

Agroproduction Parks: Perspectives and Dilemmas

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Preface

Dutch agribusiness is facing several major challenges. In the next few decades, the process of transforming into an agricultural sector that yields sustainable production while being internationally competitive and socially valued will bring about changes that will encroach deeply on the sector's structure and position. A more varied agrosector is expected to emerge, providing opportunities both for small-scale traditional production aimed at local markets and large-scale industrial production aimed at foreign markets. As a result, the boundaries between agribusiness and other sectors will be blurred. These developments will require various parties to found their collaboration on a beckoning perspective: shared visions and ambitions.

Seen in this perspective it will be necessary to develop fresh concepts that are sufficiently powerful to guide joint activities of parties while at the same time being flexible enough to respond to specific conditions and actual developments. An essential precondition here is the presence of adequate social support. The system innovation of agroproduction parks – based on the principles of industrial ecology and inter-company symbiosis – might be able to supply that perspective. This has been a reason for the LNV steering committee on Technology Assessment and the National Council for Agricultural Research - recently followed by the Innovation Network Rural Areas and Agribusiness – to decide that this system innovation should be developed in more detail while its perspectives and dilemmas should be explored from different viewpoints.

There are many ways to define the agroproduction park concept. The present quick scan specified the concept of agroproduction parks by defining four distinct designs - Delta park, Agrospecialty park, Green park and Multipark – each of them located in a specific area. The designs were then discussed with a broad range of stakeholders from the four quarters of business, government, social organisations and knowledge institutes. The result was an overview of the possibilities of those developments as well as the social issues associated with them. In particular, doubts were raised about the image projected by agroproduction parks (as seen by farmers and citizens), the possibilities of fitting them in with spatial planning and their administrative feasibility. Nevertheless, a number of interested parties became inspired by one or more of the sample designs. They could see how they opened up long-term perspectives.

We see the quick scan as an initial step in a process that may lead to realising agroproduction parks in some form or other. Two lines of development can be distinguished here. The first one refers to a continued social debate on both the pros and

cons and the alternative options with regard to agroproduction parks whereas the second line is characteristic of taking an interactive design and development course. Concrete designs have been shown to be excellent instruments to encourage the debate about normative considerations and choices, both with parties which have a direct interest and with the public at large.

In view also of the dilemmas described it is of great importance that stakeholders play a role in the future course of this development. What we envisage is a participatory development process, in which the designs presented here merely represent very rough indications of potential outcomes. Feasibility studies and pilots may be part of the process. The main issue is to promote discussion and collaboration between partners of different - agro and non-agro - feathers based on the principles of industrial ecology. The Innovation Network Rural Areas and Agricultural Systems is prepared to take the lead in organising the process.

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Management Summary

- 1. The concept of agroproduction parks, i.e. a purposive clustering of agroproduction and non-agroproduction functions at an industrial estate or in a specific area, offers potentially interesting prospects for closing cyclic processes, reducing transport and making efficient use of scarce space.**

Spatial concentration of agroproduction businesses with limited specialisations has been one of the causes of an accumulation of emissions, huge flows of transport and damage to the spatial quality of certain areas in the Netherlands. Sustainable solutions require that drastic changes are made in the spatial and operational structures of agribusiness. Concepts such as “industrial ecology” and “industrial symbiosis” could offer a useful and fundamentally different type of approach here. These concepts refer to geographical clusters of businesses which, through mutual collaboration, attempt to reduce their emissions, transports and spatial needs. When a symbiosis of predominantly agro-industrial activities, based on the principles of industrial ecology, is supplemented with non-agricultural activities it is called “an agroproduction park”. Developing agroproduction parks is a system innovation; after all, what it entails is a change of perspective (according to the concept of “industrial ecology”), an extended time horizon (10-20 years), an integrated and multi-level approach (regional, transcending sector boundaries) and collaboration between many stakeholders. The potential of agroproduction parks has been the reason to do the present quick scan, which is intended to specify this system innovation and to survey the initial reactions of stakeholders.

- 2. The system innovation of agroproduction parks allows for a great diversity of designs, varying from a concentration of intensive and footloose (agro)production functions at an industrial estate to a mixture of agricultural land use and other functions in a specific region.**

Agroproduction parks may include many different combinations of agrosectors and non-agrosectors. At present, the number of real initiatives including elements of the concept of agroproduction parks is limited. To illustrate the range available to the concept of agroproduction parks, four new designs were made. The aim was to identify various combinations of sectors and functions, positioned at various locations and varying strongly in character (from highly intensive at an industrial estate to extensive in a specific area) and size (from 30 ha to 30,000 ha). The result was the following series of designs:

1. Delta park: footloose intensive sectors including industrial processing at an industrial estate in an urban environment (port of Rotterdam).

2. Agrospecialty park: agricultural land use including industrial processing at an industrial estate in a harbour area with a rural hinterland (Eemshaven).
3. Green park: agricultural land use for breeding vegetables and cattle with concentrated industrial processing in a rural environment (Noordoostpolder).
4. Multipark: both footloose sectors and agricultural land use interwoven with other rural functions such as agrotourism (Gelderse Valley).

The first two parks were designed primarily from the perspective of finding the best sector combinations from a technological point of view, whereas the designs of the last two parks were based mainly on existing regional profiles. The designs may also be interesting venues to other locations than those referred to here, both at home and abroad. In workshops and interviews the designs were discussed with stakeholders.

3. Although stakeholders have an eye for the ecological and economic potential of agroproduction parks, they point out the risks of certain types of parks in terms of image, possibilities of spatial adjustment, administrative feasibility and their consequences for entrepreneurial freedom.

Stakeholders from trade and industry, government, social organisations and knowledge institutes generally showed great appreciation of the sample designs. They were thought to be inspiring and daring. The designs proved to be an excellent method to encourage the debate about future possibilities. Various stakeholders saw ecological and economic possibilities for agroproduction parks. Closing cyclic processes, reducing transport and utilising scarce space were thought to be particularly attractive. Also, several stakeholders pointed out the spatial-quality advantages of removing both poultry and pig farms and greenhouse horticulture from rural areas.

In addition, stakeholders also called attention to the possibility of social resistance. Their first point of concern involved the image of agroproduction parks. The large-scale and industry-like character of certain types of agroproduction parks might be met with an unfavourable response from citizens who still tend to see agribusiness as a predominantly craft-like branch of industry. A second point of concern for a number of stakeholders referred to the administrative feasibility of agroproduction parks and the possibilities of fitting them in with spatial planning. Extensive interventions in local spatial structures will be needed to realise agroproduction parks. This will require joint efforts made by several levels of administration, which in reality is often difficult to achieve. Thirdly, opposition might also develop among agrarian entrepreneurs if the necessary amount of close collaboration between highly diverse enterprises at the agroproduction park is seen by them as undermining their entrepreneurial freedom.

4. In view of both the potential of agroproduction parks and the possibility of social opposition it is necessary to follow a twofold strategy: firstly, to promote the debate about normative considerations and decisions in relation to agroproduction parks and, secondly, to encourage the development of agroproduction parks in interactive design trajectories.

As yet, the development of agroproduction parks has hardly begun. The same applies to opinion-building about this system innovation among stakeholders. The development of agroproduction parks touches on basic questions, with normative implications, about the future design of agribusiness. In this phase it is important to stimulate the debate about the issue between stakeholders and the public at large. Detailed designs can be of substantial help here. In addition, the future development of agroproduction parks should be promoted as well. In order to achieve an integration of varying social perspectives in the course of their future development it is essential that stakeholders from businesses, government bodies, social organisations and knowledge institutes are involved.

5. The Innovation Network and the Technology Assessment steering committee suggest that LNV takes the initiative in stimulating the debate between stakeholders (including citizens) and incorporating social values into the future development of agroproduction parks.

In view of both the complexity of the system innovation and the social purposes involved government should play a pro-active role. It is crucial for government to stimulate the social debate while at the same time creating possibilities for learning by doing, feasibility studies, pilots and knowledge development. The concept provides LNV, especially, with opportunities to give innovating impetus to the Dutch agrofood sector. It is suggested that LNV takes the lead by taking the following actions:

1. To initiate a social debate on normative considerations and decisions in relation to agroproduction parks. Considerations may refer to: the environment, health, well-being, nature, biodiversity, employment and related risk assessments and distribution issues.
2. To stimulate, in a joint effort with other ministries (EZ, VROM), the development of an "Agroproduction parks" innovation programme in which trade and industry, knowledge institutes, social organisations and government bodies participate. The programme should also include an analysis of factors that may contribute to the success or failure of agroproduction parks by having discussions with various stakeholders (including citizens).

1. Introduction

1.1. Industrial ecology and sustainable industrial estates

In the agrofood sector, the traditional advantages of geographical concentration (size of scale, infrastructure, knowledge) have resulted in a high density of unilaterally specialised farms in certain areas. This has been one of the main causes of regional accumulations of environmental pressures resulting from food production (Van Bruchem, 1997). In addition to emissions of minerals and biocides in high local concentrations, extensive flows of transport are needed to carry raw materials, finished and semi-finished products and waste material from one region to another (approx. 40% of all domestic transport movements by road are associated with the food column). Achieving sustainable solutions will require drastic changes in spatial and operational structures.

For companies to have sustainable development it is essential that it is seen as part of a larger economic ecosystem. This type of approach is usually called "industrial ecology". The concept refers to efforts made by individual businesses to reduce their environmental effects by seeking joint collaboration. It may also be called industrial symbiosis: a web of inputs, processes and waste. To achieve that symbiosis, a product chain, a material chain or a geographical area - or a combination of those - can be taken as a starting-point. An integrated approach within a region which houses entire production and consumption chains – or, at least, large parts of them – seems to have the best prospects here. After all, a product chain is typically characterised by symbiotic dependencies in which input/output relations are optimised. In addition, because of their physical closeness, product chains in confined geographical areas frequently are in a good position to jointly seek sustainable development. It requires drastic changes in operational and spatial structures. It will also be necessary to provide different mechanisms for settling accounts: whereas processes in individual businesses thus far have taken central position, the industrial-ecological approach will place more emphasis on the environmental performance of groups of businesses (Boons and Baas, 1999).

The concept of industrial ecology is underlying the development of "sustainable industrial estates", which was announced in the Cabinet memorandum on Environment and Economy (VROM/EZ/LNV/V&W, 1997). At large industrial estates such as the Moerdijk area, Europoort, the North Sea Canal and Eemshaven, steps have been taken even now to promote that existing enterprises jointly collaborate from a perspective of sustainable

development. Trade and industry tend to take the initiative here. Local and regional industrial estates take a bit longer to start up things. They frequently lack a strong initiator from trade and industry while government organisations or the Chamber of Commerce are the initiating parties (De Zoeten et al., 1998).

1.2. Agroproduction parks

Applying concepts from industrial ecology seems to offer starting-points for achieving a sustainable development in agro-industrial clusters. The emergence of new geographical clusters might be a contributing factor to close cyclic processes, to reduce transport distances and to make efficient use of scarce space. Also, geographical clustering might counteract the fragmentation of green space, thus contributing to improving spatial quality. The synergy between various sectors might also bring economic advantages. This purposive clustering of agroproduction functions in a confined area is called "an agroproduction park". Calling them agroproduction parks, however, certainly does not imply that combinations between agribusiness and non-agribusiness are excluded. The development of agroproduction parks meets the criteria of a system innovation (Rutten and Van Oosten, 1999): it involves a change of perspective (industrial ecology), an extended time horizon (10-20 years), an integrated and multi-level approach (regional, transcending sector boundaries) and collaboration between many stakeholders.

Reflections on a geographical clustering of agrofood companies based on environmental and spatial considerations recently received a number of fresh impulses. The NRLO made agroproduction parks an agenda item in a business plan called "Sustainable Food Supply Initiative" (Engelbart and De Wilt, 1998). In their advisory report on a "Strong and beautiful countryside" the VROM Council argued in favour of building agribusiness complexes where livestock breeding and horticulture were concentrated. As a result, stench and other types of environmental inconvenience could be reduced - a development that should be encouraged by government (VROM Council, 1999).

In "Space in the Netherlands", an introductory report to the Fifth Policy Document on Town and Country Planning (VROM, EZ, V&W and LNV, 1999), newly to be established businesses for intensive livestock breeding were located at specific agro-industrial estates: a concentration of pig farms and poultry farms at a limited number of locations. The document positioned most of these estates in existing concentration areas and, possibly, corridors. The LNV document on "Food and Green" (LNV, 2000) called it an option to build clusters of enterprises in order to reduce pressures on the rural area as a whole. In a recent study the Agricultural Economics Research Institute (LEI) pointed out the economic advantages if pig farms should join forces on an industrial estate (Van Heusden et al.,

2000). Several provincial authorities have been developing ideas that are tending towards a regional clustering of agrofood businesses, including Brabant/Limburg (Further Details Brabant and Limburg, NUBL) and Gelderland (Gelderse Valley). The agrofood sectors, too, show a growing awareness of the need make drastic changes in operational and sector structures that are motivated by environmental and animal health concerns. A reorganisation and reallocation of the pig-farming and greenhouse horticulture industries will act here as a major catalyst of change processes.

1.3. Potential social controversy

Several social controversies may ensue when specific industrial estates and regions are laid out as "agroproduction parks", depending on their specific interpretation of the concept. Controversies may be associated with: having difficulties to fit them in with spatial planning, their ousting other functions, ethical opposition against specific practices (e.g. using manure as feed) or a local aversion against certain types of food production (e.g. pig-farming in parts of Zeeland). The agricultural community, too, may have to overcome some barriers before participating in agroproduction parks, for example, when the willingness to collaborate with other entrepreneurs is not too great or when great cultural differences exist between sectors or regions of origin. It is important to have an overview of potential social controversies that may arise in connection with agroproduction parks and to take them into consideration when developing or making policy decisions about the system innovation.

All this has been the reason to do the present quick scan, which was started under NRLO flag and which was concluded by the Innovation Network Rural Areas and Agribusiness in joint collaboration with the LNV steering committee on Technology Assessment. The quick scan was designed to identify the potential possibilities and dilemmas in relation to agroproduction parks and to make suggestions about how the development of this system innovation can be put on the right track.

1.4. Quick scan approach

The quick scan was performed in three steps:

1. *A quick inventory of initiatives that can be categorised under the common denominator of "agroproduction parks".* The inventory was made in the months of November and December 1999 by approaching various stakeholders by telephone or by letter. The results are summarised in Appendix 1.

2. *Developing some technical and spatial details of agroproduction parks.* The first ideas for sample designs of agroproduction parks were formulated during a workshop on 13 January 2000. Next, in the period of March to May 2000, four sample designs were made: two by DLO (ATO, Alterra and IMAG) and two by TNO (MEP). For each individual design, the Consultancy for Physical Planning Policy, Development and Design (RBOI) made a three-dimensional representation. The full reports are represented in Appendices 2 through 5.
3. *An inventory of views held by - potential - stakeholders about the perspectives and controversial elements of the designs.* For this purpose, a workshop with stakeholders was organised on 20 June 2000. Additional opinions were collected by telephone and in writing. The workshop participants and interview respondents are listed in Appendix 6.

The present report provides an overview of main results and draws conclusions about further steps to be taken. In Chapter 2 the agroproduction park concept is illustrated and developed in more detail. Next, the chapter briefly discusses current initiatives and new sample designs. Chapter 3 provides a description of the four sample designs and the initial reactions of stakeholders regarding their potential possibilities and social dilemmas. The perspectives and dilemmas are summarised in Chapter 4. In Chapter 5, finally, suggestions are made to ensure that further developments in agroproduction parks are socially accepted. How to deal with the social dilemmas associated with this system innovation and what role should be played by government here?

2. Agroproduction parks

2.1. Definition

“Agroproduction parks” are a purposive clustering of production (including agroproduction) functions in a confined area, based on the concept of industrial ecology. “Purposive” here implies a deliberate change in existing clusters of enterprises, based on the principles of industrial ecology. For example, they may be intended to reduce the consumption and transportation of materials by having inter-sector exchange, to make a more efficient use of space or to achieve a more adequate adjustment to the landscape. “Agroproduction functions” not only involve primary production (animal breeding, arable farming, horticulture), they also include entire - food and non-food - production chains (including supply, processing and distribution). Furthermore, at an agroproduction park it is possible to exchange residual and waste products between agricultural and non-agricultural sectors, e.g. chemical, ceramic, power supply and oil sectors. The size of a “confined” region may vary from several tens to several tens of thousands of hectares. If exchange involves products that are easy to transport over longer distances (e.g. residual heat, CO₂) it may also be possible to establish links between cyclic processes of enterprises that are not nearby. This would be a special form of agroproduction parks, i.e. the virtual or network variety. Thus defined, the system innovation of agroproduction parks means a radical break with current practice, which is characterised by a fixation on producing within product chains. The concept of “agroproduction parks” responds to the specific production conditions of our country, utilising the advanced knowledge and technology levels of Dutch society. If, due to social or political-administrative barriers, certain types of agroproduction parks cannot be realised in the Netherlands although they can be realised in other countries, the concept might perhaps offer possibilities for selling the sophisticated knowledge potential of Dutch companies and knowledge institutes on the international market.

2.2. Current initiatives

Industrial ecology and, consequently, agroproduction parks are broadly defined concepts, which allows for a great diversity of interpretations. This has impeded the discussion about potential possibilities and dilemmas. It was a reason to begin making a rough inventory of current initiatives that could be categorised as “agroproduction parks”.

The actual number of initiatives containing elements of agroproduction parks appears to be limited (Appendix 1). Two development projects where trade and industry take the lead include:

- an agro-industrial complex near Dinteloord (Suiker Unie/Cosun and others)
- a new cluster of industrial activities concentrating on a biorefinery unit (Avebe and others).

Some additional projects exist where the authorities took the initiative, such as the project on Sustainable Land Use in the Winterswijk area and the project on Agrochains and Multipurpose Use of Space in North Limburg. Finally, foresight studies and research programmes were carried out, some of them commissioned by third parties, which focussed on how to cluster and link businesses from different sectors.

2.3. Sample designs

For the purposes of the present quick scan, i.e. to map out the perspectives and dilemmas associated with agroproduction parks, it was decided to make four sample designs with strongly varying qualities. This would make it easier to illustrate and discuss the concept in its full range. Also, the sample designs are practically without any vested interests, i.e. they are not charged with emotions from previous discussions. In order to make things more realistic, the designs were projected onto specific regions while stakeholders were involved in the discussions (including conservationist and environmentalist organisations, regional administrators and entrepreneurs). All the time it was explicated that the sample designs should not be seen as a blueprint for the areas involved, but rather were meant purely to make the agroproduction park concept a subject of discussion in order to get a better understanding of perspectives and dilemmas.

Agroproduction parks may be designed from two points of view. The first approach is to develop the best possible technological combinations of enterprises to exchange flows of waste material (for example, combining oil refining and greenhouse horticulture in order to utilise CO₂). In the second approach, regional conditions and development perspectives are taken as a starting-point to make clusters of functions; for example, a cluster of agrotourism and animal breeding in Gelderse Valley. The task assigned to the sample designers was to try and find an equilibrium between the two points of view: building the best technical combinations of functions, on the one hand, while connecting to pre-existing functions, infrastructure and dynamics in a specific area, on the other.

The quick scan applied the two points of view as follows: First, a technical design of a fruitful combination of activities and sectors was made, based on the principles of industrial ecology. Next, the design was fit in with spatial planning in a specific region,

supporting the specific qualities and dynamics of the area as much as possible. Stakeholders from the relevant areas were involved in the discussions about the social implications of the sample designs.

Agroproduction parks may have implicit ("virtual") or explicit structures. In cases of implicit structure, regional clustering of certain activities takes place without excluding any other activities as a matter of principle. In cases of explicit structure, it is a real park where maximum efforts are made to achieve profitable interactions - in both ecological, social and economic terms.

In designing the agroproduction parks, the aim was to get different combinations of sectors and functions, located in regions with distinct characteristics. This resulted in the following designs:

1. Delta park: footloose production, including industrial processing, in an urban environment (port of Rotterdam).
2. Agrospecialty park: agricultural land use including industrial processing in a harbour area (Eemshaven).
3. Green park: agricultural land use for breeding vegetables and cattle, including industrial processing, in a rural environment (Noordoostpolder).
4. Multipark: both footloose sectors and agricultural land use, interwoven with other rural functions such as agrotourism (Gelderse Valley).

The first two designs are dominated by the perspective of technological innovation, whereas the regional perspective is dominant in the latter two. The various designs might also be interesting venues to other locations than those referred to here, either at home or abroad.

Agroproduction parks as outlined above mainly consist of combinations of agrosectors, with occasional links to non-agrosectors. Processing primary raw materials is central to the designs, the Multipark being the exception. Their size varies between 30-100 ha (Delta park) to approximately 30,000 ha (Green park). They have both food and non-food products, including several advanced applications (e.g. fine chemicals, biocomposites, sustainable energy and organic fertilisers). Collaboration between relevant parties is institutionalised in all cases, although its form varies depending on the nature of the park involved.

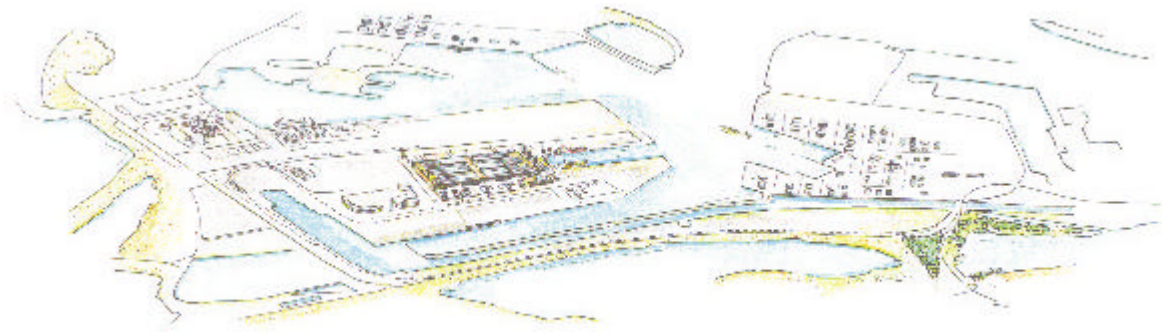
The parks are spread over three of the four areas that are distinguished in the LNV document on Food and Green (LNV, 2000): the circle of cities in the centre of the country (Delta park), the open space in the north (Agrospecialty park and Green park) and the multipurpose shell (Multipark). The function of the designs may be to pour space into the

fourth area: the central and open space that is surrounded by strongly urbanised areas. Indeed, space will be created here as a result of concentrating activities at agroproduction parks in other areas.

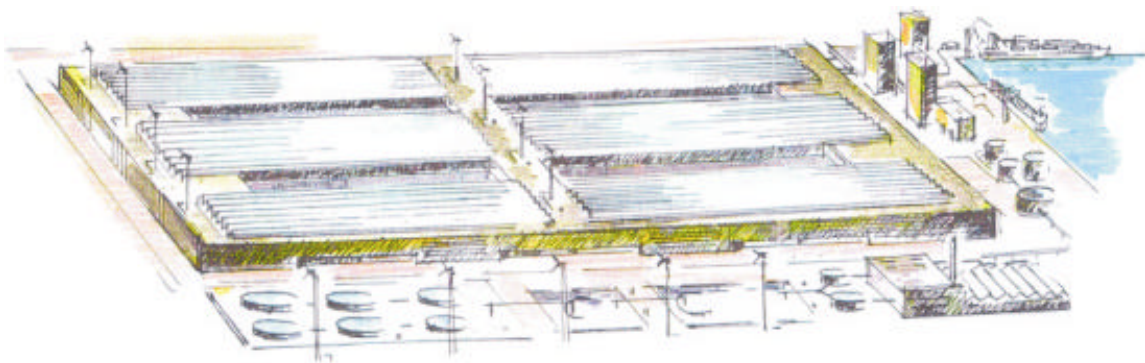
As was shown above, the “agroproduction park” concept allows for many interpretations, varying from a – physical - concentration of intensive production functions (including agroproduction) in an area the size of a normal industrial estate (e.g. Delta park and Agrospecialty park) to a mixture of agricultural land use and other functions, for example agrotourism (e.g. Multipark and Green park), in a certain area. The sample designs outlined here are specifically meant to make agroproduction parks more tangible, thus making it possible to discuss their potential possibilities and dilemmas. They are not blueprints.

The sample designs were discussed with individuals from circles of conservationist, environmentalist and consumer organisations, animal protectionists, regional administrators, national government, the processing industry and primary producers. The objective was not to make an exhaustive analysis of viewpoints and forces, but rather to take stock of the issues that might crop up in case of a future realisation of agroproduction parks. In agreement with this, the exercise did not seek to elicit official, organisational points of view. As the concept of agroproduction parks still is in an early phase, it is only recently that relevant organisations have begun to form their opinions, if at all. Those who expressed their opinions did so purely while speaking as private persons, drawing from their knowledge of - and commitment to - specific social perspectives. The authors of the report are completely responsible for the interpretation of those opinions. Since several stakeholders expressed their opinions on each individual perspective it is not possible to reduce opinions to specific individuals or organisations. The perspectives of nature and the environment, primary production and regional administration were discussed in relation to all four designs; the remaining perspectives (consumers, animal health and welfare, national government and processing industry) were surveyed only insofar as the nature of the design gave reason to do so.

The following pages provide an outline of main characteristics of the four sample designs. The designs are described and visualised in more detail in Appendices 2 to 5. Each design is followed by a representation of the more essential points expressed by stakeholders.



Bird's-eye view of Delta park



3. Sample designs and initial reactions

3.1. Delta park¹

3.1.1. Picture

Design principles

At the Delta park, intensive and footloose agricultural production has found sustainable ways for an integration with chemical industry, on a seaport near a densely populated area. The principles of industrial ecology are realised by exchanging fertilisers, organic waste, methane, CO₂ and heat between the various sectors. The seaport is important with a view to supplying energy and animal feed. The population centre is the market, which can be supplied with fresh daily products without any logistic difficulties. Making effective use of costly space is achieved by stacking various activities.

The park provides in the following functions: greenhouse horticulture and other types of indoor cultivation, protein production (pigs, poultry, fish and insects), slaughterhouses, meat processing, waste sorting and upgrading, finishing products, biorefinery, the production of organic fertilisers, support activities such as packaging and storage. The exchange between sectors has its high-tech basis in ICT and biotechnology. Chain directors enforce collaboration between separate units. In this example, the Delta park (varying between 30 and 100 ha) is situated in the Rotterdam harbour area.

Spatial interpretation

The location of the Rotterdam harbour area, immediately bordering on the water, makes it possible to ship in raw materials for animal feed (soya groats) directly while at the same time shipping out by-products (dung recycled into high-grade fertilisers, of a quality similar to artificial fertilisers). This part of the harbour also accommodates other, large blocks of buildings, including storage tanks and a power station. Other possible locations include the big inland ports of the Trans-European Inland Terminals (Venlo, Born, Valburg) and Wageningen.

Stacks of plant and animal breeding businesses (fish, pigs, chicken and horticulture) are found in an oblong building with open inner spaces (patios) to let in sufficient amounts of light, air and outdoor space. Along the patios are outdoor spaces (terraces) to make it

¹ For a more detailed description, see Appendix 2.

possible for the animals to go outdoors. Fish farms are on the bottom floors, partly underground; above them are a few floors of pigs and poultry. The upper floors consist of horticulture, their constructions adjusted to their need for light: no light whatever in the case of chicory or mushrooms, whereas roof levels can be filled with vegetable and fruit cultures. The building is over one kilometre long, about 400 metres wide and over 20 metres high.

3.1.2. Initial reactions

The perspective of nature and the environment

- The Delta park seems to offer several interesting perspectives to nature and the environment. What is especially attractive is the possibility of removing pig farms and greenhouse horticulture from rural areas in order to concentrate those activities. Pig farming and greenhouse horticulture are industrial activities, which no longer belong in rural areas.
- Claims still have to find solid ground. This is true both of claims in terms of nature, environment and scenery and of those referring to animal welfare. Thus, it is not clear whether problems may be displaced, for example between environmental themes or between regions, and how much of them may be involved. A life-cycle analysis (LCA) will be needed to survey all the elements of the production process.
- Furthermore, image problems among consumers may be a hindrance. As for now, what seems to offer better prospects is to develop types of biological pig farming and greenhouse horticulture which can sell their manure - and rotate their crops - close by. It is desirable to develop the Delta park in more detail with a view to possible long-term perspectives.

The perspective of primary production

- It is a daring design, which is not practical yet, although it has great long-term potential. It opens up new perspectives for agribusiness in the Netherlands.
- Having production within a closed environment does not contribute to the intended transparency of food supply.
- It will not be necessary in the future to locate the park at a port: the intensive livestock industry increasingly uses flows of domestic residuals, growing less dependent on cattle feed ingredients being shipped in through "the Rotterdam gap". As a result, the design can be applied on a broader level.
- The added value of products is not really clear yet. Does the Delta park supply only existing products or does it also supply new products? Where can high-quality processing and retail business be found?

The perspective of regional administration

- The Delta park does not agree with current policies regarding the establishment of harbour installations. Under the policies in force, a business of this type would not be allowed to be established in the port of Rotterdam. It does not have a harbour function.
- Certain functions associated with the Delta park, such as the supply of cattle feed ingredients or transshipment, do belong in a harbour area.

The perspective of national government

- An area between 30 and 100 ha for an entire Delta park is quite small, if it is thought that a new greenhouse horticulture area of some 750 ha in Zeeland is currently being considered.
- In the past, dung exportation appeared to be an illusion. Will it be more successful when high-quality fertilisers from the Delta park are involved?

The consumer perspective

- It is a progressive idea to concentrate activities in order to increase efficiency and to reduce environmental pressures. It agrees with the need to have industrial activities that are socially justified.
- It is difficult to explain to consumers that it is animal-friendly to stack animals in an apartment house for pigs. The same goes for battery cages.
- Consumers have romantic ideas of food production; food is believed to be produced in traditional ways, although it has now grown into a full-scale industry. The Delta park is the next step on this road. Consumers will not be very sympathetic. Information campaigns are now in preparation to make consumers more aware that today's food - production is an industrial activity. As for now, however, consumers are not ready to accept a Delta park.

The animal health and welfare perspective

- Keeping large numbers of animals within a highly artificial environment entails risks to the health and welfare of the animals. Much depends on the management: with good care, it may also be possible to keep animals in intensive systems without getting too many health or welfare problems. However, those systems are not yet available.
- Animal health and welfare are served best by extensive types of cattle farming within a natural environment. Large-scale and intensive systems such as the Delta park are less welcome.



Bird's-eye view of Agrospecialty park

3.2. Agrospecialty park²

3.2.1. Picture

Design principles

The Agrospecialty park is a functional combination of agro-industrial establishments for high-grade processing of agricultural products. Agrarian raw produce is supplied in bulk and is then made into a whole range of high-quality food and non-food products (including fine chemical applications, paper and biocomposites).

The main raw material used in this example is sugar beet. Since high-grade industrial processing is located at the Eemshaven on a parcel of 100-150 ha, the bulk material can be supplied both from the surrounding agrarian area and from other regions. To have an optimal, all-year-round exploitation, other inputs are used as well, including potatoes, wheat, flax, chicory, hemp and soya. Storage of inputs takes place in large sheds, whereas half-finished and end products are stored in compartmentalised sheds. The Agrospecialty park consists of a combination of three independent industrial establishments: a sugar factory, an alcohol plant and a biorefinery. The companies have made far-reaching mutual agreements on a preferential, albeit non-exclusive, partnership for supplying products and services.

Spatial interpretation

The spatial design is based on a close relationship between park (processing industries) and hinterland (rural area). The farms assume responsibility for part of the processing, for example the initial treatment of products in their most perishable phase. As a result, the volume of industrial buildings on farms will increase. The harbour-bound industrial estate will accommodate a conglomerate of different plants to manufacture the various products.

3.2.2. Initial reactions

The perspective of nature and the environment

- The park seems to have environmental advantages. It is an interesting idea to use beet as a component of various products of biological origin.
- Still, the environmental and economic aspects of the diversification strategy will have to be quantified in more detail. Beet monoculture does not provide opportunities for crop rotation, which is potentially dangerous to the environment.

² For a more detailed description, see Appendix 3.

The processing perspective

- It is desirable to develop Agrospecialty parks or networks. The seasonal quality of sugar beet lifting now leads to making inefficient use of processing plants.
- In itself, the biorefinery principle is a good starting-point. However, it must have the flexibility to process all kinds of different flows all year round: not only residuals from other agro-industries, but also raw materials that are produced specifically for the biorefinery, such as grass or special, genetically modified crops (for example, beet and potatoes) as the compounds of fine agrochemicals. One of the advantages of the complex is that flows are rather easy to control and certify.
- On a rapidly changing market, both for raw agroproduce and agroproducts, it is very risky to set up a complex like this. Flexibility in the area of raw materials, the exploitation of installations and products is highly important. That does not make it any easier to choose between plants or applications.
- Supplying low-grade bulk products is an expensive business. It is often better to transport intermediate products rather than raw materials. Perhaps this is why a complex is not the right starting-point; rather, it may be better to consider the possibility of a network along cheap transport routes (e.g. water) to ensure that each step in the chain can be realised at its most profitable location.
- The main question remains whether companies can be found that are able and willing to give the first impetus here. The great diversity of raw material that is needed and the great diversity of different products make things extremely complicated. A joint venture between one or more processing plants and clients would succumb to complexity. The big money is found in selling applications rather than in processing flows of organic material. Also, few businesses exist that might be able to cover the entire chain. How to bring together partners who will share everything alike?

The perspective of primary production

- A location by the harbour is a strategic choice. Raw produce is still supplied by the rural hinterland now (the arable areas in Groningen and Drente), but this may change in the future when EU subsidies cease and world trade is increasingly liberalised. In that case it may be possible to ship in raw materials from elsewhere through the port. Seen in this perspective, the Agrospecialty park should not focus primarily on local supplies from the hinterland, but rather should try to hook up to international flows of raw material. On the other hand, locations exist even now where flows of raw material meet. The latter is the case in the Dinteloord area, where Suiker Unie/Cosun took the initiative to build an agro-industrial complex.
- It is a highly vulnerable design because it is based on the principle of having three processing plants collaborating on a voluntary basis. What happens if one of the plants cancels the partnership? Examples from the motorcar industry have made it clear that a

strong initiator is needed. The beet industry might play that role here. Perhaps other initiators may be possible here as well (e.g. DSM, AKZO). And what is the perspective for primary producers? Do they have financial bonds with processing companies? Will farmers conclude contracts on an individual basis or as a cooperative? Farmers are not used to thinking and acting in terms of chains.

The perspective of regional administration

- The design agrees with the 2000-2003 strategic plan, which mentions a large agrification area to the south of the Eemshaven.
- The processing unit suits well with the Eemshaven area. Even now, many activities are taking place here that are closely related to agribusiness, logistics and transshipment.
- The activities outlined in the design could signify a major economic impulse to the area.



Bird's-eye view of Green park

3.3. Green park³

3.3.1. Picture

Design principles

This agroproduction park combines sustainable exploitation of an agrarian area of several hundreds of square kilometres with industrial processing units to realise high added value. Its clustering of production and processing activities leads to a reduction in the transport of raw materials and semi-finished products.

Its production consists of fibre crops, protein and starch crops, flowerbulb farming, grass and clover and extensive animal breeding. Several products are grown simultaneously on each plot in order to reduce the risk of diseases associated with monoculture. The aim of the processing industry is to extract high-grade components and to exploit low-grade components by applying separation technology, sorting residual waste, making organic manure and generating power. A knowledge institute maintains relations with the park, developing new applications and processing methods for the park's end products (semi-manufacture) to generate products with high added value. The Green park is owned by a limited liability company. Its shareholders are producers and consumers. The park, which for illustration purposes is situated in the Noordoostpolder, covers approximately 30,000 ha.

Spatial interpretation

The design is situated in a vast agrarian area in the expansive polder landscape of the Noordoostpolder. Similar locations in the Netherlands are found in Groningen and Zeeland.

The division of land in the polder is completely transformed. The roadways and waterways are the only pattern that is maintained. The new land division consists of narrow and elongated parcels with several crops which may change according to the season. It makes for a highly variegated landscape. Farm buildings have disappeared. The farm workers live in the villages. The only buildings in the agrarian area are a few scattered sheds housing the equipment of agricultural maintenance companies (similar to current contractor businesses). Processing industry and energy production are located in a well-developed area which, being right at the centre of the polder, borders on the industrial estate of Emmeloord.

³ For a more detailed description, see Appendix 4.

3.3.2. Initial reactions

The perspective of nature and the environment

- The park's agricultural land use is good for the environment. Still, the land should remain in the hands of the farmers. A significant factor to promote sustainable production is that farmers feel committed to the production methods, the products and the area.
- The park's chances of success seem small as agrification is not a real option in view of current high land prices in the Netherlands.

The perspective of primary production

- The top-down approach by spatial planning, showing a lack of respect for the cultural history and value of existing landscape, is not conducive to achieving a broad base of support among farmers.
- The design strongly limits free entrepreneurship. This is a very sensitive issue.

The perspective of regional administration

- The design provides for a drastic reorganisation of practically the entire Noordoostpolder. Right now, however, there is not any economic or social need to make that intervention. The structure of the industry is sufficiently sound. Expansion occurs because large businesses are buying up smaller ones.
- The Noordoostpolder has been nominated as a Belvédère area of great scenic value. Plans resulting in changes in the landscape (e.g. the Green park) are met with great restraint.
- Entrepreneurs who have healthy farms will not exchange their land for shares.

The perspective of national government

- The locations that are suitable for Green parks (i.e. Noordoostpolder, Groningen and Zeeland) are not very attractive when seen from the perspectives of biodiversity or scenic and tourist value. The government does not want to invest in those areas.
- According to the design, farmers have to join or else sell their land. Their loss of autonomy will be very important to many farmers. In reality it will prove impossible to create an unbroken area of 30,000 ha to have a Green park. What will emerge is a patchwork of farms which do and farms which do not wish to join.
- The processing industry of the Green park is totally dependent on buying products from its immediate surroundings. It makes the design vulnerable, for example when raw materials can be produced cheaper in Eastern Europe.



Bird's-eye view of Multipark

3.4. Multipark⁴

3.4.1. Picture

Design principles

The essence of a Multipark is that the quality of the rural area is dramatically increased by interweaving agrarian production functions with other social functions such as forestry, recreation and housing. In this design, intensive stock farming is practised on a large scale while being strongly concentrated. It has ceased to be the dominant economic pillar or the main characteristic of the rural area.

The Multipark combines the following activities: intensive stock farming (pigs, poultry), extensive stock farming (cattle, horses), vegetable production (arable farming, mushrooms), forestry (production forest, recreational forest), blueberry cultivation, energy production (biomass from wood, poultry manure and waste produce from arable farming and horticulture), recreation (agrotourism) and housing. They are functions that can be combined within a confined area because new technological applications have reduced the smells of intensive stock farming to levels that can be neglected. A regional partnership of entrepreneurs and government takes control of the innovation process. Its possible location is thought to be an area of approx. 100 km² or 10,000 hectare in Achterhoek, Peel or Gelderse Valley. In the present example, the park is situated in the development area of Gelderse Valley.

Spatial interpretation

The intention of the Multipark philosophy is to create a multipurpose rural area, especially in areas which are now fully dominated by a few functions. The spatial representation of a Multipark covering part of Gelderse Valley is based on the assumption that intensive stock farming in this area is preserved, although it must be newly organised. Several zones are distinguished within the design.

In the northern part, a coherent green structure of a series of country estates (connecting to the country estates in the Utrecht part of Gelderse Valley) is combined with forestry, blueberry cultivation and recreational activities. This green zone is to fulfil a major ecological role as a connecting zone. Intensive stock farming in this zone is gradually dismantled. In the central area, intensive stock farming is maintained, being concentrated around pre-existing, large businesses. A manure processing plant is found in the middle of the area. In the southern zone, where many houses have been built already, a green residential area will be developed which has a planting design that is a continuation of the landscape structure. In this area intensive stock farming is dismantled as well.

⁴ For a more detailed description, see Appendix 5.

3.4.2. Initial reactions

The perspective of nature and the environment

- Seen from a conservationist and environmentalist point of view, the model is not innovative enough. The presented outline of large-scale energy production by using manure and crops should be questioned in the light of current land and power prices in the Netherlands.

The perspective of primary production

- The design makes an attempt to break the antagonism between farmers and citizens. What it tries to achieve is that citizens develop closer relations with farming. This is a positive thing. Still, the possibilities to visit large, intensive stock farms are limited, e.g. due to health hazards. Extensive stock farming (meat, milk and cheese) offer better opportunities for closing the gap between farmers and citizens.
- In this design, large-scale intensive stock farms are concentrated within a specific area. This will require farms to move. The question is whether farmers who must relocate their business will not prefer to establish themselves in other parts of the Netherlands, or even abroad, rather than opting for a location in Gelderse Valley.

The perspective of regional administration

- What is positive is the ambition to strengthen spatial quality. The idea of an extensive clustering of intensive stock farming combined with other functions is inspiring. Yet, the question is whether large-scale intensive stock farming suits the area.
- Tourism is likely to be the most important future motor of the area (agrotourism, residential recreation and daytrips). Biological agriculture, extensive stock farming and part-time farming lend themselves better to a combination with those functions than does intensive stock farming.
- This transformation may be accompanied by a high outflow of labour from agriculture. With current employment conditions it will be relatively easy for other sectors of the Dutch economy to absorb this potential.

The animal health and welfare perspective

- Large-scale and intensive stock farming is less desirable in terms of animal health and welfare.

4. Perspectives and dilemmas

The development and realisation of agroproduction parks involves discontinuities in many areas, with considerable social implications. Stakeholder reactions to the sample designs described in the previous chapter present a differentiated picture, their differences depending on perspective and sample design. Yet, several leitmotifs can be distinguished.

The “agroproduction park” concept appears to inspire many. Stakeholders generally find the designs refreshing, progressive and a boost to discussion. They stir up energy and hold beckoning prospects for certain stakeholders. What is particularly appreciated is the potential of agroproduction parks to reduce environmental pressures, to curb flows of transport and to make effective use of scarce space. Concentrating intensive business activities such as poultry farming, pig farming and greenhouse horticulture at industrial estates is seen as an opportunity to improve the spatial quality of rural areas. The economic potential of agroproduction parks is perceived as well. The foundations and quantifications of its ecological and economic potential need to be developed in more detail.

The present quick scan focussed particularly on possibilities of social opposition and controversy. Stakeholder reactions presented three areas where social dilemmas and aversions may arise:

Image

The agroproduction park concept generally leads to larger, more industrial types of production and processing, concentrated in specific regions. Occasionally, it will be possible to have a blending with other functions in the rural area (e.g. the Multipark), although a more frequent outcome will be that intensive and footloose production is moved from rural areas to large industrial estates (e.g. the Delta park). Such large-scale units do not lend themselves to having an open interaction with the public. As a result, the gap separating citizens and consumers from food production will grow. Moreover, the artificial production environment may give rise to concerns – rightly or wrongly – about the welfare of animals or about plant and animal health.

Spatial-planning agreement and administrative feasibility

Agroproduction parks do not develop automatically – in spite of their outlined potential. They require large-scale and inevitable interventions in local structures. The latter frequently are at odds with municipal zoning schemes or provincial regional planning. Often, a restrictive policy is pursued with regard to rural areas. Activities that may bring

dramatic changes in the quality of the landscape will meet with resistance. Restrictions apply even in a typically agrarian area such as the Noordoostpolder, in this case because of its aspiration to be recognised as a Belvédère area. Realising the spatial and legal conditions for establishing agroproduction parks therefore requires local administrators to show vision and courage. Adequate cooperation between various administrative levels will be a necessity. In reality, this often appears to be a bottleneck. Local administrators should take part in the development of agroproduction parks as full partners from the very first phase of generating ideas.

Freedom of enterprise

In order to create – operational - agroproduction parks it is essential that a dominant actor takes central control. It may be a chain party (e.g. a processing industry, as in the case of an Agrospecialty park) or a local party (e.g. Suiker Unie/Cosun at the Dinteloord agro-industrial complex). Closing cyclic processes, making efficient use of available space as well as logistic and other on-site provisions require close collaboration both between enterprises themselves and between enterprises and – local - authorities. As a result, mutual dependencies will increase, which may be perceived by farmers and growers as a limitation to their freedom of enterprise. This will apply even stronger when they have ceased to own their lands (Green park) or when they are employees employed by a consortium (Delta park).

Apart from their potential and the possibilities of social opposition, the following factors were mentioned as relevant to a successful or failing development of agroproduction parks:

1. *Initiators*: a clearly defined initiator – or group of initiators – is needed to bring a design to realisation;
2. *Organisation*: the individual interests of stakeholders do not automatically coincide with the collective interest of the consortium. Thus, a careful construction of the consortium and clear agreements about mutual collaboration and organisation are essential;
3. *Path*: without exception, the development and realisation of the designs makes it necessary to have a well-controlled development course or phased planning in which various actors take a number of steps simultaneously. By dividing the trajectory into intermediate steps it will be easier to control and guide the process as a whole (go/no go decisions);
4. *Government*: government should play a pro-active role in developing agroproduction parks, actively stimulating and creating necessary preconditions. Although traditional policies (rules) may be able to remove barriers, they will not be sufficient to make the outlined designs a reality.

5. From design to realisation

5.1. Debate as well as innovation

The development of agroproduction parks has hardly begun. The same applies to stakeholders forming their opinions about the system innovation. The designs described in this report concern fundamental issues that have normative implications for the future design of the agrosector in the Netherlands. They involve decisions that may affect the environment, public health, welfare, nature, biodiversity, natural quality, the use of space, employment and their associated risk assessments and distribution issues.

In this stage it is important to encourage the social debate about agroproduction parks among stakeholders (including citizens). Specific designs have been shown to be excellent means to promote a discussion both with parties that have a direct interest and with the public at large.

Furthermore, it is important to promote that agroproduction parks are developed in more detail, also in view of the theoretical potential of the concept. Developing agroproduction parks requires intensive and mutual collaboration between those parties that have a direct interest. Thus, all the critical success factors mentioned in the previous chapter refer to achieving some form of synergy between parties: the availability of an initiator from trade and industry, a carefully built consortium to take an initiating role, adequate process control and pro-active government. The social debate, by starting from a social perspective, will contribute to gaining a better understanding of a number of critical success factors which should be taken into account when agroproduction parks are being designed or actually realised.

5.2. Stakeholder roles

It is essential to an integration of different social perspectives that stakeholders from trade and industry, government, social organisations and knowledge institutes are actively involved in the development of agroproduction parks. Stakeholders each have their individual roles to play.

Government

Government constitutes a crucial factor in the development of agroproduction parks, partly to watch over social values, partly as a central actor in spatial planning and legislation. In order to encourage the debate and to create favourable conditions for developing agroproduction parks it is advisable that government takes the following actions:

1. To stimulate the social debate about normative assumptions, considerations and decisions regarding the agribusiness in the Netherlands. In addition to the parties that are directly involved, citizens and social organisations should be involved as well.
2. To promote that several government levels define a joint view on the advisability of agroproduction parks and the role government should play in developing them. All too often, entrepreneurs are confronted with ambiguous and inconsistent views presented by different authorities.
3. To translate this view unambiguously into spatial policy and legislation. It is government who sets the tasks in cases of large-scale spatial interventions, e.g. agroproduction parks. A comparison with the reconstruction areas for pig farming and greenhouse horticulture is forcing itself.
4. To facilitate the development of agroproduction parks through pilots, demos and scientific knowledge development. Identify dominant supporters of agroproduction park development and encourage that new clusters of enterprises are created. Being government, do not take the place of entrepreneurs. In case of interregional initiatives (across national borders) the EU may play a stimulating role.

Governments at various levels (municipalities, provincial authorities, water boards, national government, interregions, EU) are advised to participate.

Enterprises

An agroproduction park is a partnership of enterprises one of which acts as “primus inter pares”, giving directions. An illustration of this is the creation of an agro-industrial complex near Dinteloord, where Suiker Unie/Cosun is the initiator. Another example is that a new cluster of enterprises is created around a biorefinery for grass, which is being initiated by Avebe. A major condition for developing agroproduction parks is that enterprises are available for playing the initiator role. Thus, it is up to trade and industry to take the initiative. What it demands from the enterprises involved is that they take an active attitude:

1. Initiate or participate in exploratory studies into the potential of the agroproduction park concept for your company and identify potentially interesting partners.
2. Build networks together with other companies outside your product chain, based on the possibilities for combining cyclic processes, joint exploitation of facilities and other synergetic effects.

Knowledge institutes

What is characteristic of agroproduction parks is that they demonstrate a great deal of technological, administrative and organisational innovation. Knowledge institutes have an outstanding capacity for developing these innovative concepts - in interaction with stakeholders. A major challenge here is to achieve an integration of technological, spatial and administrative-organisational perspectives. Knowledge from the domains of technology, town and country planning and social and public administration should be effectively combined to be successful. It will make high demands on the network, in relation to both other knowledge institutes and stakeholders. The following actions must be taken by knowledge institutes:

1. Find strong initiators in trade and industry and engage them – and other stakeholders – in developing new concepts.
2. Build interdisciplinary and transdisciplinary partnerships with researchers and stakeholders, aimed at developing specific designs of agroproduction parks that are an integration of technological, spatial and administrative-organisational knowledge.

Social organisations

Environmentalist, conservationist, consumer and animal rights organisations have shown themselves critically constructive regarding the agroproduction park concept. Representing specific social points of view, their contributions will help to find an interpretation of agroproduction parks that can stand the test of social criticism. They also play an important role in informing the public at large. The development of agroproduction parks is aided by the following actions:

1. Active participation in developing agroproduction parks.
2. Communicating with the rank and file about the subject.

5.3. Actions to be taken by LNV

In view of the complexity of the system innovation and the social objectives involved it is desirable that government plays a stimulating role. It is crucial that government promotes the social debate on agroproduction parks while at the same time creating opportunities for “learning by doing”, feasibility studies, pilots and knowledge development. To LNV, particularly, the system innovation is an opportunity to give an innovative impetus to the agrofood sector. It is suggested that LNV takes the lead.

The following actions are needed:

1. To initiate a social debate on normative decisions and choices regarding agroproduction parks. This may refer to weighing the pros and cons of decisions involving the environment, health, welfare, nature, biodiversity and employment and their related risk assessments and distribution issues.
2. To stimulate in a joint effort with other ministries (EZ, VROM) the development of an "Agroproduction parks" innovation programme in which trade and industry, knowledge institutes, social organisations and government participate. The programme will also include an analysis of the factors that may determine the success or failure of agroproduction parks by organising discussions with various stakeholders (including citizens).

To facilitate those processes it is possible to call on the assistance of intermediary organisations, e.g. the Innovation Network Rural Areas and Agribusiness.

The two courses of action, i.e. debate and innovation, do not alter the fact that politicians and government will have to make decisions about the future design of agribusiness in the Netherlands. What is not yet clear is how they should do this and how, for example, they should weigh the opposition expressed by interested parties and society at large – if any. Whatever the case may be, the action suggestions provide the necessary input for making those decisions.

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Appendix 1:

Current initiatives

This appendix presents the harvest of an inventory of activities in the Netherlands which contain elements of “agroproduction parks”. The aim of the inventory – which was certainly not exhaustive - was to get an overall impression of ideas and stakeholders. This overview describes the state of affairs on 1 January 2000.

Dinteloord Agro-Industrial Complex

Principle: A sustainable combination of various industrial activities around a sugar factory, including a coarse-ceramic industry, a company producing sandlime brick, a pectin extraction plant, a solid state fermentation unit, a system for growing algae, a business producing power from biomass and a water company. Their goal is to increase competitiveness through symbiosis and innovation. Process integration across plants and an efficient organisation of the estate may lead to considerable reductions in environmental pressures.

Stage: In 1998, at the initiative of Suiker Unie/Cosun, a Masterplan was made by over twenty organisations from the industrial community, government and knowledge institutes. Preparations are now made to have it realised.

Stakeholders: They include: Suiker Unie/Cosun, Noord-Brabant Province, Chamber of Commerce, Delft University of Technology, PNEM Energy Systems, Polder Board, Deloitte & Touche Milieu, the Energy 2050 Consultancy, municipality of Steenberg, Dutch Protestant Farmers' Association (NCB), ATO, Netherlands Energy Research Foundation (ECN), Amsterdam University, Boudewijn Brickworks.

Biorefinery for grass

Principle: An industrial process is applied to transform the constituent parts of grass into compounds for various applications. For example, its proteins can be used as nutrients for animals with a single stomach (including man: meat substitutes), the sugars as a fermentation ingredient for alcohol that is fit for human consumption and the fibres for making paper, cardboard, isolation material, compost or green fuel. The grass components are exploited with considerably greater efficiency than in current dairy farming. An entirely new cluster of businesses will emerge around this processing application.

Stage: Right now, the technological concept has been developed in great detail as part of a research project. The project is shortlisted for the annual Environmental Awards for the

Industry, which are conferred by VROM. The concept is expected to be applied on an industrial scale within a few years' time.

Stakeholders: Avebe, NEDALCO, Mommersteeg International, Plant Research International, dairy farming, arable farming, pig farming, paper industry, electricity companies.

Stable-greenhouse complexes in agroparks

Principle: Waste flows are recycled by establishing links between pig farming, greenhouse horticulture, dairy farming, aquaculture and power stations. Examples include: untreated pig urine can be used to grow high-protein algae; the water component of purified pig urine can be used to sprinkle land; the potassium, phosphate, magnesium and lithium found in pig manure can be converted into fertilisers; methane that is released when fermenting manure can be converted into heat and electricity; hot air from the pigsty, which is rich in carbon dioxide, is led into the greenhouse; organic waste from the greenhouse is treated to make pig feed or it is fermented into biogas; waste from the cowshed may also be fermented while salt waste water from the greenhouse is suitable for growing seafish.

Stage: Parts of the technical concept have been tested; the construction of the first stable-greenhouse complex is in preparation.

Stakeholders: V.d. Wijngaart's Engineering, IMAG, pig farmers, dairy farmers and horticultural farms.

Sustainable land use

Principle: Combining functions on a single piece of land provides opportunities for closing the cycles of compounds and for meeting strict and functional environmental standards. Organic residuals, which may be the result of agrarian, natural or recreational functions, can be exploited as animal feed. In addition to meat, animals may also provide energy and high-quality fertilisers, etc.

Stage: The DTO project on Sustainable Land Use has developed ideas in more detail, both in general and for a specific region, i.e. the Winterswijk area. Several activities are taking place now in this region, including research, development and demonstration projects.

Stakeholders: A partnership of authorities, businesses and interest groups.

Agrochains and multipurpose use of space

Principle: North Limburg, particularly the Venlo area, is a major junction in the Brabant-Limburg town series. The idea here is to switch from trade port to brain port. The problems faced by pig farming have been one of the reasons to explore the possibilities of an agroproduction park in the Venlo area. The idea is to combine pig farming with greenhouse horticulture, breweries and power companies. The project is part of the North

Limburg Region Dialogue programme. Participants include Rabobank, LLTB, Limburg Province, the North Limburg District, Recron Limburg, several municipalities, Chamber of Commerce and Alterra.

Stage: Report available as sheet presentation.

Stakeholders: Alterra, Arcadis, DLG.

Compact Valleys/Building regional chains and networks

Principle: Increasing ICT, specialisation and differentiation give rise to new partnerships between businesses and services within regions. As a result of compact production, spatial pressures and transport needs are reduced. Favourable environmental conditions arise out of an interdependency between production and improved recycling. Compact Valleys in urban areas fulfil a bridging function between town and countryside, making it possible to serve consumers more adequately. New crystallisation points will develop, e.g. the manufacturing industry around Eindhoven. Sometimes developments may come to a standstill, as is the case with the accumulation of problems in dairy farming in sandy areas. The main question is how to attract commercial activities around the crystallisation points by exploiting the appealing strength of a region or the advantages of having mutually close operations. The theme provides a set of instruments for supporting the actors involved.

In this context, existing crystallisation points of agro-industrial activities are used to increase the synergy between agrosectors and industrial sectors in order to create win-win situations. Another possibility is to run down old functions while at the same time creating new ones. Three types of “valleys” are distinguished (see table below).

	Urban Valleys	Silicon Valleys	Bio Valleys
Characteristic	Market-bound	Knowledge-bound	Source-bound
Area	Urban area	Sandy area	North
Production chain/ Network	Processing and distribution	Combining intensive stock-farming functions	Combining functions with producing raw materials
Impact	Serving consumers	Economic impulse	Employment
Preconditions	Access, spatial pressures	Environment	Spatial quality
Logistics	Efficient consumer response	Transport	ERP systems

Stage: The theme has been approved by the KLICT board; execution is in preparation.

Stakeholders: KLICT, LNV, EZ, provincial authorities, businesses, knowledge institutes.

Mixed-farming systems (A.P. Minderhoudhoeve)

Principle: The main objective of this systems study is to develop sustainable mixed-farming systems by closing cyclic processes. One farm of 135 ha seeks to achieve this by using “the best technological means” while another farm applies “the best ecological means”.

The latter farming system has an additional objective, i.e. to be independent of external input. Both systems combine arable crops with growing vegetables and dairy and sheep farming. In the near future, pig farming and, later, perhaps poultry farming may become part of these operational systems. The designs are based on calculations with computerised models and the results are a constant feedback for making adjustments.

Stage: Implementation of research programme since 1994.

Stakeholders: C.T. de Wit Graduate School for Production Ecology (LUW), Wageningen Institute of Animal Sciences (LUW), Plant Research International.

Combining specialised businesses in a region

Principle: Elaborating on the principles of the systems study at the A.P. Minderhoudhoeve, it is conceivable to have an extension of scale, i.e. to encompass regional collaboration between specialised businesses from different sectors. LUW and the Louis Bolk Institute together concluded a survey to examine the amount of collaboration between "tied businesses", both in biological and in traditional agriculture, in Noord-Holland and in the centre of the country, respectively. Tied businesses are enterprises from different sectors which exchange matter between them in order to close cyclic processes. The study particularly examined collaboration between arable and dairy farms. Exchange is much more common in biological agriculture than it is in traditional agriculture. Due to recent manure legislation it has also become a necessity for traditional agriculture.

Stage: Inventory has been made.

Stakeholders: Laboratory of Genetics (LUW), Louis Bolk Institute.

Technology in and from rural areas

Principle: Exploiting synergy possibilities between chains in a region to find structural solutions to environmental problems. It involves optimising a network of chains within a region rather than optimising links within a single chain. Whereas traditionally the market and the socio-economic and technological possibilities were taken as the main focus for optimising chains, the present research project will also take into account the effects on spatial planning and the environment. Thus, a methodology will be applied which, transcending discipline boundaries, will be based on regional-economic, agrarian, chain-competent, logistic, technological and administrative disciplines. Making multipurpose use of space also implies a combination of functions, including water collection, conservation, recreation, food production and local treatment.

Stage: Developing ideas for the purpose of research programming.

Stakeholders: ATO, LNV.

Small-scale technology: both a vital countryside and a vital industry

Principle: Upgrading local raw materials by using new technology that is applied on a small scale. To achieve this, new and vital, regional and compact industrial production units must be created. In practice, what it implies is that part of the treatment is decentralised, being performed in the immediate vicinity of primary production. This is called "distributed production". The advantages of the concept include: logistic savings; quality control at the beginning of the chain; local flows of waste can be treated locally; economic activity in the countryside is encouraged.

Stage: Developing ideas for the purpose of research programming.

Stakeholders: ATO, LNV.

Foresight study: broader functions for agriculture

Principle: An IMAG foresight study to explore the possibilities of assigning broader functions to agriculture (Eerkens, 1999) focussed on both agricultural land use and footloose types of agriculture and horticulture combined with conservation. As the author stated, having centrally managed organisations, e.g. multinationals, makes it easier to create symbiosis between various activities, especially when their aim is to make a more efficient use of waste flows. By analogy, different divisions are envisaged, e.g. stock farming, open farming, greenhouse horticulture and arboriculture, in addition to a special division, "culture and the environment", which may exploit nature for biodiversity and recreational purposes. Technological expectations are high for concepts such as precision agriculture, pig apartment houses and round greenhouses.

Stage: Developing ideas. It is suggested to make various designs and to test their feasibility.

Stakeholders: LEI, DLV Advisory Group, PAV, ATO and Alterra are mentioned as potential partners.

Foresight study: the desirability of intensive stock farming at industrial estates

Principle: In the document called "Space in the Netherlands", new establishments for intensive stock farming are allocated to special industrial estates: very high concentrations of pig and poultry farms at a limited number of locations. According to the document, the estates are localised mainly in existing concentration areas, possibly in corridors. However, LNV has thus far failed to define a final position on the matter. Consequently, the initial foresight study has surveyed the pros and cons both of decentralising or having separate intensive stock farms in rural areas (present situation) and of concentrating them at industrial estates.

Stage: Concept is ready and has been discussed in consultations between LNV directors.

Stakeholders: Alterra, Department of Agriculture (LNV).

Selecting locations for agroproduction parks for farms

Principle: By using a geographical information system containing identifying details of every stable, shed and sty in the Netherlands, the possibilities were examined to achieve even now - i.e. without moving any farms - a local concentration of pig farms that might function as an industrial estate. Hardly any possibilities appeared to exist when the current distribution of farms was taken as a starting-point. LEI is elaborating on this, under the authority of Brabant and Limburg provinces.

Stage: Completed by Alterra. Still in progress at LEI.

Stakeholder: Alterra.

Myth and legend in pig farming

Principle: As a follow-up to "Myth and legend in pig farming" several innovation paths were initiated, mostly starting from environmental issues. The paths frequently begin with manure processing and result in networks of innovations in chains. For example, one of the developed systems was designed to supply greenhouse horticulture with pig manure. The process diagram of the system refers to an entire region, thus demanding impulses from spatial planning.

Stage: In progress.

Stakeholders: Alterra, ATO, (IMAG).

Integrated conversion

Principle: The technological system consists of a combination of two elements: (1) primary production by means of precision agriculture and (2) a (bio)refinery for processing and treating agrarian crops to produce semi-finished products or composite end products. A (bio)refinery is a production unit for separating, refining and processing primary agricultural base products. Every region can have its own type of (bio)refinery, which is adjusted to specific processing methods and specific base materials.

Stage: The concept is described by DTO. An experimental biorefinery with a capacity of 10,000 tons is currently operational in Denmark. An illustration in the Netherlands is a biorefinery for grass (Avebe a.o.).

Appendix 2:

Delta park: a harbour-related agroproduction park

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P.J.A.M. Smeets, J.K.M. te Boekhorst (Alterra)

J.H.M. Metz, P.W.G. Groot Koerkamp (IMAG)

Spatial design: T. van Oosten-Snoek and N. Dielemans (RBOI)

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 - 7.3. Size and arrangement of functions
 - 7.4. Mutual adjustment of functions
8. Challenges and solutions

1. Introduction

Due to a geographical concentration of limited activities and their resulting environmental problems and transport flows, today's organisation of the agroproduction column in the Netherlands is faced with increasing resistance. In addition, its organisation is also inadequately adjusted to a growing need for flexibility. Prolonged continuation of its current design will not be sustainable.

Wageningen UR has focussed a great deal of its efforts on finding integrated solutions to achieve a sustainable development of agricultural production in the densely populated north-western parts of Europe. Issues of major relevance to these efforts include:

- the environment: reducing emissions and utilising flows of residuals;
- plant and animal welfare;
- use of space;
- organising a base of support among citizens and consumers;
- consumer-controlled development.

These ambitions are aimed at finding sustainable methods to maintain agricultural production in the delta metropolis, i.e. ways that are acceptable to society in economic, environmental and welfare terms.

Three research institutes (i.e. ATO, Alterra and IMAG of Wageningen UR) have taken a joint initiative to develop those ambitions into sustainable perspectives of agricultural production in our densely populated habitat.

Parallel to these developments, the National Council for Agricultural Research (recently followed by the Innovation Network Rural Areas and Agribusiness) and the LNV steering committee on Technology Assessment are doing a quick scan on agroproduction parks. For some time ATO, Alterra and IMAG have synchronised their initiative to the quick scan; the sample design presented here is seen by the institutes as an intermediate result of the initiative.

The crucial point in the sample design presented here is that a large park is set up which, through its size of scale and its local combination of activities, can generate a sufficient amount of critical mass to be an ecologically strong and economically sound entity. The sample design has elaborated a combination of new ideas which are intended to raise several topics of discussion. The authors of this text have had the explicit intention of presenting this combination of ideas; in principle, however, any topic can be brought up for discussion.

2. Delta park

Spatial concentration of agricultural enterprises with limited specialisations has been one of the main reasons for an accumulation of environmental problems. This is caused partly by high local emissions of substances that increase environmental pressures, partly also by the fact that they generate considerable flows of transport. The Delta park provides in a regional clustering of different sectors while at the same time building a sufficient amount of critical mass. These factors are the driving forces behind technological and organisational breakthroughs to find sustainable ways of reducing problems from an ecological and economic perspective.

In order to generate fresh opportunities for agricultural production in a densely populated area, a sample design is presented here which provides sustainable ways to integrate agrarian production with chemical industry on a seaport near a population concentration. Thus, transport flows for carrying – semi-finished – products can be minimised, flows of residuals can be exploited on an economically sound basis and emissions can be controlled more effectively.

The aim of the Delta park is to maintain agrarian production in sustainable ways in our densely populated habitat while being aware of the environment, animal welfare, technological developments and competitiveness. The Delta park is a so-called agroproduction park which – especially by matching agrarian and industrial activities – is able to gain combined economic and environmental advantages. Managing and using information is central to the Delta park; modern information technology will make it possible to adjust its range of processes to the means supplied.

Delta park in brief

Function	footloose production of high-quality, safe and fresh food
Products	fresh meat and fish fresh vegetables
Motor	chain directors
Space	30 to 100 ha
Opportunities	utilising space transport reduction exploiting flows of residuals ecological and animal-friendly connecting to social context critical mass for knowledge- and capital-intensive developments
+ / –	+ adequate protection possible + quality can be managed + flexibility through control – (too) competitive with current agrosector

3. The function of a Delta park

The central focus of the Delta park is on the footloose production of high-quality, safe and fresh food. In addition, the Delta park also supplies a number of by-products, including eggs, cattle feed and high-grade fertilisers.

Production efforts at the Delta park are aimed at supplying the consumers in its densely populated, surrounding area. Its location is near a population centre (1) to be close to the market without running into great logistic difficulties, and (2) to be able to tap the labour market. In order to fulfil its main function, the Delta park must provide in at least the following functions:

- greenhouse horticulture;
- protein production;
- separating and reprocessing waste material;
- product finishing;
- refinery or other chemical industrial activity.

In this design, its seaport function is of great importance to facilitate the supply of energy and cattle feed compounds to supplement waste from greenhouse horticulture.

To facilitate adequate control of the park's environmental efficiency, it has an information management system to describe its flows of energy, minerals, carbohydrates and proteins. The system is connected to specific systems measuring plant and animal conditions, feed composition and administration, manure and other products, and to systems registering product flows between businesses. Available information is also used to inform consumers.

4. Opportunities and threats

The Delta park combines relatively high investment costs with low operational costs. Its ambitious set-up and combination of functions generate a great critical mass for new developments which, due to a high fragmentation of interests in the past, appeared impossible to achieve either for economic or technological reasons. Major developments include:

- combining different activities, resulting in effective use of space;
- maintaining high animal welfare levels, allowing them much room to move (resulting in clean behaviour, e.g. pigs);
- reduction of transport and logistic problems;
- transport of animals is no longer needed;
- exploitation of residual flows;

- controlled flows of minerals, energy and proteins;
- product safety can be controlled;
- concentrated critical mass for sustainable and knowledge-intensive developments;
- responding to social preferences: ecological and animal-friendly.

In sum: combining ecological production with high animal welfare levels, new technological developments and competitiveness, aimed at sustainable agricultural production in a densely populated habitat.

Potential threats and barriers are expected to occur in attracting necessary investments and in having the park accepted by the agrosector and by society at large:

- The investments needed are not expected to be insurmountable barriers in view of international agribusiness developments and the ambitions of some of the big - meat - chain directors in the Netherlands.
- Social acceptance need not be problematic if lay-out and practical operations allow for the fact that, essentially, the rationale of the park is precisely its response to the social context. If the park should deviate from this, it will be ultimately unable to compete with – foreign – businesses that produce in less animal-friendly ways.
- The agricultural sector may experience the Delta park as a threat, especially in the beginning. Practically, however, it will function as a breeding-ground for new developments which may be implemented throughout the sector. Consequently, it will reduce a number of existing inadequacies of the sector while supporting Dutch agriculture in its international competition.

5. Activities at the Delta park

The Delta park combines:⁵

- protein production: pigs, poultry, fish and insects;
- slaughterhouses, meat processing;
- greenhouse horticulture and other types of indoor cultivation;
- waste separation;
- production of organic fertilisers, including anaerobic fermentation (generating methane as a major by-product, which can make the park mostly self-supporting in terms of energy);
- cattle feed production;
- importation of soya groats and cereals;
- chemical industry (including refinery);

⁵ The combination and mutual adjustment of activities presented here is meant to illustrate the concept. Thorough studies will be needed to achieve the best possible arrangements.

- support activities such as storage, packaging, etc.

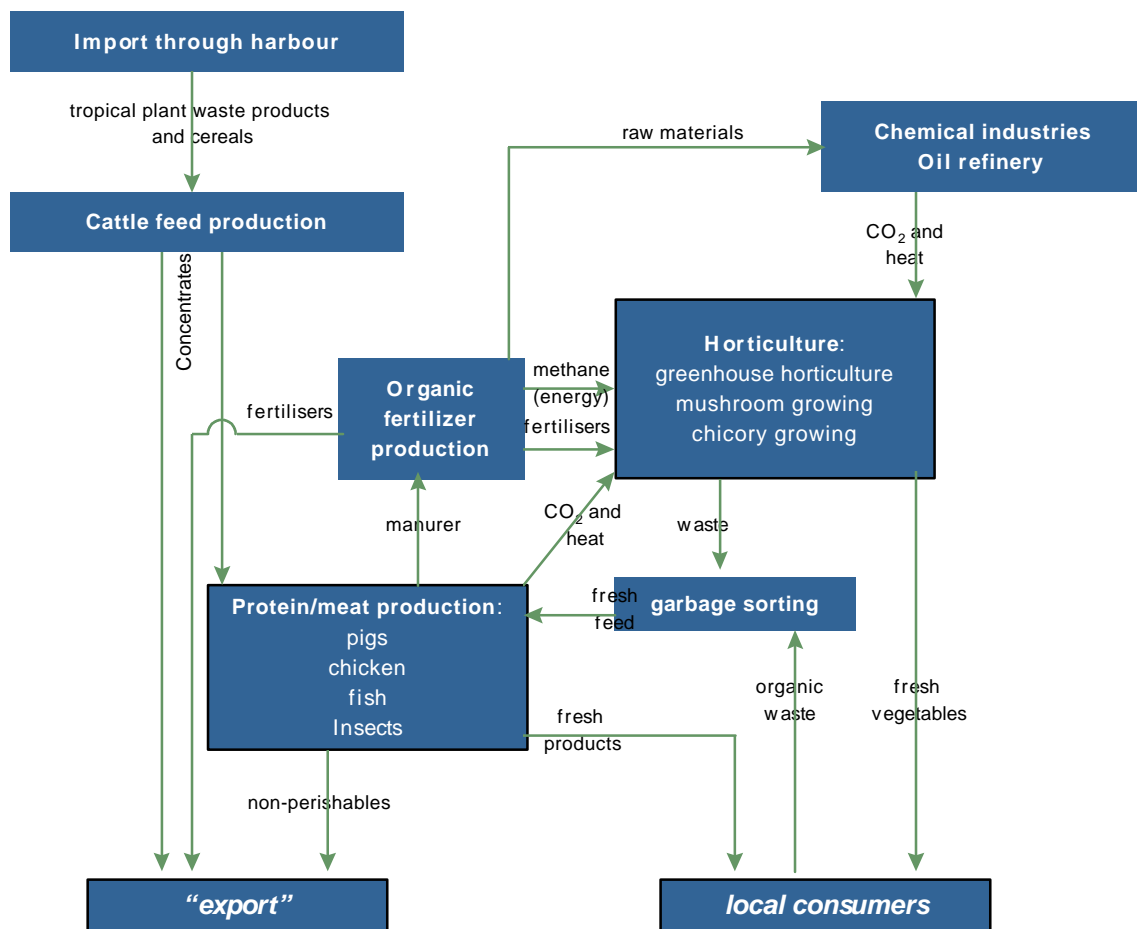


Figure 2.1: Activities and product flows at a Delta park

Some major considerations underlying this combination include:

- Pigs are not critical in terms of feed and they effectively convert the biomass of waste into meat.
- Basically, the harbour area is an ideal location for keeping laying hens. Feed compounds are shipped in and only high-grade products (i.e. eggs) are transported further inland. Thus, transports of voluminous quantities of feed and manure by land are avoided.
- For similar reasons, cattle feed production will produce more feed than is needed at the Delta park.
- Manure is converted into high-grade fertilisers. Undesired chemicals are eliminated and mineral compositions are adjusted to specific applications. As a result, fertilisers are produced whose quality can compete with chemical manure. Since the capacity of the horticultural unit is too small to use all the compost, part of the fertilisers will be shipped out.

6. Organisation

The organisation of the park should be well adjusted to the social context, resulting in both maximum consumer acceptance and favourable competitiveness with - foreign -rivals. In view of the attitudes prevailing in society today, this will imply that animal welfare and ecological aspects are handled with care.

It is of central importance to the organisation of the Delta park that there is control of information about, for example, product flows and production knowledge. This will make it possible to control a great variety of – delegated - activities.

Each activity is carried out in a number of more or less independent units. For example, the pig stock may be spread among some ten individual businesses. For chicken and salmon, the total number of separate businesses will be somewhat less. Greenhouse culture will be distributed among approximately 10 units. Since spaces are constructed in a modular fashion, they are highly versatile, enabling units to respond swiftly to changing market needs.

Major parties who have an interest in maintaining agricultural production in the Netherlands include farmers and consumers. However, since they have great and scattered interests, they are not in a position in the present situation to force the construction of a park like this.

At present, several parties who are active in the areas of cattle feed production and meat processing are taking increasingly stronger positions in terms of chain control. These chain directors have a great interest in sustaining – or, preferably, extending - the market position of Dutch agroproduction so the Delta park – with its controlled and consumer-adjusted production –fits in perfectly with that picture. Consequently, a single chain director or a group of chain directors can be the driving force par excellence at the park.

7. Delta park in focus

The high-tech industry at the Delta park outlined above should find its expression in a high-tech design. As a result, the estate may also be attractive to interested parties, being a showpiece of the efforts made in the Netherlands to use production methods that are harmless both to man and the environment. Not only the architecture of buildings is involved, it is also the lay-out of the estate that should make an up-to-date appearance. Combining an effective use of valuable land with a large ground area per animal is realised by stacking activities (see also Figure 2.2.).

The park consists of a central unit for animal and vegetable production. Along the edges of the Delta park several terraces have been made: opportunities for leaving the building which can be used every day at some part of the day by all pigs. In addition, support facilities are also located on the edge, including cattle feed production and storage, waste separation and fertiliser production.

Supply of cattle-feed compounds and removal of minerals take place by ship, which requires the proximity of a terminal. Fresh products for the target group (i.e. shops) are conveyed by lorry. An arterial road for cargo transport is planned at the harbour side of the park.

7.1. Location

For the Delta park it was tried to find a location where relevant goods were produced and shipped in, on the one hand, while large population concentrations were available in its immediate surroundings, on the other hand. In the Netherlands, the Rotterdam harbour area is the most obvious area to meet those location requirements.

The parts of the harbour area which are closest to the city (population concentration), however, do not have any room left. Therefore, a part of the harbour area was selected (i.e. the most western part) which still had some room available – at least, until recently. It was decided to have a location within the harbour area that was bordering immediately on the water, making it possible to ship in cattle-feed compounds (soya groats) and to ship out by-products (manure converted into granulated fertilisers) direct.

This part of the harbour has enormous blocks of buildings, such as storage tanks and a power station.

Other locations where similar developments may be possible include the big inland ports of the Trans-European Inland Terminals (Venlo, Born, Valburg) and Wageningen.

7.2. Design

The problem of stacking nurseries and breeding farms (fish, pigs, chicken and horticulture) was solved by creating an oblong building with open inner spaces (patios) to let in sufficient amounts of light, air and outdoor space. Along the patios are outdoor spaces (terraces) to make it possible for the animals to go outdoors. The design of the building is completely animal-friendly. The fish farms are on the bottom floors, partly underground; above them are a few floors of pigs and poultry. The upper floors consist of horticulture, their constructions adjusted to their need for light: no light whatever in the case of chicory or mushrooms, whereas roof levels can be filled with vegetable and fruit cultures.

The measures of the building are as follows: it is over one kilometre long, about 400 metres wide and over 20 metres high. The totality of the building is organised in such a way that it has what may be called “a clean side” and “a dirty side”. What is found at the

“clean” side is the input of cattle feed and the output of clean products such as packed meats from the butchery and cut and packed vegetables from the vegetable-cutting department. At the “dirty” side, manure treatment and energy extraction from waste products take place. This is also the side where wind turbines are placed. Its measures are so large that the building, because of its size, stands out even in this industrial environment.

7.3. Size and arrangement of functions

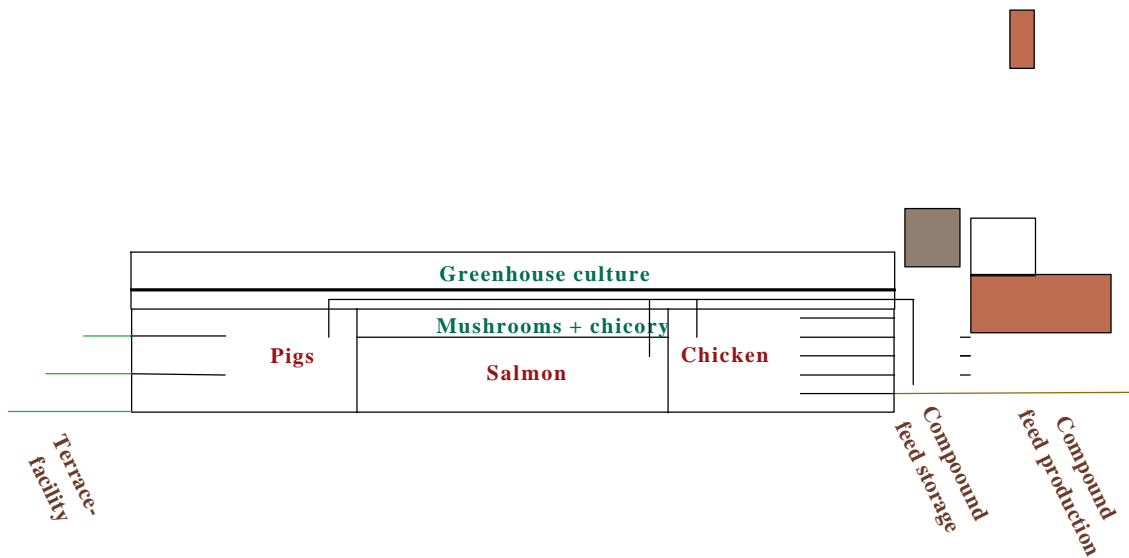


Figure 2.2.: Vertical cross-section of a Delta park
(the areas of different functions are not to scale)

Depending on financial resources available and on the shape desired, the Delta park will cover an area between 30 and 100 ha. Its various functions are distributed over the area as follows:

Protein production

Meat production will define the size of the park. Considering the high cost prices of land in the area in view, the building will have several floors. The livestock is expected to have the following size:

- Pigs: 300,000 beds. This number is needed to satisfy the needs of the local population (about 1 million people). An area of 1.5 to 2 m² is allocated per pig (very generous compared with current situation, sufficient for pigs to be clean). Three floors will be available, their net height (including floorings) being 2.5 m. Thus, the total surface area of pig production will amount to approximately 20 ha.
- Laying hens: in order to meet the demand for fresh eggs made by a population of 1 million people, the complex will allocate space for about a quarter million layers.

Having 10 chicken per m², this will require a net surface area of 25,000 m². By dividing it into 6 floors, the net result will be that a net surface area of 0.5 ha is used. This may be increased when there is a sufficient demand for eggs from outside the population referred to here.

- Table chicken: space will be earmarked for accommodating 1 million table chicken. Net surface area: 2 ha.
- Salmon: 0.5 ha is earmarked for this growing market. Since a lot of weight is involved here, salmon is planned to be bred at the bottom floor only. On the floors immediately above, horticultural products are grown that can do without light (mushrooms and chicory).

The modular arrangement will make it easy to have future adjustments between spaces used by various activities. The agropark (i.e. the central unit) will cover a total surface area of about 25 ha.

Vegetable production

Vegetable production is placed above protein production. Its total surface is about 25 ha. As this is not enough to fulfil the needs of the total hinterland population, production will be limited to fast-growing and perishable products (e.g. leaved vegetables).

Production will take place on several storeys (± 4). Storey height is 2.5 m. The upper storey will have sunlight directly from outside. Glass bricks will be used to have sufficient amounts of light on lower storeys. If necessary, it may be possible to transport light to the park over greater distances by applying light conductors (e.g. provided by 3M).

Room for support facilities

- A space of at least 2.5 m high is kept open between the protein production layer and greenhouse horticulture. It is meant for transport systems (e.g. supplying cattle feed, transporting heat and CO₂-rich air from pig and chicken spaces to the greenhouse, leading products outside). This layer may also accommodate a number of product-finishing operations (including slaughterhouses, vegetable processing, packaging, etc.).
- Vegetable processing facilities (washing, cutting, packing) and slaughterhouses for pigs and chicken are placed at the layer for infrastructure facilities.
- Cattle-feed production and storage: borders on the agropark, placed at the harbour side.
- Supply of tropical products as cattle feed compounds: harbour transshipment facility close to cattle feed production.
- Waste separation and fertiliser production: along the edge of the central unit.
- Other industrial production (refinery and, possibly, other chemical industry: CO₂ and heat supply): leaving existing industry where it is. The Delta park is placed close by so a simple pipe system may suffice.

7.4. Mutual adjustment of functions

The combination of animal and vegetable production is used to achieve that there is a minimum squandering of useful flows (e.g. waste). Most concrete flows involve the heat and manure of the pig unit. This can be illustrated as follows:

For linking pigsties to greenhouses, a logical ratio would be to have 2.8 ha of greenhouse to each 4,800 butcher's pigs. Such a pairing will lead to the following annual savings:

1. in energy: 32,500 GJ (mainly heat savings and 50 tons of methane extracted from manure)
2. in reduced emissions of hothouse gasses: 1,700 tons of CO₂ and 50 tons of methane.

Major links at the Delta park involve:

- CO₂ and heat.

Hot air produced in the pigsties is transported into the greenhouses - following purification, if necessary – in order to exploit its heat and relatively high CO₂ levels to stimulate plant growth. The heat and CO₂ levels of the suggested amount of pig stock will be more than sufficient to meet the demands of greenhouse horticulture (net 100 ha). Thus, based on the illustration presented above, the suggested surface area for greenhouse horticulture will make it possible to achieve annual energy savings of 600,000 GJ.

- Manure and minerals, energy extraction.

Pig manure consists of water for more than 90%. Separating solid and fluid fractions generates two useful flows of raw materials.

The viscous fraction is fermented to extract methane for energy production (light and electricity). When an adequate technological design is applied, the Delta park can be self-supporting in terms of energy.

Purifying the thin liquid fraction will produce drinking water and minerals (nitrogen, nitrate, potassium, phosphate, etc.): fertilisers needed by greenhouse horticulture. By separating them like this, the fertilisers can be administered in optimum dosages.

Any surplus production by the park is shipped out as high-grade export fertilisers.

8. Challenges and solutions

In order to realise a park with the qualities described above, several new developments will be needed:

- To create an environment that promotes plant and animal welfare.

One of the demands that can be met at the park is that animals have enough room to move. In addition, the environment must be adjusted to animal needs. For example, some terrace space for daily outdoor ventures must be included. Studies will be made to examine climate control for plants and animals.

To break the monotony, some type of socio-management is considered:

- ◊ combining different animal species (e.g. flycatchers with pigs or adding a few pot-bellied pigs to each group of pigs);
 - ◊ keeping pig families together.
- To develop park design and implementation procedures.
It was observed earlier that chain managers are the driving forces of the park. To make implementation successful it is essential to have an open debate with society at large. In addition, it is very important for the park to be carefully embedded into its environment in order to be sustainable.
Since many different activities of the park must be mutually adjusted, a gradually growing system is not the best option conceivable; at most, the park may grow in a few steps. Even at the initial design, its maximum size must be taken into account (for example, for selecting a location that provides sufficient growth opportunities while having maximum capacity for support functions).
 - To realise general ambitions.
Research is needed to find the technological means for realising the ecological and other aspirations as described. Also, the information management must be adequately organised and applied.

Figure 2.5 Bird's-eye view of Deltapark



Detail agrocomplex

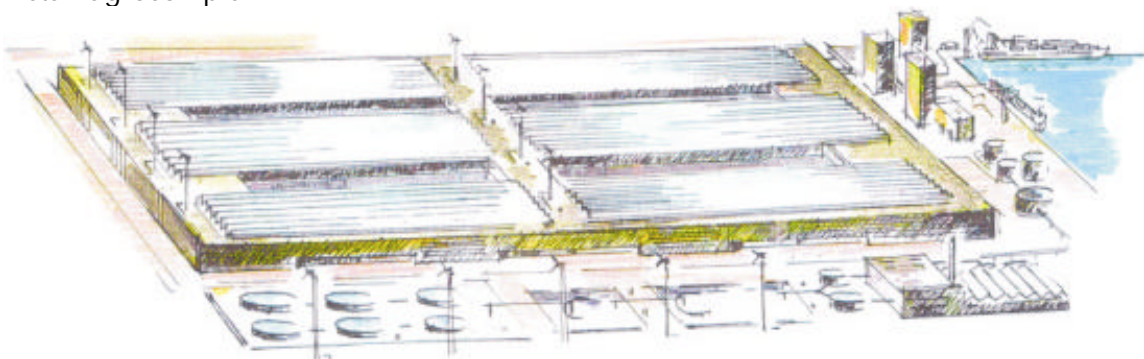




Figure 2.3 Rotterdam harbour area: current situation

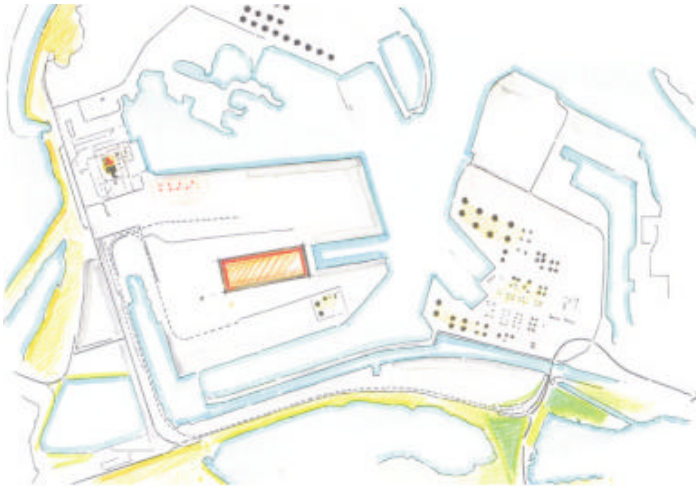


Figure 2.4 Rotterdam harbour area: new situation with Delta park

Appendix 3:

Agrospecialty park: Combined processing of agrospecialties

R.A.P.M. Weterings, J.W. Ekelenkamp (TNO-MEP)

Spatial design: T. van Oosten-Snoek and N. Dielemans (RBOI)

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1. Introduction
2. Relevant trends in agribusiness
3. The Agrospecialty park described
 - 3.1. Innovativeness
 - 3.2. Location selection and current situation
 - 3.3. Design: spatial characteristics
 - 3.4. Organisation and operational structure
 - 3.5. Employment
 - 3.6. Transport and logistics
4. Future potential and barriers

1. Introduction

The National Council for Agricultural Research (recently followed by the Innovation Network Rural Areas and Agribusiness) and the LNV steering committee on Technology Assessment were doing a quick scan on production - including agroproduction - parks. Their aim was to explore the possibilities of the concept in more detail and to make an overview of those elements that might lead to social or political controversy. As part of the quick scan, TNO was asked to make two sample designs of production - including agroproduction - parks. The Agrospecialty park presented here is one of them. The design is meant to provide a basis for discussion. It is based on an analysis of trends in agribusiness; in developing the design, the main focus was on the innovativeness and desirability of the design as compared to current practice. Obviously, before the design can be really developed, its technological and economic feasibility must be studied in more detail.

2. Relevant trends in agribusiness

Agribusiness is in a state of great flux. Due to strong developments such as market globalisation, increasing political pressures on agricultural subsidies and consumers who want agroproducts to meet increasingly higher quality standards, big changes are taking place in the sector. Our basic assumption when selecting sample designs was that they must be in keeping with developments that are expected to occur during the next few decades. Thus, the sample design also presents a picture of the future.

A brief scan of the available literature yielded two clusters of developments in agribusiness that offered good clues for developing future scenarios.

Firstly, the social significance of agribusiness in our society has been changing. Whereas agroproduction was long considered to be a predominantly economic activity, the past ten years have made it clear that agrosector development not only involves economic values. The focus of attention has been broadened to include a variety of value domains: economic values, ecological values, social values, cultural values and ethics, spatial values.⁶

Secondly, the place of agroproduction and agroproducts in our society has been changing. Traditionally, the main task of the agrosector was to ensure an efficient supply of - first-quality and cheap - food products and ornamental plants. Strategic foresight studies made

⁶ Knowledge and innovation priorities: Agribusiness. Aspirations for the 21st century, 1998. NRLO report no. 98/20E.

in the context of the Sustainable Technology Development programme have drawn the attention to the possibilities of using biomass as feedstock for chemical industry (bulk and niches) and power supply.⁷ Thus, the Agrospecialty park sample design presented here was aimed at achieving the combined processing of a single - bulk - agroproduct. The essential idea is that it is technically possible – and even, at first glance, economically attractive – to make a high-grade and combined use of raw produce. In current practice, however, it is done hardly at all.

3. The Agrospecialty park described

The aim of the Agrospecialty park is to realise a high-grade, combined processing of agricultural products that are produced in bulk. In our country, potatoes, sugar beet, grass and oats are examples of agroproducts that lend themselves to combined processing at the Agrospecialty park. The design presented here has opted for sugar beet.

The essence of an Agrospecialty park is represented in Figure 3.1. The core of the design is a local concentration of three conversion steps:

- converting beet into sugar at the sugar factory;
- converting beet pulp and tops into a wide variety of feed and non-food products at the biorefinery;
- converting molasses into alcohol.

As Figure 3.1. shows, primary production (in this case: beet growing) is not covered by the Agrospecialty park design. The beet is delivered at the park including tops, so treatment in the fields is reduced to a minimum: beet and tops are harvested mechanically.

⁷ DTO Sleutels Chemie en Voeden (Keys to Chemical Industry and Food). Sustainable Technology Development Programme, 1998.

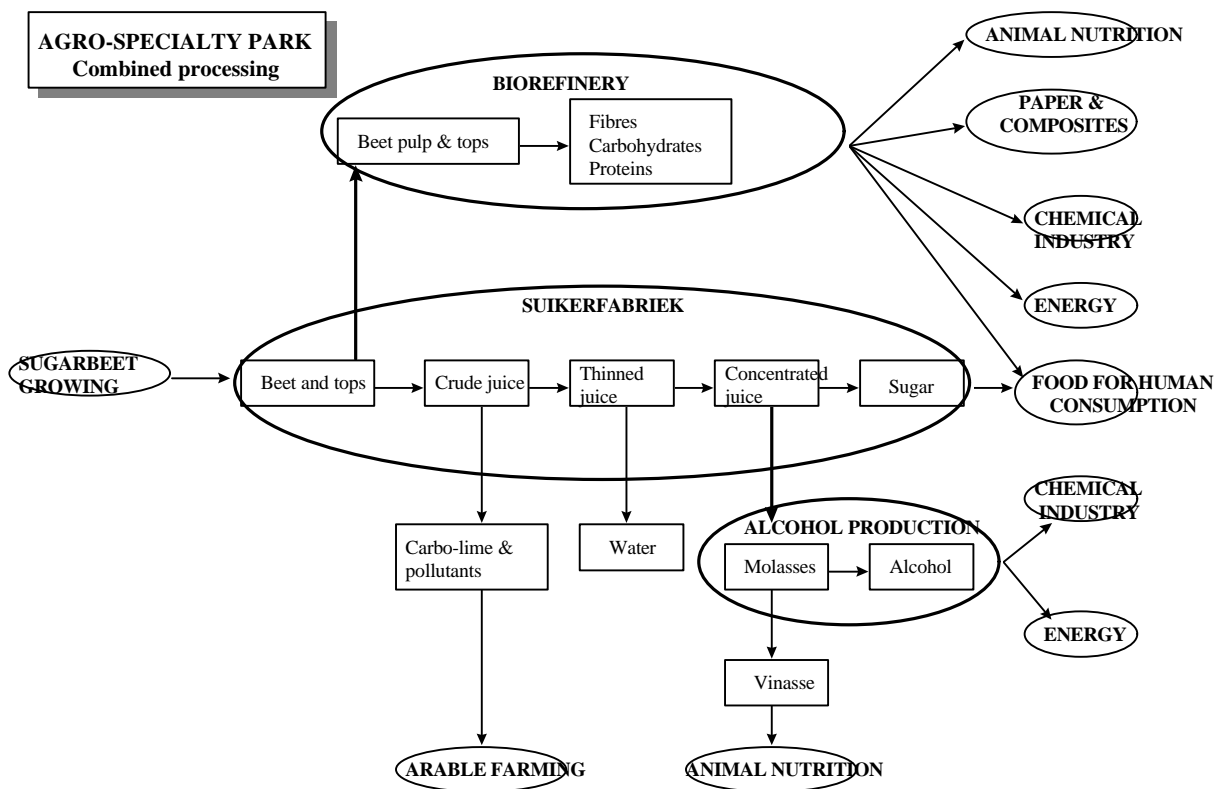


Figure 3.1.: Process diagram of Agrospecialty park

The first processing step at the Agrospecialty park is similar to what is currently found at the sugar factory. The beet are treated to make two flows, which will then follow separate conversion routes: crude juice and beet pulp (including leaves).

Crude juice follows the same conversion route that is now taken at the sugar factory to produce concentrated juice. The difference with current practice is that all side flows (carbo-lime and pollutants, water) are collected and recycled to make them useful again: carbo-lime as a fertiliser in arable farming, water to be added to the water cycle of the Agrospecialty park. Concentrated juice is used as a compound for sugar production for the retail market (in various quality gradations). Contrary to current practice, concentrated juice is also used as a compound for alcohol production. The residual flow that is released in this alcohol production, i.e. vinasse, is made useful again as animal feed. The alcohol is not sold for human consumption, but rather as a compound for fine-chemical industry and as fuel for specific energy applications requiring very clean types of fuel.

Beet pulp (including leaves) follows a conversion route that deviates strongly from current practice. Beet pulp is now used especially for animal nutrition. However, this flow also contains elements which, following separation and treatment, are suitable for applications of much higher quality levels, including:

- applying protein fractions and carbohydrate fractions in human nutrition: aromatics, colourings, flavourings, thickeners and preservatives;
- applying protein fractions and carbohydrate fractions in fine-chemical industry;

- applying fibre fractions in the production of paper and biocomposites.

Fractions that cannot be used for these high-grade applications are still used for animal feed and energy production (through gasification or hydro-terminal upgrading).

In the Agrospecialty park design presented here, sugar beet are the main flow of input. As was mentioned previously, other bulk agroproducts (e.g. potatoes, oats and grass) are also suitable for processing at an Agrospecialty park. A number of those bulk flows, especially sugar beet, has a limited harvesting period ("the season"). During the beet lifting season, the volume processed by the sugar factory in only a few months is gigantic. To avoid that the Agrospecialty park is operational during a limited period of the year only, other agroproducts are added to the primary input flow to be processed. Examples may include potatoes, wheat, flax, chicory, grasses, hemp and soya, which can all be treated by the biorefinery.

3.1. Innovativeness

The added value of the Agrospecialty park can be found in its integrated processing of agricultural – bulk - products (e.g. beet, potatoes, oats and grass) into high-grade end products. In order to have integrated processing, it is advisable to have a spatial concentration of the various conversion steps. It will serve optimum adjustment and adequate timing of flows exchanged. The individual conversion steps incorporated into the design have all been tested even now. What is innovative is a far-reaching integration of the conversion steps, which is made possible by concentrating activities geographically. Major advantages include:

- large-scale concentration at a production park will produce the best possible conditions for industrial symbiosis: efficient exchange of energy, heat/cold, primary and secondary compound flows, water etc. between subprocesses;
- good opportunities for making efficient use of installations by processing several successive bulk flows. As a result, the operational period of installations which used to be dependent on seasonal supply is extended.

What is also innovative is the output which lends its name to the Agrospecialty park: a broad range of high-grade end products. Major advantages include:

- the economic added value of the product portfolio will increase;
- the product portfolio has a much better spread: not only sugar for human consumption and residual flows for animal nutrition, but also products for other, substantial market segments. As a result, the Agrospecialty park will be less vulnerable to economic recession in individual sectors.

3.2. Location selection and current situation

Specific initiatives to realise an Agrospecialty park in some form are currently undertaken in developing the Dinteloord Agro-Industrial Complex. In 1999 a master plan was developed which interconnected the energy and product flows of businesses from various sectors, including a sugar factory. Naturally, it is important that the lessons learnt from experiences such as those in Dinteloord are taken to heart.

Other locations may also be conceived for Agrospecialty parks. The present sample design is based on a new location: the Eemshaven Energy Park in North Groningen. The location was selected partly because of the possibility to ship in raw materials and to ship out products directly, partly also because it is in the immediate vicinity of a vast area of agricultural production whose products may be processed at the Agrospecialty park. The Eemshaven in the north of Groningen province is a young harbour area which, while still having a limited number of buildings, borders on an extensive and open agrarian area with large, scattered farms.

3.3. Design: spatial characteristics

The spatial representation of the Agrospecialty park can be based on two variants.

The first variant is represented in Figure 3.3. It is based on a close relation between park (processing plants) and hinterland (rural area). It finds its expression in an option where the farms assume responsibility for doing part of the treatment, for example the initial treatment of products when they are most perishable. The harbour-related industrial estate accommodates a complex of various plants which manufacture the various products. In the rural area, the total volume of farm buildings is assumed to increase.

The starting-point of the second variant is that all processing steps take place at the park proper. In this variant the development of the Agrospecialty park can be expected to have few spatial effects on the surrounding rural area.

The main spatial characteristics of the Agrospecialty park are:

1. Size of the park: approximately 100 to 150 ha.
2. Position: in view of the possibility of causing inconvenience (sound pollution) to its environment, the estate must be well away from areas with ecologically sensitive purposes (housing, nature, sanctuaries). An indication here would be between 500 and 1,000 metres (VNG distance table).
3. Opening up and access:
 - located at main road system (motorway, secondary roads);
 - located on the water (harbour, waterways), providing possibilities for shipping in and out;

- it is advisable to have a railway terminal nearby for removing - high-quality - by-products and end products (biorefinery, alcohol production).

4. Scale:

- large plots, especially for the sugar factory (production, storage and transshipment, cooling ponds):
 - ◊ development (buildings/installations): 25% = 25 to 35 ha
 - ◊ storage and cooling ponds/water supply: approx. 50% = 50 to 75 ha
 - ◊ other functions (internal infrastructure, weighbridges): approx. 25% = 25 to 35 ha;
- biorefinery and alcohol production: less extensive, although plots of adequate size are needed (approx. 3-5 ha): development 70% (buildings/installations);
- infrastructure: dimensions adjusted to freight traffic and one or more loading and discharging quays on the water;
- building height: 40-50 metres maximum.

3.4. Organisation and operational structure

The Agrospecialty park consists of a combination of three independent industrial establishments: a sugar factory, an alcohol production plant and a biorefinery. To promote mutual adjustment, the businesses make far-reaching mutual arrangements on the supply of products and services, which are put down in written contracts. Even now, similar contracts are used to learn more about their role while developing sustainable industrial estates. Arrangements are aimed at achieving preferential collaboration (exchange within the park is the option preferred), although not exclusively (businesses remain free to do business with other suppliers or clients).

3.5. Employment

Throughout the year, the Agrospecialty park provides jobs for employees with varying backgrounds. In addition to employees who have had specialised training (e.g. industrial engineering or process technology) the park also offers employment to those who have a generic type of basic training. The latter may include contract workers who assist farmers during the harvesting months. When the season is over, they may be employed in production activities at the park.

3.6. Transport and logistics

The amounts of - bulk - agroproducts delivered at the Agrospecialty park are enormous. Consequently, it is necessary for the park to be opened up well, to have easy access. As far as supply is concerned, transport by water is preferred, if only because of the volume to be moved. If reduction of transport movements were the only goal, decentralised production of semi-finished products (beet pulp and crude juice) might perhaps be preferred. Still, the

design has decided to exploit the advantages of a spatial concentration of all the conversion steps regarding the mutual adjustment of products and the exchange of energy, water, heat, etc.

Storage at the estate takes place in two forms:

- storage of input flows in large sheds;
- storage of - dry - intermediary and end products in compartmentalised sheds.

In addition to these types of storage it is possible to construct a small storage facility for concentrated juice in specially designed tanks, which may be used in cases of emergency or as a buffer.

End products are removed from the Agrospecialty park by road or by rail. Thus, adequate access by road is also important.

4. Future potential and barriers

This final section will discuss some of the more important potential capacities and barriers of the Agrospecialty park. Its potential refers to the opportunities and strengths of the design. Barriers refer to the design's threats and weaknesses. What follows is not an extensive description, but rather a definition of relevant points that may be brought up for discussion during the workshop. They have been divided into five themes:

- economy: position agro-industry, employment, costs, knowledge infrastructure;
- spatial planning: size of scale, use of space and scenery;
- transport/mobility: traffic and transport flows;
- image: consumer wishes, high-quality and sustainable production;
- transition/organisation: changes needed to realise things.

Theme	Potential/opportunities/ strengths	Barriers/threats/weaknesses
Economy	<ul style="list-style-type: none"> • prominent position Dutch agro-industry • cost advantages for businesses (direct/fixed charges) • employment spin-off (supply and farming-out relations in the area, new initiatives) • increased exchange of knowledge, network building and creativity through concentration of knowledge • attracting/expanding with other economic activities (e.g. paper industry/pharmaceutical company) 	<ul style="list-style-type: none"> • agrosubsidies strongly reduced, especially in primary sector • economic centre of primary production moving to other parts of EU/world: raw materials must then be shipped in from far and near • specific types of employment decreased due to collective facilities (installation/maintenance/ management) • dependency relations between businesses (risks and reduced flexibility)
Spatial planning/ design	<ul style="list-style-type: none"> • efficient use of space through concentration/clustering of activities at single location • combined "adjustment" to landscape/ space 	<ul style="list-style-type: none"> • size of scale: large-scale intervention at location • environmental effects: intensified transport, smells, noise • higher risks of nimby effects
Transport	<ul style="list-style-type: none"> • clustering of traffic and transport flows • multimodal transport (water, road, rail) • larger base of support for investments in infrastructure 	<ul style="list-style-type: none"> • relatively low current transport costs not motivating towards geographical clustering • logistics/transport is not a core activity of the businesses, resulting in less involvement production companies • who invests in infrastructure?
Image	<ul style="list-style-type: none"> • environmental effects of a conglomerate (e.g. Silicon Valley) • sustainable production in agreement with consumer wishes • realising high-grade production/ added value 	<ul style="list-style-type: none"> • local environmental effects (smells, noise, traffic)
Transition/ organisation	<ul style="list-style-type: none"> • defragmentation of interests • defining actions for the near future based on long-term perspective • seizing opportunities for sustainable development at initial stage 	<ul style="list-style-type: none"> • great many parties, interests, cultural differences • many consultations needed, designing organisational structure • resistance to "change" • dependency relations • short-term solutions prevail over long-term solutions



Figure 3.4 Bird's-eye view of Agrospecialty park



Figure 3.2 Eemshaven and hinterland: current situation



Figure 3.3 Eemshaven and hinterland: new situation with Agrospecialty park

Appendix 4:

Green park: Agroproduction park with agricultural land use

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1. Introduction
2. Green park
3. The function of a Green park
4. Opportunities and threats
5. Activities at the Green park
6. Organisation
7. Green park in focus
 - 7.1. Location
 - 7.2. Design
8. Challenges and solutions

1. Introduction

Due to a geographical concentration of limited activities and their resulting environmental problems and transport flows, today's organisation of the agroproduction column in the Netherlands is faced with increasing resistance. In addition, its organisation is also inadequately adjusted to a growing need for flexibility. Prolonged continuation of its current design will not be sustainable.

Wageningen UR has focussed a great deal of its efforts on finding integrated solutions to achieve a sustainable development of agricultural production in the densely populated north-western parts of Europe. Issues of major relevance to these efforts include:

- the environment: reducing emissions and utilising flows of residuals;
- plant and animal welfare;
- use of space;
- organising a base of support among citizens and consumers;
- consumer-controlled development.

These ambitions are aimed at finding sustainable methods to maintain agricultural production in the delta metropolis, i.e. ways that are acceptable to society in economic, environmental and welfare terms.

Three research institutes (i.e. ATO, Alterra and IMAG of Wageningen UR) have taken a joint initiative to develop those ambitions into sustainable perspectives of agricultural production in our densely populated habitat.

Parallel to these developments, the National Council for Agricultural Research (recently followed by the Innovation Network Rural Areas and Agribusiness) and the LNV steering committee on Technology Assessment are doing a quick scan on agroproduction parks. For some time ATO, Alterra and IMAG have synchronised their initiative to the quick scan; the sample design presented here is seen by the institutes as an intermediate result of the initiative.

The crucial point in the sample design presented here is that a large park is set up which, through its size of scale and its local combination of activities, can generate a sufficient amount of critical mass to be an ecologically strong and economically sound entity. The sample design has elaborated a combination of new ideas which are intended to raise several topics of discussion. The authors of this text have had the explicit intention of presenting this combination of ideas; in principle, however, any topic can be brought up for discussion.

2. Green park

Due to a geographical concentration of limited activities and their resulting environmental problems and transport flows, today's organisation of the agroproduction column in the Netherlands is faced with increasing resistance. In addition, its organisation is also inadequately adjusted to a growing need for flexibility. In order to generate fresh opportunities for agricultural production in a relatively thinly populated area, a sample design is presented here in which a new organisational pattern will bring new solutions for achieving sustainable and flexible production.

Spatial concentration of agricultural enterprises with limited specialisations has been one of the main reasons for an accumulation of environmental problems, partly as a result of high local emissions of substances that increase environmental pressures, partly also because they generate considerable flows of transport. By providing for a regional clustering of different sectors as well as technological innovations and adjustments in physical planning and organisation it will be possible to reduce those problems from an ecological and economic perspective. Thus, transport flows for carrying – semi-finished – products can be minimised, flows of residuals can be exploited on an economically sound basis and emissions can be controlled more effectively.

The Green park abandons the principle of growing a single product on each plot: this type of monoculture requires that pesticides are applied intensively because diseases may spread easily. The Green park opts for a modern design that fits a modern and flexible production processes: using narrow strips for each individual product. The result is that any effects of local diseases are limited in a natural way so that a smaller volume of pesticides may suffice. This transition is made

Green park in brief

Function	clean and effective production of high-grade materials and energy
Products	high-grade semi-finished products knowledge t.b.v. agrification energy
Driving force	shareholders + knowledge development
Use of space	30,000 ha
Organisation	owned by shareholders omvangrijke percelen combining several products at a single plot
Opportunities	critical mass for breakthroughs in agrification sustainable and clean production multiple applications of products attractive development of landscape
+ / -	+ flexible production + shared concern mission + consumer share-holding – dependent on success of research on applications of high-grade components

possible by applying the latest developments in precision agriculture.

In order to realise this new method of production the organisation of agricultural production must be completely modernised. The principle of specialised farmers who,

owning their individual piece of land, have specialised in a few crops will be substituted by contract workers who perform all the activities to grow products on several large, cultivated areas. Consequently, organisational modernisation will be one of the big challenges.

The agricultural production capacity of the Green park will be used in a sensible way to produce high-grade natural compounds and energy. This agroproduction park combines sustainable use of some hundreds of square kilometres of agricultural lands with industrial processing units that can give production sufficient added value. It is precisely by combining the various activities on a local basis that the appropriate context is created to produce ecologically sound products in economically sound ways.

The park is owned by a limited liability company. Its shareholders are the previous land owners and consumers.

3. The function of a Green park

Its central feature is the efficient and environment-friendly production of high-grade materials and energy based on crops from agricultural lands. To this end, the Green park clusters several activities at a single location with a view to producing sustainable compounds and materials (semi-finished products). To increase added product value, what is added to agricultural production and industry is a research institute whose task is to find new applications for the semi-finished products. Any remaining biomass is used for energy production.

Clustering production activities will minimise transport of compounds and semi-finished products. Transportation to clients (mostly in densely populated areas in other parts of the country) does not cause any problems: most semi-finished products are not really perishable while – electrical - energy is transported by wire.

4. Opportunities and threats

As a result of its large scale, the Green park creates a large critical mass for new developments which, due to a fragmentation of interests, previously proved impossible to attain in economic or technological terms. The most important of them are:

- critical mass for breakthroughs in agrification;
- sustainable and clean production of compounds, materials and energy;
- an economically attractive cascade of product applications.

Other attractive developments include:

- landscape development will lead to an attractive and distinct structure;
- knowledge of the system innovation is a uniquely Dutch product. The concept can be exported and Dutch system knowledge can be used to play a directing role when parks are established abroad.

What is needed to realise the park is a substantial acreage of unbroken farmland. It implies that a great number of farmers will have to participate in the park or else must sell their lands. This barrier can be overcome only by presenting a most solid, preliminary development course whose financial prospects, while being based on foundations that can easily be demonstrated, are compared with other alternatives, including continuation of current farming operations.

Other threats may arise when new developments fail in finding applications of agromaterials or in developing high-tech methods for precision agriculture. Investments in those areas will be necessary in order to find a practical interpretation of the park.

5. Activities at the Green park

The combination and adjustment of activities presented here is meant to illustrate the concept. Thorough studies will be needed to achieve optimum mutual adjustment. Three types of main activities at the Green park can be distinguished:

Agrarian production

The essential production method of the park is to have a clean production of agricultural crops containing high-grade materials in a modern design that will ensure that the area also invites tourism. The aim is to achieve a wide biodiversity, with sufficient scenic and economic value. Its intended production consists of:

- fibre crops:
 - * annual crops (flax, hemp);
 - * perennial crops (switch grass, reed grass; planted for periods of 10 to 15 years, harvested once a year);
 - * short-rotation deciduous trees: willow and poplar (growing period 25 years, harvest every 4 years);
- protein and starch crops (soya, potatoes, cereals);
- bulb farming;
- grass and clover;
- extensive stock farming.

Surface waters and forest areas are also used for production and recreational purposes. Up-to-date knowledge of and developments in rotational growing and precision agriculture will be used to ensure that pesticides are applied as little as possible.

Processing industry

In order to find the best possible applications for the products of agriculture the park is connected to processing industry. Its objective is to extract high-grade components from agricultural products and to exploit low-grade residual products:

- separating industry (fibre, starch and protein production) producing semi-finished products;
- separating residual waste;
- organic fertiliser industry (composting);
- power station.

Applied research

To improve the added value of products, the park maintains relations with a knowledge institute. Its objective is to develop new processes and end products for the semi-finished products produced by the park. The resulting knowledge is provided as added value when semi-finished products are supplied.

Other activities are designed to involve shareholders (consumers). In order to increase consumer involvement with the park – thus improving social acceptance of agriculture in the Netherlands and, specifically, Green parks – it is possible for shareholders to virtually “lease” crops. By specifying the type of sustainable products they wish to buy in six months’ time consumers may determine which plant species are grown. The internet will enable shareholders to see how their leased plants are developing.

6. Organisation

The Green park has a completely modernised organisation. The principle of small and independent farmers who have their own piece of land is abandoned because they cannot combine enough forces to create the amount of critical mass needed here. The Green park is set up as an independent business with shareholders (i.e. large shareholders and consumers). This will make it possible to have an unambiguous company mission and to avoid conflicting interests.

Operations are performed on a large scale by contract workers (who manage the land under the authority of the shareholders). The contract-worker businesses will each control an area of a few thousands of hectares.

The shareholders, i.e. consumers, have an interest in making the initiative successful. They have both an economic purpose (i.e. park output) and an idealistic goal (i.e. to invest in safe food and other sustainable products).

7. Green park in focus

7.1. Location

The park will cover a few tens of thousands of hectares. The challenge to achieve a different method of cultivation in a vast and extensive area of arable farming is located in the expansive Noordoostpolder landscape because making this switch on a large scale will have the best chances of success.

At present, the polder is divided into oblong lots with fixed measures. In addition, straight roads and watercourses cut through the polder. Farms are found at regular intervals along the roads. Apart from the big centre of Emmeloord, some scattered smaller villages are found.

Other potential locations in the Netherlands are Groningen and Zeeland. Also, the idea can be exported to, for example, America, France or Russia. In case of exportation, the Netherlands may continue to play a role as knowledge supplier, which was mentioned earlier as a critical factor for making the concept successful.

7.2. Design

The polder will be completely transformed in terms of allotment. The pattern of roads and waterways is the only thing that remains. The new division is not permanent and may vary according to season while the allotment consists of narrow and elongated plots with different crops. As a result, the landscape offers great variety. The farm buildings are expected to disappear over time since individual property will cease to exist. The workers employed in agriculture will be living in the villages. The only buildings needed in the rural area will be a few scattered sheds housing the equipment of agricultural maintenance companies (similar to previous contractor businesses).

The site for establishing processing industry and energy production was decided to be a well-developed location at the centre of the polder, bordering on the industrial estate of Emmeloord.

Crop allocation

In order to minimise the risk of transmitting diseases, products will be grown on elongated plots where neighbouring products are constantly varied. It is combined with rotational cultivation of annual crops. Thus, the use of pesticides may be strongly reduced. Perennial crops and deciduous trees are grown on special lands, i.e. in wet areas and on less fertile lands, respectively.

The design offers a number of additional advantages that may also be of major importance to sustainable and flexible cultivation:

- Rotational growing can be easily achieved by moving crop arrangements each year.
- It is possible to have layered cultivation.
- Plants of various lengths may be arranged in such a way that optimum use is made of sunlight to grow useful products.

Industrial buildings and houses

Since the agricultural activities are performed by contract workers, houses will be clustered in a few villages. Contracting firms have large sheds to house their machinery. In order to prevent traffic congestion during seasonal periods, the agricultural products, when harvested, are stored with the contract workers and, possibly, even on a smaller scale, i.e. in pits or silos.

The machine sheds are about 8 m high and have a surface area of 2,000 m² per contract worker. The pits and silos for storing harvested products will cover several hectares per contract worker. The processing industry is clustered at the centre of the park, near a motorway.

Transport

Contract workers are transported to the processing industry by light vans. Semi-finished products are moved away to processing clients in other parts of the Netherlands or abroad by heavy lorries. Low-grade products can be removed by inland shipping.

8. Challenges and solutions

Setting up the new organisation and developing this method of agricultural production will be essential for the park to be successful.

The new organisation should be initiated by a number of stakeholders. Obvious stakeholders are today's farmers, who are faced with previously described problems and moderate financial prospects.

Other crucial – more technical – elements are:

- developing/selecting suitable species;
- crop allocation;
- precision agriculture;
- extracting crop compounds;
- agrification: economically and technologically interesting applications of agromaterials;
- manure upgrading.

Research efforts to study these elements – which are of great importance to agricultural and industrial sectors in the Netherlands – may help to gain a large competitive edge on other countries.



Figure 4.3 Bird's-eye view of Green park



Figure 4.1 Noordoostpolder west of Emmeloord: current situation



Figure 4.2 Noordoostpolder west of Emmeloord: new situation with Green park

Appendix 5:

Multipark: Multipurpose use of space in rural areas

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Spatial design: T. van Oosten-Snoek and N. Dielemans (RBOI)

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2. Relevant trends in agribusiness
3. The Multipark described
 - 3.1. Innovativeness
 - 3.2. Location selection and current situation
 - 3.3. Design: spatial characteristics
 - 3.4. Organisation and investments
 - 3.5. Employment
4. Future potential and barriers

1. Introduction

The National Council for Agricultural Research, recently followed by the Innovation Network Rural Areas and Agribusiness, and the LNV steering committee on Technology Assessment were doing a quick scan on production - including agroproduction - parks. Their aim was to explore the possibilities of the concept in more detail and to make an overview of those elements that might lead to social or political controversy.

As part of the quick scan, TNO was asked to make two sample designs of production - including agroproduction - parks. The Multipark presented here is one of them. The design is meant to provide a basis for discussion. It is based on an analysis of trends in agribusiness; in developing the design, the main focus was on the innovativeness and desirability of the design as compared to current practice. Obviously, before the design can be really developed, its technological and economic feasibility must be studied in more detail.

2. Relevant trends in agribusiness

Agribusiness is in a state of great flux. Due to strong developments such as market globalisation, increasing political pressures on agricultural subsidies and consumers who want agroproducts to meet increasingly higher quality standards, big changes are taking place in the sector. Our basic assumption when selecting sample designs was that they must be in keeping with developments that are expected to occur during the next few decades. Thus, the sample design also presents a picture of the future.

A brief scan of the available literature yielded two clusters of developments in agribusiness that offered good clues for developing future scenarios.

Firstly, the place of agroproduction and agroproducts in our society has been changing. Traditionally, the main task of the agrosector was to ensure an efficient supply of – first-quality and cheap - food products and ornamental plants. Strategic foresight studies made in the context of the Sustainable Technology Development programme have drawn the attention to the possibilities of using biomass as feedstock for chemical industry (bulk and niches) and power supply.⁸

⁸ DTO Sleutels Chemie en Voeden (Keys to Chemical Industry and Food). Sustainable Technology Development Programme, 1998.

The design of a Multipark as described here represents a future agrosector with broader social significance. Whereas agroproduction was long considered to be a predominantly economic activity, the past ten years have made it clear that agrosector development not only involves economic values. The focus of attention has been broadened to include a variety of value domains: economic values, ecological values, social values, cultural values and ethics, spatial values.⁹ Thus, the Multipark sample design presented here is aimed at achieving a multipurpose use of space in rural, agrarian areas. The essential idea of the design is that we can improve the quality of rural areas dramatically by concentrating a great number of functions within a confined area. Although we even have the technological means to do this, it is due to cultural and social reasons that hardly any of these combinations have been realised.

3. The Multipark described

The purpose of the Multipark is to increase spatial quality in rural, agrarian areas which are now dominated by intensive stock farming (especially chicken and pigs). The key is a transformation from single-purpose to multipurpose use of space.

The essence of the Multipark is that agrarian production functions are closely interrelated with other social functions. Typical characteristics of the Multipark include:

- a combination of agroproduction functions, forestry, recreation and housing;
- utilising manure from intensive stock farming for decentralised energy production and fertiliser application.

Figure 5.1. represents this interweaving of functions in diagram.

⁹ Knowledge and innovation priorities: Agribusiness. Aspirations for the 21st century, 1998. NRLO report no. 98/20E.

MULTIPARK:
Multipurpose use of space

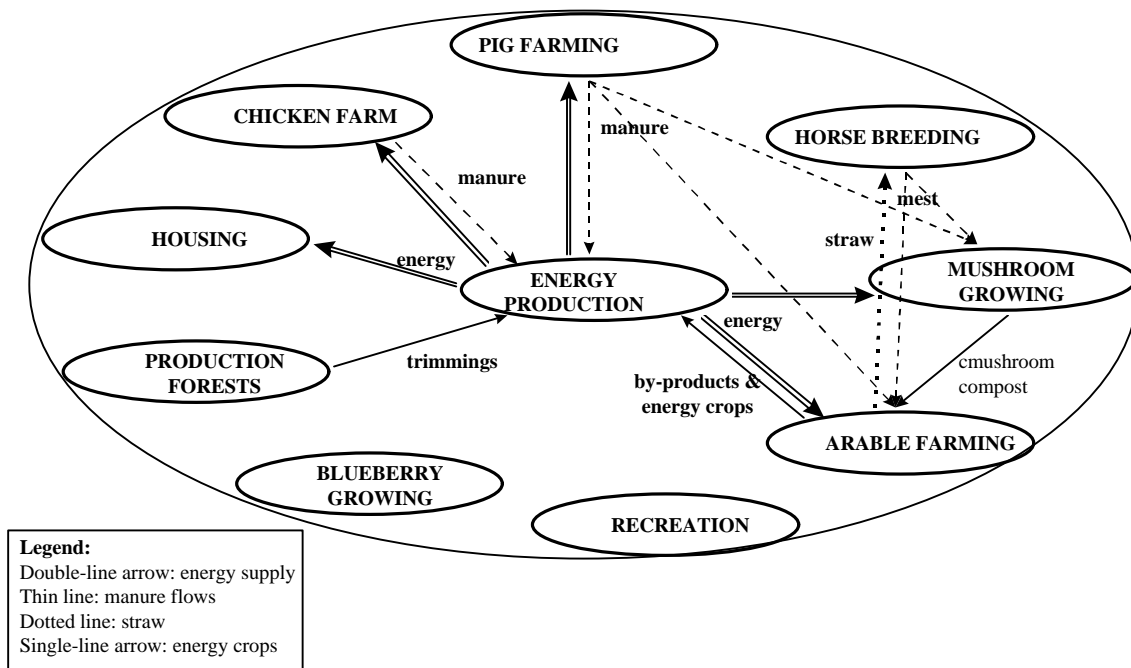


Figure 5.1.: Cyclic processes at the Multipark

In terms of scenery, the Multipark makes a varied appearance. The design derives its structure from the differences in emphasis between specific parts of the area: woods, residential centres, intensive stock farms and extensively used outlying areas. The Multipark is a clustering of the following activities:

Intensive stock farming

Traditionally, intensive pig farming and chicken farming have been the central activities in the area where the Multipark is developed. In the Multipark, the intensity and methods found in intensive stock farming do not essentially differ from what is common today. Large-scale stock farms, particularly, will keep their place in the Multipark. A major difference, however, is that this activity has ceased to be the outstanding economic pillar of the area. In the Multipark they are no longer dominating the landscape (less than 10% of the area) or defining the quality of the physical environment. Using gas washers will reduce ammonia emissions to about 10%, which will be associated with a substantial reduction of stench.

Extensive stock farming

Apart from intensive stock farming, the Multipark also has a limited amount of extensive stock farming. In particular, it involves cattle grazing large pastures and a few horse-breeding farms. Because of its high spatial distribution (together with arable farming about 30% of the total Multipark area) extensive stock farming is a major landscape-defining factor.

Vegetable production

Arable farming is of great importance to scenery (together with extensive stock farming about 30% of the area). Arable activities are varied: grasslands and clover, potatoes and cereals, horticulture (in the open and in greenhouses). Also, a limited number of mushroom farms is established in the Multipark.

Forestry

Another major factor to define the landscape is the existence of forests, which are partly used as production forests. In the production forests, fast-growing deciduous trees (short rotation, e.g. poplars) are grown for - artisan - woodworking and decentralised energy production at a biomass power station. They involve several forest areas which together cover 15% of the Multipark area. In addition to its production function, the forest area of a Multipark also has recreational and ecological functions while providing a nice environment for preserving some cultural heritage (country estates). Also, in some parts of the forests, professional blueberry growing is found. The blueberries are picked and delivered to the food industry (e.g. jams, soft drinks, desserts, etc.).

Recreation

The Multipark's recreational quality is derived from its variety of scenery in which forests, arable farming, extensive stock farming, country estates and residential areas alternate. The target group sought out by recreational business at the Multipark consists of - wealthy - city-dwellers who, during the weekend or on a midweek holiday, flee the crowds of modern city life in order to recover amidst the salutary quiet of the countryside.

Apart from the usual catering and hotel facilities, the Multipark's recreational supply is focussed on agrotourism, as it is called: camping on a farm, educational model farms (arable and stock farming), the possibility to take an active part in country life at retreat farms (extensive stock farming), etc. Furthermore, recreational facilities are designed to exploit the quiet and rural character of the Multipark: livery stables (horses and ponies), trips in covered wagons, guided forest walks, etc. In view of its position between Veluwe and Randstad, Gelderse Valley provides excellent opportunities for a Multipark to develop those types of tourism.

Housing

Approximately 10% of the Multipark area is earmarked for housing. It involves several scattered – pre-existing – residential areas and - new - extensive housing in a green outlying zone. High-rise buildings are ruled out in the Multipark. Houses built in residential areas do not disrupt the landscape image while being in keeping with the historical architecture of the area.

Energy production

The Multipark has its own power station which will meet part of its own energy demand. The energy is produced at a biomass power station (through hydro-terminal upgrading) which is fed mainly with wood from the production forests. Also, limited amounts of chicken manure (from intensive stock farming) and by-products from arable farming and horticulture are used in the power station. The station produces 1 MWe per hour. If only wood is used, it will need approximately 12,000 tons of wood annually. Thus, based on an average annual yield of 8 tons per hectare of production forest, what will be needed is a production forest of at least 1500 ha.

3.1. Innovativeness

The innovative quality of the Multipark is in its multi-purpose character. In areas that are now dominated by intensive stock farming, this broadening of functions is an improvement both in terms of scenery and in economic terms. The Multipark refers especially to an interweaving of:

- production functions (some of which are intensive): production forest, blueberry growing, intensive stock farming, arable farming and mushroom farming;
- recreation;
- housing.

A great number of functions is combined in – production - forests: recreation, silviculture (for woodworking and energy production), cultural heritage (country estates), ecological function and blueberry growing for the food industry.

What is particularly special is the combination of housing and intensive stock farming. This is something that is practically impossible to achieve under current conditions. In the Multipark it is possible to locate residential areas in the immediate vicinity of intensive stock farms by applying new technologies. Indeed, ammonia emissions by chicken and pig farms can be reduced to approximately 10% of their current levels by using gas washers. As a result, functions that are sensitive to ammonia (forest/nature on sandy grounds, production forests) or stench (housing) can be located in the immediate vicinity of intensive stock farms. This is something which is virtually made impossible under current conditions by stench and emission problems.

Combining housing and intensive stock farming might also lead to innovations in the latter sector. Today, social pressures on the intensive production of pigs and chicken are high in view of environmental problems as well as problems with animal health and welfare. It is very well conceivable that narrowing the gap between citizens/consumers and intensive stock farming will finally lead to innovations in the types of housing and methods used by this controversial type of bio-industry. In addition to its production function, intensive stock farming may then come to perform other functions as well (e.g. recreation, education).

Finally, one more innovative aspect can be distinguished in the Multipark. The selection of activities in the Multipark design is aimed at recycling residual flows (biocascade) and closing cyclic processes. Thus, the design offers possibilities for using on a local scale the manure and substrate (mushroom beds) that are made available for mushroom growing, energy production and the production of compost for outdoor crops.

3.2. Location selection and current situation

In the Winterswijk area, the Assessment Network for Multi-Purpose Use of Space has now developed initiatives to achieve that the organisation of the agrarian area serves a greater number of functions. Essentially, the area provides a good opportunity for developing the sample design presented here.

The objective of the Multipark philosophy is to create the possibility of having multi-purpose rural areas, particularly in regions which are now completely dominated by a few functions only, making it impossible for other functions to develop. Typical examples of such areas are the intensive stock-farming areas of Gelderse Valley and Peel. In order to make a representation of the Multipark it was tried to find some part in those concentration areas where the landscape still had some structure that would offer good opportunities for making a multi-purpose design. Such an area was found west of the Veluwe, in Gelderse Valley. The area is now unable to function as a residential area (stencil) although it has a great many houses of – former – small-scale farms. Also, the ecological link between Veluwe and Utrechtse Heuvelrug, which Gelderse Valley used to be, has now been lost due to intensive agrarian land use and the loss of coherent planting structures.

3.3. Design: spatial characteristics

A basic assumption underlying the spatial representation of a Multipark in this part of Gelderse Valley is that, although intensive stock farming in the area is maintained, it must be newly organised. After all, not only the amount of environmental disturbance is important to the perception of the landscape as a residential or recreational environment,

but also the presence of buildings and plants. The design distinguishes between different zones which emphasise different expressions of functions and appearance:

- In the northern part, a coherent green structure is made by combining a series of country estates – which connect to the country estates of the Utrecht part of Gelderse Valley – with forestry, blueberry growing and recreational activities. This green zone will perform a major ecological function as a connecting zone. Intensive stock farming is gradually ended.
- In the central part, intensive stock farming is maintained, being concentrated around large farms that already exist. A manure processing plant will be established at a central location in the area.
- In the southern zone, which already has many houses, a green residential area is developed whose planting structure will be a continuation of the structure of the landscape. In this area, intensive stock farming is gradually ended.

Major spatial characteristics of the Multipark are:

1. Total size of the Multipark is about 100 km² or 10,000 hectare. It involves part of Gelderse Valley, i.e. the Ede area to the north of the A12 motorway.
2. A bio-energy station (stand-alone) which is fed mainly with wood, supplemented with chicken manure and by-products from arable farming and horticulture. The power station produces 1 MWe per hour (electricity). To do this, it will need about 12,000 tons of wood annually.
3. A production forest of sufficient size to provide the bio-energy station with all the fuel it needs. Based on an average annual production of 8 tons of wood per hectare, approximately 1,500 ha of cultivated forest will be sufficient to run the biomass station entirely on wood. The design is based on a production forest area that is about 15% of the Multipark.

4. Thus, approximately 85% of the total area remains available for other functions. Assuming that the Multipark is a patchwork of various functions that may find a place here, the remaining functions must be spread as best - and "fairly" - as possible over the space available. The following distribution may be considered as an indication (100% = 10,000 ha):

- agrarian area:
 - ◊ intensive (pigs, chicken, mushrooms) : 10% = 1,000 ha
 - ◊ extensive (cattle, arable farming, horses) : 30% = 3,000 ha
- housing/ residential area : 10% = 1,000 ha
- recreation (intensive/extensive) and infrastructure : 10% = 1,000 ha
- nature/forest : 15% = 2,000 ha
- country estates : 10% = 1,000 ha
- production forest : 15% = 1.500 ha

3.4. Organisation and investments

Realising the Multipark requires a joint effort made by authorities (national, regional and municipal), the sector of agriculture (umbrella organisations and individual farmers) and investors. After all, making the above-mentioned transformation from a relatively single-function region to a Multipark with a wide range of social functions is beyond the capacities of individual investors.

Essentially, developing a Multipark is a form of system innovation. Its failure or success is determined by the quality of interactions between individual actors and initiatives. In order to direct and control the innovation process it will be necessary to establish a regional partnership which brings together those parties that have the greatest interests. Within the partnership, the contributions made by various parties can be attuned best.

For example, the government could provide an unambiguous frame of reference for developments while facilitating them by providing a balanced package of measures, taking account both economic, environmental and employment considerations.

Agricultural umbrella organisations may support the transition by combining the knowledge and creativity of the farmers involved into a joint initiative. In addition to achieving a reorganisation of agricultural activities, the initiative should also include retraining and support for those who wish to make a new start.

Real-estate investors such as large pension funds and insurance companies may provide the venture capital that is needed to help starting entrepreneurs (particularly in recreation) and to realise new facilities (hotels and catering) and residential areas.

Last but not least, an electricity company may invest in the realisation of a bio-energy station. The government may also be expected to make a contribution here, though, in view of sustainable energy policies.

3.5. Employment

Based on economic developments and as the immediate result of intended environmental and agricultural policies, areas such as Gelderse Valley and Peel will see many changes in the near future. Expanding a few intensive stock farms will go hand in hand with closing a great number of other businesses. The result will be increasing unemployment. Income differences will grow fast in the next few decades if no alternative options are developed in those regions. Buying out farmers – or, possibly, compensating them - is inadequate to offer the region and its inhabitants a long-term perspective.

The Multipark in these regions offers a beckoning perspective as improved spatial quality goes hand in hand with an economic impulse that leaves intact the nature of the original landscape. Part of the population will have to be retrained, preparing themselves for recreational or educational functions. On balance, the Multipark is expected to help increase both the volume and diversity of regional employment.

4. Future potential and barriers

This final section points out some of the more important potential capacities and barriers of the Multipark. Its potential refers to the opportunities and strengths of the design. Barriers refer to the design's threats and weaknesses. The description is not extensive, although it identifies some relevant items that may be brought up for discussion during the workshop. They have been divided into five themes:

- economy: position agro-industry, employment, costs, knowledge infrastructure;
- spatial planning: size of scale, use of space and scenery;
- transport/mobility: traffic and transport flows;
- image: consumer wishes, high-quality and sustainable production;
- transition/organisation: changes needed to realise things.

Theme	Potential/opportunities/strengths	Barriers/threats/weaknesses
Economy	<ul style="list-style-type: none"> • broadening economic basis: less dependent on agriculture • creating a socially and economically vital countryside by maintaining employment in primary production while increasing employment in other functions • economically strong functions supporting weaker functions (red helping green) 	<ul style="list-style-type: none"> • structure of primary production (many small/medium-sized farms) • column structure of intensive stock farming • moving economic centre of primary production to other parts of EU/ world • agrosubsidies decreasing strongly (only real big ones can hold their ground)
Spatial planning/design	<ul style="list-style-type: none"> • economical use of space by interweaving/multi-purpose usage • improving the quality of landscape and nature • countryside as attractive area to live and work (vital habitat) 	<ul style="list-style-type: none"> • adjusting environmental/sectoral legislation and regulation • complex decisions due to increasing claims - for space - by other functions • restrictive policy for rural areas • land ownership/ land prices
Mobility	<ul style="list-style-type: none"> • mobility quality impulse in rural area 	<ul style="list-style-type: none"> • more functions means increased – car – mobility
Image	<ul style="list-style-type: none"> • sustainable production in accordance with consumer wishes • making better use of available technologies 	<ul style="list-style-type: none"> • farmer today is entrepreneur rather than employee • animal-friendly versus sustainable • volume/growth versus emission/growth reduction
Transition/organisation	<ul style="list-style-type: none"> • defragmentation of interests • defining actions for the near future based on long-term perspective • seizing opportunities for sustainable development at initial stage 	<ul style="list-style-type: none"> • great many parties, interests, cultural differences • many consultations needed, designing organisational structure • resistance to “change” • dependency relations • short-term solutions prevail over long-term solutions



Figure 5.4 Bird's-eye view of Multipark



Figure 5.2 Gelderse Valley west of Lunteren: current situation



Figure 5.3
Gelderse Valley west of
Lunteren: new situation with
Multipark

Appendix 6:

Project team members, workshop participants and interview respondents

Project team

Oosten, Dr H.J. van	NRLO
Rutten, H.	NRLO (till 1 April 2000)
Sterrenberg, Dr L.	Rathenau Institute
Wilt, Dr J.G. de	NRLO

Workshop participants, 13 January 2000

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Hetsen, Dr H.	NRLO
Hulst, Dr A.C.	Avebe B.A.
Jacobs, H.C.	VROM-RPD
Ketelaars, Dr J.J.M.H.	AB
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Mansvelt, Dr J.D. van	LUW
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Weterings, Dr R.A.P.M.	TNO-MEP
Wilt, de, Dr J.G.	NRLO
Zuurbier, Dr P.J.P	LUW

Workshop participants, 20 June 2000

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Bethe, F.	Alterra
Bijl, J.R. van der	Municipality of Bleiswijk

Broeze, Dr J.	ATO
Ekelenkamp, J.W.	TNO-MEP
Genugten, A.J.M. van	Pig farmer
Goselink, A.B.M.	Gelderland Province
Groot Koerkamp, Dr P.W.G.	IMAG
Hagens, P.	Suiker Unie
Hetsen, Dr H.	NRLO
Huizing, Dr H.J.	NRLO
Hulsbeek, Mrs M.M. van	Municipal Harbour Installations Rotterdam
Kamminga, K.J.	KNN Milieu B.V.
Ketelaars, P.C.M.	Dairy and pig farmer
Kruijf, A. de	Foundation Renewal Gelderse Valley
Kuik, J.A.M. van	SNM
Lameijer, N.	LTO Netherlands
Metz, Prof. Dr J.H.M.	IMAG
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Simons, A.E.	ATO
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Snaijer, A.M. de	LTO Groeiservice B.V.
Staalduinen, J.A. van	(horticulture)
Staman, J.	LNV/BSB
Sterrenberg, Mrs Dr L.	Rathenau Institute
Verkade, G.J.	Habiforum/EMR
Weterings, Dr R.A.P.M.	TNO-MEP
Wijnands, F.G.	PAV
Wilt, Dr J.G. de	NRLO
Zeijts, H. van	CLM

Interview respondents

Hagens, P.	Suiker Unie
Kuik, J.A.M. van	SNM
Kurstjens, P.H.A.M.	DLG
Paas, J.	Municipality of Noordoostpolder
Schalk-Otte, Mrs S.	National Consumers' Association
Schuiten, P.F.A.	Municipality of Eemsmund
Veen, Mrs M.H. van	Animal Protection Society

List of Abbreviations

AB	Research Institute for Agrobiological and Soil Fertility
ATO	Agrotechnological Research Institute
BSB	Strategic Policies Division
CLM	Centre for Agriculture and Environment
DLG	Rural Area Service
DLO	Agricultural Research Department
DTO	Sustainable Technology Development
EMR	Assessment Network for Multi-Purpose Use of Space
EU	European Union
EZ	Ministry of Economic Affairs
ICT	Information and Communication Technology
IMAG	Institute of Agricultural and Environmental Engineering
KLICT	Chain Networks, Logistics and ICT
LEI	Agricultural Economics Research Institute
LLTB	Agricultural and Horticultural Organisation Limburg
LNV	Ministry of Agriculture, Nature Management and Fisheries
LTO	Agricultural and Horticultural Organisation
LUW	Wageningen Agricultural University
MEP	Environment, Energy and Process Innovation
NOVEM	Netherlands Agency for Energy and the Environment
NRLO	National Council for Agricultural Research
PAV	Applied Research for Arable Farming and Field Production of Vegetables
RBOI	Consultancy for Physical Planning Policy, Development and Design
RPD	National Land Use Planning Agency
SNM	Foundation for Nature Conservation and Environmental Protection
TNO	Netherlands Organisation for Applied Scientific Research
V&W	Ministry of Transport and Public Works
VNG	Union of Netherlands Municipalities
VROM	Ministry of Housing, Spatial Planning and Environment