels can meanwhile be a chance on firms and parcels of land that do not have higher valued alternatives. On the mid-term chances for crops will increase, due to the development of bio-refinery chains for high valued products, bulk chemicals and energy-carriers from crops. The implementation of second generation bio-fuels grass and woody waste streams play a specific role in the production of bio-ethanol and Fischer-Tropisch-gasoline from lignocelluloses containing biomass.

Understanding the financial and non-financial factors that influence farmer adoption is critical for designing public policies that will facilitate the adoption of practices and technologies with the greatest potential to mitigate climate change. Change in agriculture has historically followed the “adoption curve”, with a small number of innovators trying an untested practice and refining it, followed by the more numerous early adopters, and then the bulk of the farmers. The combination of farm demonstrations with socioeconomic analysis will lead to rapid adoption of project findings, particularly those that have low capital requirements and those where we can clearly demonstrate multiple benefits to farmers, communities and local industry.

20.7.3 Conclusions

Bio-energy production is not viable in North West Europe, except if it is rewarded for its contribution to the objectives of the society. CO_2 certificates are not bound to our region, and they will not provide a comparative advantage over Brazilian bio-energy. Cultivation solely for energy purposes would not appear to be of economic interest; a link with another function, such as water purification, recreation, water storage or the use of marginal land would appear to offer better prospects. To stimulate bio-energy production these benefits have to be attached to flows of money. In the future, if second generation techniques can be applied to transform biomasses into energy, the production of bio-energy will be more environmental efficient. Given possible major changes in the price ratio of fossil fuels and bio-fuels in the future, it is possible that bio-energy is a competitive agriculture product.

20.8 Conclusions

Given the current competitive strength of North West European agriculture organic farming and bio-energy production will not expand without subsidies. Subsidies can be supplied because of the positive external effects of both organic faming and bio-energy production. For bio-energy flows of money are already attached to the environmental benefits, by CO_2 certificates. It is expected that prices of fossil fuels will rise in the future, hence bio-energy production will be more competitive with respect to fossil fuel, but production in North West Europe will not be competitive compared to production in Brazil.

Technical research shows that high tech agriculture can be viable in the future if it is both efficient with respect to the environment and with respect to energy input. This is a more attractive route to attain the goals of the Lisbon strategy than to bet on organic agriculture. This high tech agriculture will be competitive with respect to large-scale producers of other continents. A policy that corresponds with the Lisbon strategy is to invest in research that will make these new techniques available for farmers and stimulation of the adoption of this high tech agriculture.

Roughly same applies for bio-energy. Here the value for society of producing bio-energy has to be larger than the market value of the biomass produced. This can be achieved by combining functions in rural areas, for instance increasing water quality to comply with the Water Framework Directive. The value of CO_2 certificates is not tied to the location, and will not lead to comparative advantages over production in other continents. High tech conversion of various bio-energy streams will provide a competitive advantage for the rural areas in North West Europe. Here again, research after multiple land-use and high tech conversion of multiple biomass streams will lead to competitive advantages, towards improved environmental quality and to more employment. The required policy is an investment into new technique and fast adoption of these techniques.

The overall conclusion is that organic farming and bio-energy will not contribute to the Lisbon strategy goals of 2010. However, investments in developing high tech agriculture and bio-refinery will contribute to the Lisbon strategy, although the objectives will be met at a later stage. To fulfil the Lisbon strategy we have to change directions. We do not reach the desired objectives if we focus on minor improvement of current production systems. We have to develop completely new production systems. North West European agriculture has to do what it can do best: focus on knowledge intensive production of agricultural products.

20.9 References

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