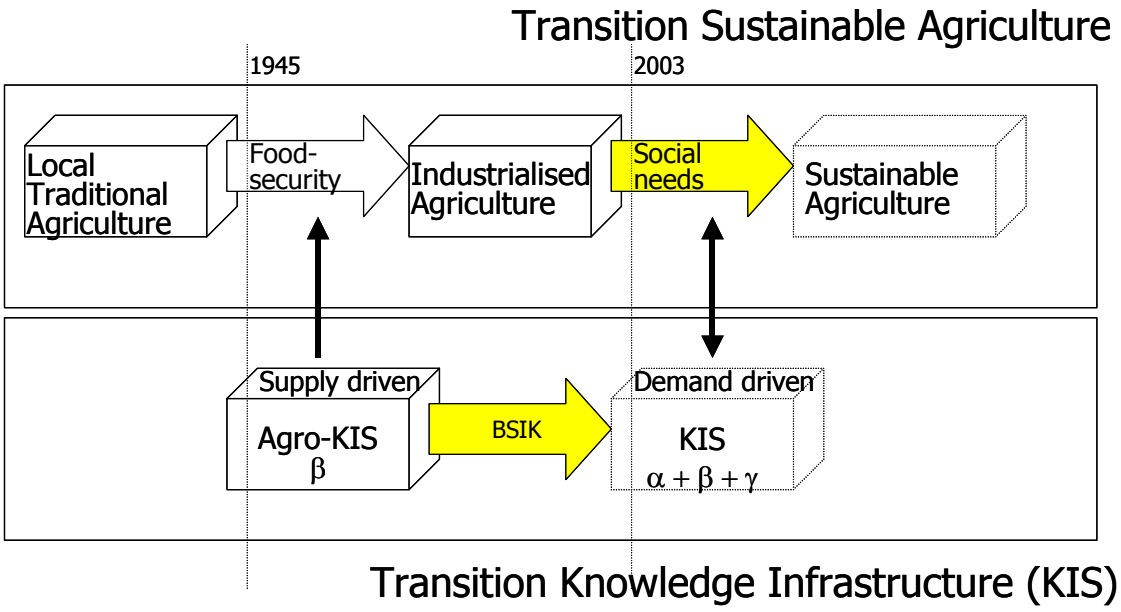
Knowledge Network
Transition Sustainable Agriculture

Bsik Project Plan



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Transition Sustainable Agriculture

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Contents

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The Cabinet has made the Transition to Sustainable Agriculture into a major target of the fourth National Environmental Policy Plan (NMP-4). The importance of the transition is also emphasized in the second Structural Action Programme Rural Areas and in the Cabinet's response to the Wijffels report regarding intensive livestock production. The transition requires a great deal of fresh knowledge; thus, in view of its great relevance to the Netherlands, the theme has been made into a key issue for policy-making in the third ICES/KIS programme.

By using strong investment incentives it is possible to build a demand-driven and interdisciplinary knowledge infrastructure based on the strengths of various universities. Although not an easy condition to meet it will be a prerequisite to ensure the high quality of system innovations needed to make the transition to sustainable and multifunctional agriculture. This will make it possible to realise a cost-effective and responsible production whitin societal limits while at the same time creating a beautiful and liveable rural area.

The urgency and complexity of the changes in agriculture and in the knowledge infrastructure have made us – executives from the communities of agriculture, agribusiness, retail, nature, environment, physical planning, tourism and recreation, financial services, insurance, logistic services and, last but not least, the universities and institutes involved - join forces. We have appointed ourselves "collaborative leaders" who wish to create space while pointing the way and establishing the conditions needed to realise the transition to sustainable agriculture.

In this context we have committed ourselves to the Transition Sustainable Agriculture project plan which was developed as part of the "Knowledge infrastructure investment subsidies decision". The project plan describes the issue of making the transition from current industrial agriculture to sustainable and multifunctional agriculture and it specifies how the required change of the knowledge infrastructure can be realised.

We are convinced that realisation of the project plan will lead to the required revitalisation of the knowledge infrastructure. As a result, agriculture's contribution to the quality of life in Dutch society will be realised better and faster.

Partnership for the Transition to Sustainable Agriculture,

Ir.ing. H. de Boon, chairman.

1. Summary

Motivation
The “licence to operate” for Dutch agriculture is at stake. This strongly influences the position of agriculture as the fundament for spatial and economic development. Increased spatial needs and the social discussion about “licence to operate” will be more and more interconnected. This gives rise to pressure on the available space for Dutch agriculture and as a consequence the vitality and liveability of the rural area are threatened. The economic value of the agribusiness will definitely deteriorate without drastic innovations of the whole system. The opportunity to develop the Dutch agribusiness to a strong international knowledge cluster might be lost. This is the main motivation for this proposal.

Transition to sustainable agriculture gives rise to the following challenges for Dutch agriculture:
1. In order to maintain and develop the economic and social value of agriculture, spatial concentration and the production of high added value should be connected. The creation of spatial, environmental and economic value needs to be intertwined.
2. In order to develop spatial quality, vitality and liveability of the rural area it is essential for agriculture - with its fundamental role in rural areas - to deliver new services, such as water conservation, nature management, recreation, human care, education and protection of cultural values.
3. In order to economically exploit its strong knowledge position, the Dutch agribusiness pursues a leading role in the orchestration of international agri-knowledge networks.

Key challenge
The key challenge is to speed up the transition to sustainable agriculture by initiating and securing a transition of the existing technology- and supply-driven knowledge infrastructure into a demand-driven infrastructure which transcends boundaries between disciplines and which has a significantly broader scope than at present. This change in the knowledge infrastructure is an essential prerequisite to make the transition from current, industrialised agriculture to a sustainable and multifunctional agriculture that anticipates the social needs for a responsible food production and a beautiful rural area.

Structure
The major activities of this knowledge project focus on the following main themes:
1. Vital clusters: high-quality supply of food and agricultural components in an urbanized delta, meeting the high demands of post-modern society;
2. Multifunctional rural areas: enhancement of socially desirable functions of rural areas, including nature and landscape management, water management, care services and recreation;
3. Orchestrating international agri-knowledge networks: developing and orchestrating international agrifood chains and knowledge networks in a liberalised global context.

The activities for the three main themes should result in developing and securing a cluster of knowledge areas within the knowledge infrastructure. This cluster, which is called Knowledge Network Transition Sustainable Agriculture, includes the following knowledge areas:
1. Functioning of agro-ecosystems
2. Value creation in networks
3. Perception and social appreciation
4. Governance

The connection of these three main themes and the four knowledge areas together with more specific knowledge development on transitions and systems innovations (related to the NIDO/KSI – scientific programme) leads to Agricultural Transitions Studies.

Within the main themes, knowledge areas will be developed along two lines:
1. Integrated projects, i.e. projects where knowledge development is realised in interaction between science, practice and society.
2. Scientific projects, i.e. basic/strategic research projects which are designed to explore the scientific knowledge that is needed for the integrated projects.

In addition, knowledge will be exchanged, transferred and disseminated as an intrinsic part of each main theme.

It is agreed to cooperate with the following Bsik initiatives: Food and Food Integrity, NIDO/Knowledge Network System Innovations, Living with Water, System Innovations, "Land Use and Development of Urban and Rural Areas" and Arrachne.

Results

The knowledge project aims at the following results:
1. Development of new knowledge: the development and validation of new concepts, instruments, methods and systems for sustainable agriculture;
2. Creation of new networks: changes in the performance of the knowledge infrastructure, directed towards:
   a. restoring the relationship of science on the one side and society and agriculture on the other;
   b. reinforcing the humanities and social sciences and connecting them to natural sciences.
3. Exchange, transfer and dissemination of knowledge between stakeholders from trade and industry, government bodies, social organisations, citizens/consumers and knowledge institutes.

Finally an interdisciplinary field of knowledge will be developed: Agricultural Transition Studies (ATS). This comprises: a) the development of new designs of agricultural systems; b) their evaluation with respect to sustainability; and c) the development of dedicated mechanisms and procedures for transition.

The result of this project is a virtual network, the Knowledge Network Sustainable Agriculture, which is connected to the Universities of Eindhoven, Tilburg and Wageningen.
The Knowledge Network Sustainable Agriculture will act as a Centre of Competence for the Sustainable Agriculture Initiative (SAI). In this way cooperation with a great number of international businesses is guaranteed.

Knowledge exchange, dissemination and transfer

Knowledge transfer and competence development will be realised primarily by "learning by doing", mainly in integrated projects where science, practice and society jointly develop and exchange knowledge. In addition, three new instruments will be developed and employed as part of the knowledge project, mainly to open up relevant knowledge in the field of sustainable agriculture for many thousands of entrepreneurs. The instruments are:
1. the *Agrocluster Academy*, an inspiring environment to provide permanent reinforcement of the cluster's learning and innovating abilities by "learning things from each other and from others".
2. the *Agro Centre Sustainable Enterpreneurship,* an international knowledge network to bridge the gap between entrepreneurs and other groups in realising sustainability.

3. the *Agroportal Duurteelt (i.e. "Sustainable cultivation")*, an internet site providing information and tools that can be used to benchmark businesses on sustainability criteria.

In order to disseminate the knowledge in the world of science, interdisciplinary scientific conferences will be organised in addition to the usual channels of scientific publications. Educational modules and training courses will be developed for specific target groups as part of the programme. Also, more common methods will be applied, including workshops, symposia, newsletters, the internet, articles and reports as well as the mass media, in order to make the developed knowledge broadly available.

Social and economic impact

When the knowledge project is completed, its social and economic impact can be characterized as follows:

1. Physical clustering of intensive agroproduction ("multipurpose use of space") is a generally accepted strategy to combine several social and economic objectives.
2. Rural and environmental services such as landscape, nature and water management, recreation and care services have become full-grown economic activities and effective arrangements have been developed to achieve adequate compensation for those social functions based on public-private funding.
3. Dutch agricultural enterprises throughout the chain and Dutch knowledge institutes increasingly succeed in acquiring strategic positions in international agri networks.
4. Sustainable entrepreneurship is broadly understood and accepted in agriculture and useful tools have been developed to have it realised in actual practice.
5. As a result of their increased awareness, knowledge and options, consumers have more influence on the development of sustainable agriculture.

Innovation as an export opportunity

Agriculture in other densely populated delta's in the world is confronted with similar problems. Knowledge and experience gained in the Netherlands with developing sustainable and multifunctional agriculture can be applied in other countries as well. Investments made in solutions realised here can amply pay for themselves if the knowledge, the systems and the organisational skills are exploited abroad. Starting from the Dutch situation, the experimental garden or the "breeding ground", it is possible to expand our leading position in the world, as in horticulture.

Knowledge consortium

A Knowledge Consortium for the Transition to Sustainable Agriculture is responsible for this knowledge project. This consortium consists of chief executives from the communities of knowledge infrastructure, agriculture, agribusiness, retail, consumer affairs, nature, environment, recreation, finance, insurance and logistics. Those participating in the knowledge consortium include:

- Knowledge institutes: WageningenUR, University of Eindhoven (TUE), University of Tilburg (UvT), University of Rotterdam (EUR), TNO and Nijenrode;
- Business organisations: the Farmers' organisation (LTO), the Product Board of Horticulture (PT), the Board for Meat Production (PVE), Unilever, Nutreco, Campina, the Retailers' organisation (CBL), Rabobank and Essent;
- Social organisations: the Dutch Society for the Preservation of Nature (NM), the Foundation for Nature Conservation and Environmental Protection (SNM), the Consumers' Association (CB), the Animal Protection Society (DB) and the Royal Dutch Touring Club (ANWB).
- Government bodies: the Ministry of Agriculture, Nature Management and Fisheries, the Ministry of Housing, Spatial Planning and the Environment and the Ministry of Economic Affairs and Limburg province.

Organisation
The Knowledge Network Transition Sustainable Agriculture is managed by an executive director who will give account to the board. Scientific directors are responsible for the content of the three research programmes, based on the three main themes. The scientific directors will be assisted by programme coordinators. Each programme will have a social advisory council and a scientific advisory council. An international advisory board will be appointed for the knowledge project as a whole. Two small units will be available for secretarial, commnunicative and financial/administrative support.
A strategic connection will be realised with the Innovation Network Rural Areas and Agricultural Systems, an independent organisation which was recently established by the government to act as an initiator, stimulator and facilitator of system innovations in the domains of agriculture and rural areas.

Finance
1. The total knowledge project amounts to 60 million euro over a period of 4 years.
2. The project is in line with the European Framework Programme FP6. Therefore cummulation of subsidy up to 65% is allowed.
3. The private sector will invest 12 million euro, government and other public bodies 3 million euro, the participating knowledge institutes will co-finance for 15 million euro.
4. Bsik has been asked for a contribution of 30 million euro.

2. Context

2.1. Background

Agriculture is the total sum of economic activities associated with producing, processing and distributing agricultural food and non-food products, including supplying industry. Primary production is realised on 60% of all Dutch arable land; therefore agriculture has a strong influence on the spatial quality in the rural areas. The intertwining of both agrifood chains with activities in the rural area is represented in Figure 1. After the Second World War agriculture has developed into a highly productive sector of national and international significance. These dimensions are further elaborated. The knowledge infrastructure has contributed strongly to achieving that position. Today, this position is under pressure as a result of growing tensions concerning agriculture's social position, its position in relation to rural areas, its international position and its position in science and technology.

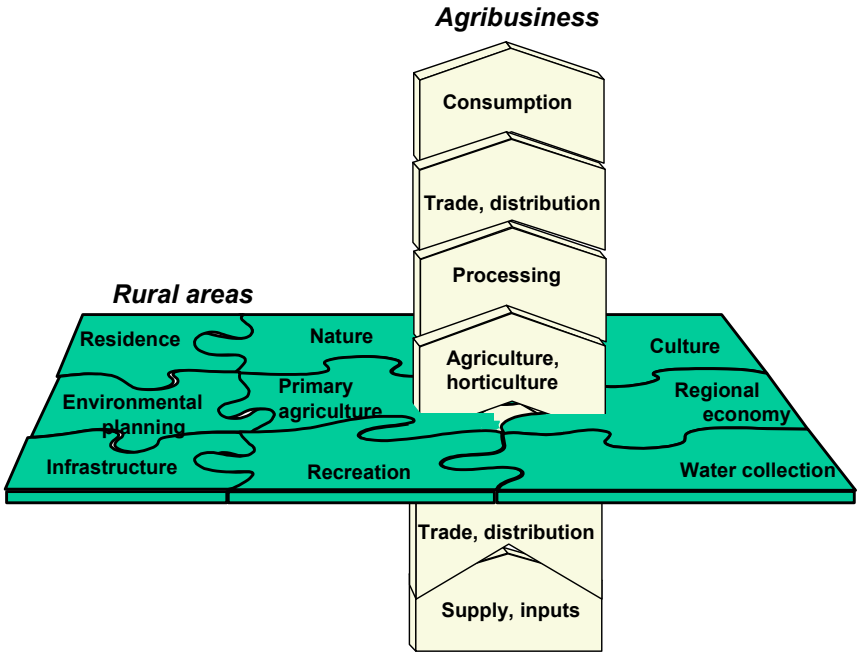

Figure 1: Key position of agriculture in food chains and rural areas

Social position
Since the transition from an agricultural into an industrialized society the gap between society and agriculture has been growing. This tendency continues when society develops into a knowledge and services economy. As a result, a large number of social values is increasingly at odds with current agriculture. New values are emerging alongside existing ones. There is broad consensus about some of them while others are being heavily disputed.

- *Existing values, which are shared*: food security, quality, liveability, innovation.
- *Existing values, which are disputed:* uniformity, price orientation, quantity of production.
- *New values, which are shared:* animal welfare, sustainability, biodiversity, transparency, landscape quality, fairer prices, diversity and variety.
- *New values, which are disputed:* small scale, natural quality, spirituality, regional governance.

Agriculture should adequately anticipate those values in order to keep its “licence to operate”.

> Following a period of strongly growing production and productivity during the first few decades after the Second World War – in which government played a highly stimulating role – a phase began in which agriculture was confronted with social, economic and ecological boundaries. By now we are at the beginning of a phase that is forward-looking, exploring and exploiting new opportunities and needs.
> *LNV, Voedsel en Groen, 2000.*

Position in rural areas
As in many other places around the world, a process of urbanisation is developing, which involves the area from Amsterdam to the Ruhr and beyond. Territories which were traditionally used only for agriculture are now gradually claimed for urban functions. Slowly but irreversibly, the urban zone is extending, thus changing the character of these areas. Several new scarcities develop, for example: the ecological strength of the area, the available space, recreational possibilities, urban infrastructure, water storage capacity, liveability, cultural-historical value, regional diversity, animal welfare, food safety, landscape quality, the need for renewable materials, the care for the elderly and the socially weak, etc. Agriculture, being the largest user of territory, closely related with rural areas, will have to acquire a new position by anticipating the emergence of new scarcities.

International position
Agriculture and its associated structure of supplying and processing industries still have a strong international position. Its favourable geographic position, a highly developed infrastructure of logistics, an internationally orientation and a strong knowledge complex as well as facilitating government policies have contributed to that position. The entry of new member states results in an expansion of the EU market. Market protection as part of a common agricultural policy by the European Union is decreasing further still, forcing the supported sectors of agriculture, mainly arable and dairy farming, to rely more and more on their own competitiveness. As a result of those liberalisation and internationalisation tendencies agricultural trade is increasingly becoming a global activity. As a consequence, competition in consumer markets will increase strongly. Maintaining and strengthening the agribusiness’ international position, both in a changing international context and in the context of social and physical tensions described, requires new strategies and approaches.

> The Dutch agrocomplex makes a nominal contribution of 37 billion euro to gross added value (a share of 10.4%). The significance of the agrocomplex for national employment is 10.7%. The Dutch agrocomplex exports 45 billion euro (19% of total goods exports), with a credit balance of 19 billion euro on the balance of trade.
> *Landbouw Economisch Bericht, 2002.*

Position in science and technology
The agrocluster is strongly autarkic with respect to its technology and innovations: most technologies and innovations are home-bred or else are borrowed from agriculture in other countries. Many other economic clusters show substantially more activity in the mutual exchange of knowledge and technology. This independent position used to be a strength of stature. However, now that technologies of a generic nature arise (biotechnology, information technology, new materials) and non-agro businesses are beginning to display activities within the agrocluster (retail, pharmaceutical industry) this may turn into a critical weakness. More openness in technology development may turn this threat into an opportunity.

Transition and system innovations necessary
The result of all this has been that agriculture is faced with:
1. a lack of balance between economic, ecological and socio-cultural dimensions;
2. social resistance against the dominant technical and economical rationality;
3. a vacuum in the governance of the necessary change processes.

Dutch agriculture certainly has the potential to make significant social and economic contributions. A fundamental transition of agriculture is urgently needed for sustainable production, international competitiveness and social trust. Modernisation of agriculture also requires that the knowledge infrastructure which is traditionally focused on the natural sciences is more dynamic and integrated.

> Transitions are long-term and interdependent processes of social transformation in which both technological, economic, socio-cultural and institutional innovations need to be achieved.
> *Een wereld en een wil: National Environmental Policy Plan 4 (NMP-4), 2001.*
>
> Major characteristics of system innovations include:
> - a more or less fundamental change of perspective;
> - a drastic change of culture with the parties involved;
> - a long-term horizon;
> - integrated innovation rather than partial improvement.

> *Innoveren met ambitie, National Council for Agricultural Research, 1999.*
>
> The relation between transitions and system innovations is that social transitions are evoked by the simultaneous occurrence of a number of system innovations in various domains.
> *Samenleving in transitie: een vernieuwend gezichtspunt. J. Dirven, J. Rotmans and A.P. Verkaik, 2002.*

Innovation as an export opportunity
Agriculture in other densely populated deltas in the world is confronted with similar problems, which have their origins in the types of social needs mentioned above. Knowledge and experience gained in the Netherlands with developing sustainable agriculture can be applied in other countries as well. Investments made in solutions realised here can amply pay for themselves if knowledge, systems and organisational skills are exploited abroad.
Starting from the Dutch situation, the “experimental garden”or “breeding ground”, it is possible to expand a global leading position in the same way as for example in horticulture.

> The world is faced with the challenge to provide food for 8 billion people in the year 2025. It is necessary to intensify agriculture on a global scale because additional arable lands are hardly available. This requires new technology if we want to maintain current biodiversity.
> *National Strategy Sustainable Development, 2001.*

2.2. Partnership Transition Sustainable Agriculture

The transition to sustainable agriculture cannot be managed by using a hierarchical control model; the complexity of this process of social change is too great to allow this. Rather, transitions are realised through interactive learning processes. These can be accelerated by key actors in a transition arena (Dirven, Rotmans & Verkaik, 2002). Such an arena has been organised to promote the transition to sustainable agriculture. The arena has three parts:
1. a group of influential “collaborative leaders” from government, trade and industry, science and society, who have committed themselves to a so-called partnership with the joint ambition to get the transition to sustainable agriculture really going;

2. an extensive network of innovators, which participate in numerous foresight studies, design studies, feasibility studies and pilot projects aimed at developing sustainable agriculture;
3. a small and independent facilitator in the form of Innovation Network Rural Areas and Agricultural Systems.

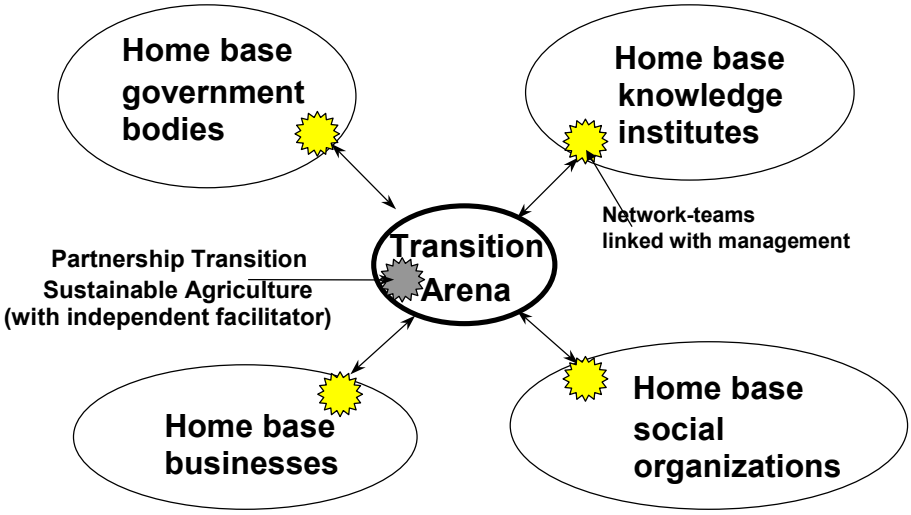

Figure 2: Transition arena and home bases for the transition to sustainable agriculture

The Partnership for the Transition to Sustainable Agriculture supports this knowledge project and wants to take the governance role. The partnership consists of leaders from the knowledge infrastructure, agriculture, agribusiness, retail, nature, environment, physical planning, tourism and recreation, financial services, insurance and logistic services (see also section 6). This broad scope is needed to find new perspectives and new interconnections.

Partnership members come from various corners of the social field: trade and industry, government bodies, knowledge institutes and social organisations. It is for various reasons that they participate in the knowledge project:

- The government wishes to use the project to boost the knowledge infrastructure so that it can promote the transition to sustainable agriculture more effectively; in addition, government is interested in developing new policy-making concepts to bring sustainable agriculture closer.
- As for the knowledge institutes, the project is at the heart of their activities: it offers opportunities to strengthen their positions at the interface between various disciplines, to enrich their network by finding new partners and to increase their contributions to solve socially relevant issues.
- Trade and industry participate mainly in order to acquire new knowledge and to expand their network, in pursuit of increasing their competitiveness; trade and industry gradually recognise the importance of socially sound entrepreneurship.
- The social organisations predominantly regard the project as an opportunity to put social issues on the knowledge and innovation agenda, including socially sound production and consumption, agrarian nature management, the physical planning of rural areas and animal welfare.

Bringing together those organisations within the transition arena will create an integrated approach such as is needed for system innovations. The aim of the members of the partnership is to stimulate and focus energy of innovators; to search and to learn; to put things on the agenda, to orchestrate as well as to implement; to both think and do; to combine short-term and long-term perspectives.

The partnership acts as a stimulator and facilitator for innovators of the network, creating opportunities for experimentation. The partnership members operate strictly as private persons, thus making room for innovative views and activities. Since they have managerial positions in their respective organisations they are able to make a difference. By doing so they will substantiate their role as “collaborative leaders” in the transition to sustainable agriculture.

It is necessary to connect the knowledge project with the partnership in order to avoid that another, entirely new organisation is set up. In addition, this connection will promote:

- adequate mobilisation of available knowledge and experience in the area of system innovations and transition processes;
- close and intrinsic links with innovation activities initiated by the partnership;
- enhancement of the coherence and synergy of the knowledge network with innovation networks, making knowledge “flow” and “work”;
- a strong carry-over from the knowledge project to politics, public administration and policy-making;
- securing achievements of the knowledge project within an existing network.

Several foresight studies, feasibility studies and pilots have already been started. Also, a number of sub-arenas for specific themes and sectors are added to the network.

2.3. Strategic context and objectives

The partnership wishes to bring about a discontinuity in the orientation and functioning of the knowledge infrastructure, which is needed to develop sustainable agriculture. It will involve changes in “soft” elements such as incentives, attitudes, knowledge, competences and networks rather than adjustments in its “hard” structure.

The context for making the agroknowledge infrastructure more dynamic and more integrated is as follows:

1. The growing intertwining of agriculture and other sectors (e.g. health, chemistry, energy, transport, recreation, water management). This increases the need to understand problems based on a multidimensional and integrated approach of the issue.
2. The blurring of the boundaries of agricultural sciences, as a result of the growing importance of developments in non-agricultural disciplines such as ICT, biotechnology, public and business administration, communication sciences.
3. The increasing importance of combining both explicit knowledge and “tacit knowledge”.
4. The disappearing of the independent position of research and education due to developments in the knowledge and innovation community; interdisciplinary innovation networks and learning networks are gaining dominant roles.
5. The increasingly international dimensions as a result of cross-border issues and internationalisation of both the economy and the knowledge market.

In addition, the very nature of innovation processes is subject to changes. Increasingly, research, product development, implementation and marketing are interrelated. All this shows that there is an urgent need to apply an integrated approach to the entire innovation chain, from basic research to application, including knowledge protection and exploitation as well as communication. Only then knowledge will be quickly available for society.

The key challenge is to speed up the transition to sustainable agriculture by initiating and securing a transformation of the existing - technology-controlled and supply-driven - knowledge infrastructure into a demand-driven knowledge infrastructure which transcends boundaries between disciplines and whose scope is broader than that of the current knowledge institutes (fig. 4). This dynamisation and broadening of the knowledge infrastructure is an essential prerequisite to make the transition from current industrialised agriculture to a sustainable and multifunctional agriculture that anticipates social issues associated with food supply, nature and landscape, environment and spatial planning, logistics and transport, water management, energy, renewable resources, the exploitation of residual flows and consumer wishes. This knowledge project is dedicated to this purpose.

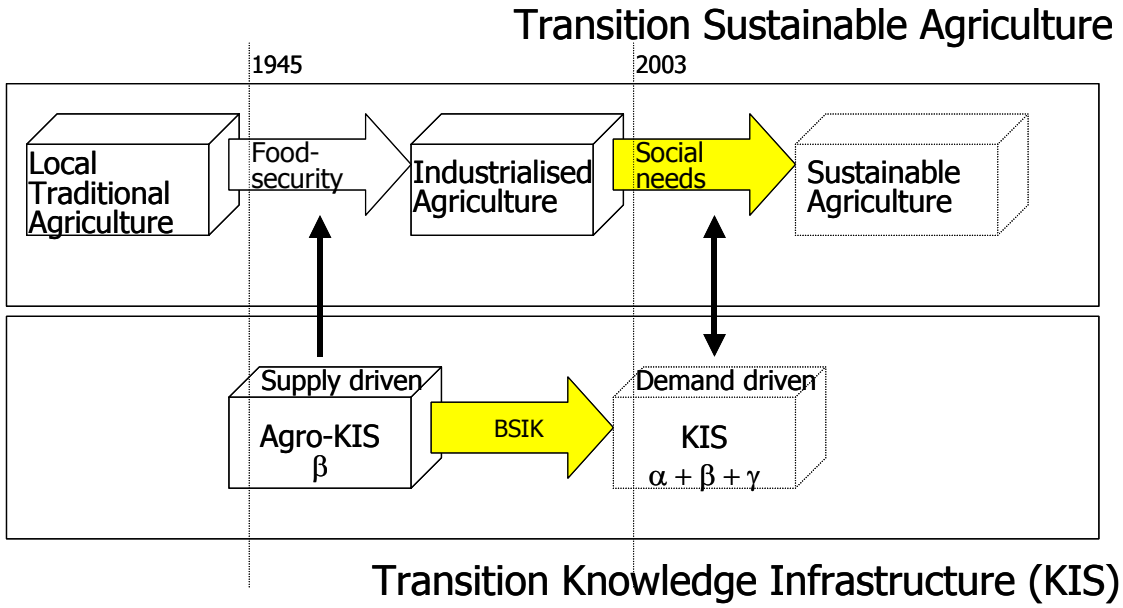

Figure 4: Transition of both agriculture and knowledge infrastructure

The following strategy is adopted to realise those objectives:

1. To create networks in which both the knowledge chain, entrepreneurs, public administrators and citizens make their own contributions, based on their respective roles. The so-called “integrated projects” are a major vehicle to achieve this (appendix 1).
2. To promote strategic knowledge development in interdisciplinary partnerships, aimed specifically at four areas of strategic knowledge development: (1) funcitoning of agro-ecosystems, (2) value creation in networks; (3) perception and social appreciation and (4) governance (see section 4.3). This is achieved predominantly in the “scientific projects”.
3. To develop and use new methods for exchanging and disseminating knowledge, for example in the Agrocluster Academy, the Agrocentre Sustainable Entrepreneurship and the *Duurteelt* project.
4. To create a transition arena, an open network of participants, supported by an independent facilitating agent. In this arena, shared ambitions will guide the transition to sustainable agriculture.

3. Problem definition

3.1. Problem analysis

The contribution of agriculture to the spatial-economic structure of the Netherlands is based on three pillars:
1. The net production value, which was 37 billion Euro in 2002, with a net surplus on the trade balance of 19 billion. The contribution of the agrocomplex to the national employment is about 10,7 %.
2. The contribution to the spatial quality, the vitality and liveability of the rural area represents a unique and huge social value.
3. The international orchestration function in agro-food chains. The yearly foreign investments of the Dutch food business amounts today nearly 32 bilion Euro and are increasing.

The “licence to operate” for the Dutch agriculture is at stake. This is caused by the increasing demands of our society with respect to production methods, the decrease in available space and the ongoing liberalisation and internationalisation of markets. This strongly influences the position of agriculture as the fundament for spatial and economic development. The vitality and liveability of the rural area are at stake. Opportunities to develop the Dutch agribusiness to a strong international knowledge cluster will be lost. Without drastic innovations of the whole system (“system innovations”) the economic value of the agribusiness will definitely deteriorate without innovations of the whole system. This is the main reason for this project proposal.

Dutch agriculture faces the following challenges:
1. *Vital clusters:* In order to maintain and develop the economic and social value of agriculture, spatial concentration and the production of high added value should be connected. Creation of spatial, environmental and economic value need to be intertwined.
2. *Multifunctional rural areas:* In order to develop spatial quality, vitality and liveability of the rural area it is essential for agriculture with its fundamental role in rural areas to deliver new services, such as water conservation, nature management, human care, education and protection of cultural values.
3. *Orchestrating international agri-knowledge networks:* To economically exploit the strong knowledge position of the Dutch agribusiness by a leading role in the orchestration of international knowledge intensive networks.

In view of the strengthening of the spatial-economic structure of the Netherlands three major innovation strategies should be followed for a sustainable development of agriculture.
1. *Vital clusters:* increasing pressures on space inevitably lead to a reduction of space available for agriculture as a producer of raw materials for food and non-food uses. A twofold strategy is needed to maintain – and perhaps even expand - its economic position at international export markets: high-quality production combined with spatial concentration. In this strategy, producing economic value and improving spatiel quality go hand in hand.
2. *Multifunctional rural areas:* the loss of economic potential by way of food production may be more or less compensated by a strategy of creating new values. By following this strategy, agriculture provides new services, for example by making combinations with functions such as water management, nature and landscape management, human care, education and the preservation of cultural-historical values.

3. *Orchestrating international agri-knowledge networks:* a third alternative to compensate for a reduction of production space is to develop a strategy for providing knowledge-intensive services with high added value in international agrofood chains.

Combining the strategies described will lead to a sustainable reinforcement of the spatial-economic structure of Dutch agriculture, to the benefit of society as a whole (see Figure 3).

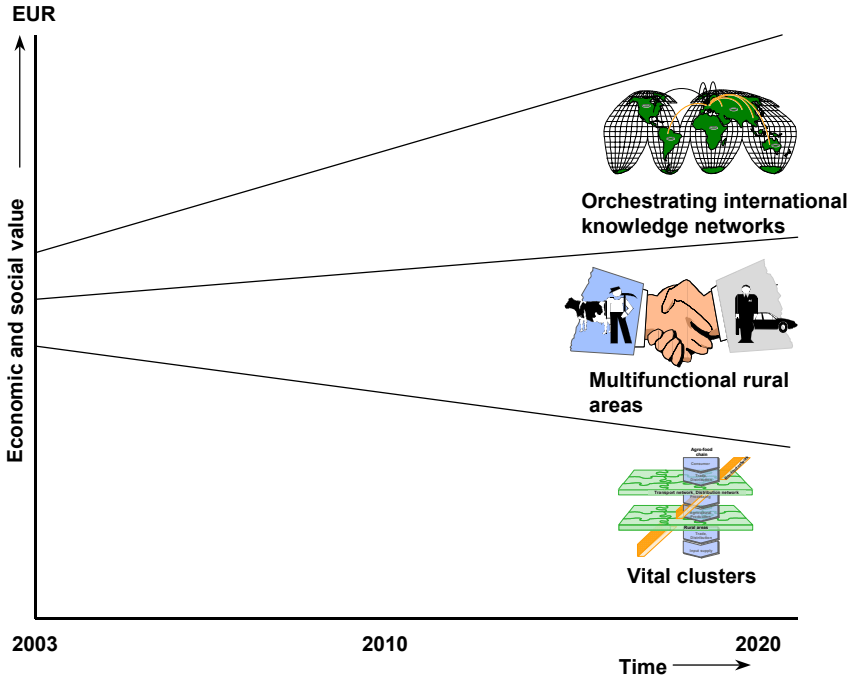

Figure 3: Three spatial-economic innovation strategies for agriculture

3.2. Challenges and key questions

The key challenges and the knowledge required to meet these challenges in the three integrated projects are described in this section. To improve the coherence of the knowledge project four strategic areas for knowledge development were identified. These areas are:

1. Functioning of agro-eco systems;
2. Value creation in networks;
3. Perception and social appreciation;
4. Governance.

For each of the three integrated projects (vital clusters, multifunctional rural areas and orchestrating international agri-knowledge networks) the major questions in these strategic knowledge fields are presented in the following.

3.2.1. Vital clusters

3.2.1.1. Challenges

The rol of agriculture in the Western world is changing from supplying food to to offering consumers freedom of choice. This refocus on demand-driven production will cause further changes in the agricultural sector in the coming decades. A second development concerns the changing requirements regarding quality of life. The way space is arranged and organised is insufficiently adapted to changes in society. The growing need to create space in rural areas, partly because of ongoing urbanisation, necessitates decisions on whether to discourage or encourage economic activity. These decisions need to be made systematically. It is about functions that currently obstruct

each other. This process will be accompanied by the concentration of activities in specific areas. Interacting with this development is the increasingly complex strategic context in which the authorities operate. Simultaneously, we are seeing globalisation and regionalisation together with alternating visions on society and, by consequence, on the policy strategies of authorities to bring about this turnaround. New concepts are necessary to address the challenge of creating changes to ways of turning these forces into opportunities.

Vital clusters can contribute to the sustainability of agriculture and market gardening through the development of sustainable agro ecosystems (design, role of technology in sustainability, configuration and optimisation of links), value creation (translating sustainable business at strategic level, social systems science focused on forming alliances and co-operation) and value-driven agriculture (perceptions, ethics). New governance concepts and institutional arrangements are required for all three of the challenges outlined above. The task that must be accomplished in the coming 15-20 years is to deliver recognisable contributions to quality of life, reduce greenhouse gases, ensure healthy food, keep a watch on animal welfare, ensure a sufficient supply of good quality water and so on.

Although technologically oriented and intensive types of agriculture and horticulture make greater contributions to economic standards they tend to have a negative impact on the desired landscape and on the ecological qualities. Since this type of agriculture is less dependent on the soil it might find a better place, for example, at high-quality business locations or agribusiness complexes.
De toekomst van het landelijk gebied, Letter by the Minister and State Secretary of Agriculture, Nature Management and Fisheries, Parliament, session year 2001-2002, 28 181, nr 1.

3.2.1.2. Key questions

The development of new knowledge and the combination of knowledge already available will play a crucial role in tackling the social issues described above. Major challenges exist in various areas of knowledge. The presence of and balance between knowledge of the environment and knowledge of production processes is crucially important. In particular, this gives rise to the following key questions:

Functioning of agro eco-systems

- How does the process of designing vital clusters and entering into co-operation agreements take place?
- Which new sustainable combinations of functions (agricultural and non-agricultural) and forms of co-operation can we develop within clusters?
- Which process modules and process links can we develop in order to interconnect companies and processes?
- Which sustainable couplings are possible between agricultural business parks and primary agricultural/non-agricultural activities?
- How can we transform glasshouse horticulture into an energy-producing sector?
- How can technology facilitate system transitions?

Value creation in networks

- How can existing rural values and other functions be utilised to strengthen the socio-economic structure?
- How can we reinforce innovations in vital clusters by utilising the combined local presence of hands-on activities and knowledge institutions?
- What type of technology is necessary to strengthen the competitiveness of regional or small-scale production?
- What opportunities are created by the presence of different types of agro-industrial activity in a cluster?
- Which prospects exist for new combinations of production (vegetable and animal) and industrial processing?

Perception and social appreciation
- What perceptions do consumers have of the use of technology in the production of food and other agricultural products?
- Which mix of communicative, social and economic instruments can help bring about a demand-driven improvement of animal welfare in the livestock sector?
- How can ethical considerations be incorporated in technology assessment?
- How can technology contribute towards the sustainability of agro chains, bearing in mind the perceptions that consumers and the public have about technology?
- How can information and communication technology (ICT) meet the need for information and communication that exists among producers and consumers?

Governance
- Which institutional arrangements and forms of public-private partnerships can we develop to reduce the risks attached to investments in specific relationships?
- How can we flexibly organise co-operation in clusters in a way that keeps in place the possibility for interim evaluation and adjustments?
- How can we design decision-making processes for the embedding in spatial planning of clusters that serve the interests of businesses, the public and other stakeholders?
- How can we transform business strategies into chain and cluster strategies?
- Which system innovations will contribute to the sustainable spatial reorganisation of the agro-food sector in areas where agricultural and non-agricultural functions are strongly interwoven?
- Which new control mechanisms and process models can we develop to initiate spatial/economic processes of change, maintain their momentum and put them on a clear course?

Sustainable entrepreneurship is about translating the challenges involved in making agriculture sustainable at system level to individual business level. The focus is on enabling individual businesses to cope with the challenges of sustainability issues, both in the primary sector and in the chain. The scientific challenge is to gain a better understanding of what sustainable entrepreneurship really is and how businesses can transform themselves towards sustainable enterprises. The applications to be developed in this knowledge project focus explicitly on the agrospecific heterogeneity of chain parties.
Based on contributions of Van der Schans (LEI) and Wempe (EUR).

3.2.2. Multifunctional rural areas

3.2.2.1. Challenges
Rural areas are facing far-reaching and complex changes. The mutual dependency between town and country is growing. The rural area fulfils many roles in society, both now and in the future: it no longer simply provides land for farming but is now also a place where city and country people can seek peace and quiet, enjoy nature, live, work and relax.

The role that agriculture plays in the rural area of the future will be determined both by the market and by the conditions that society imposes. A one-sided emphasis on boosting efficiency has so far undermined the “licence to operate” of agriculture. The fundamental shift that the agricultural sector must now undergo is to change from a supply-driven sector that is primarily motivated by economic and technical concerns into a demand-driven sector that is guided by social, cultural, ecological and other values, in addition to economic imperatives.

On a local level, many promising niches can be seen in which farmers are already displaying all sorts of activities, which are the forerunners of a transition towards a multi-functional rural system. This transition unfolds along three lines of development which are mutually reinforcing (Van der Ploeg *et al.* 2002):
1. *Deepening* by transforming existing food chains and/or developing new food chains. Typical elements of this development are biological agriculture, quality production,

For rural areas the challenge lies in bringing about socially responsible and sustainable management. This means that ecological, economic and social developments must reinforce each other within the constraints imposed by international developments.

Living and working in the rural area has already overtaken farming as an economic factor. Regulations and new financial incentives are now needed to create synergie between socially desirable developments and commercially-based activities. Economic drivers will also increasingly be deployed to improve the quality of rural areas.

There are two transitional priorities within this theme:
1. First, to bring about a dynamic and vital rural area with a broad range of user and perception functions within the conditions that society imposes.
2. And second, to develop against this background new forms of rural enterprises that are driven by social, cultural, ecological and other values in addition to economic imperatives, in order to preserve the social and cultural identity of the “rural” heritage.

The Dutch rural area is characterised by a wide diversity of qualities. The local character must be the starting point when seeking to combine economic vitality with spatial and social quality. A regional approach is essential if we are to prevent the rural area from degenerating into a stereotypical uniformity.
The challenges we face in ensuring the sustainable management of rural areras are reflected in policy in various ways. In the European context, a farming policy shifts from market and pricing policies towards a rural policy. At national level, a shift has begun in which the key priorities for rural policy encompass economic competitiveness, ecological sustainability, social cohesion and cultural identity. The role of the municipalities and provinces is also increasing under the influence of the progressive decentralisation of powers, including public involvement in the preparation and implementation of policy.

Rural areas are important as a counter-mould of the city, both spatially and morphologically as well as socio-culturally. An essential quality of rurality is that man and nature co-produce. Rurality is important to both farmers and city and country people and it extends beyond agriculture and nature. It covers a broad range of landscapes, activities like hunting and fishing, forest management, recreation and living in rural areas. Important elements are authenticity, cultural identity, social cohesion, small communities, personal ties between people, self-sufficiency, quiet, space and a “more relaxed” type of culture.
“Boeren, burgers en buitenlui”, RLG memorandum, August 2002.

3.2.2.2. Key questions

Experiences to date have shown that there are gaps in the various spheres of knowledge. Facing the need for a transition, the knowledge base in the following areas must be strengthened in the following areas:

Functioning of agro eco-systems

- How can agriculture be transformed so that it contributes more effectively to preserving ecological values such as natural habitats, landscape, open spaces, peace, silence and darkness (less light pollution) – while at the same time ensuring its own economic continuity?
- How does agricultural diversity in an area contribute to natural biodiversity, the natural resilience of ecosystems and the prevention of animal disease?
- How can spatial planning be used to uphold the ecological and agro-production potential of an area in the face of a sharp rise in other functions?
- What contributions can farming make to resolving issues of e.g. water management, renewable energy, regional identity and recreational land-use?

Value creation in networks

- What processes do consumers apply when making choices: what are the alternatives and when are they selected?
- What are people's future needs, for example regarding regional identity, and how are these needs to be identified?
- How to make agreements in rural services, in order to uphold both the future value of the rural areas *and* the needs of consumers?
- How to develop a professional retail function for the rural area?
- What systems are required to ensure that users of public goods and services actually pay for them?

Perception and social appreciation

- What are the ideas and perceptions of different groups of people (lifestyles) concerning the quality of the rural area?
- What role do citizens and consumers see for farming in the context of preserving and strengthening ecological values in the region?
- What are the consequences of the tensions between *consumer concern* and *citizen concern* and how can society tackle them?
- What parameters does (will) civil society apply, both now and in the future, to the sustainability outlook and the preservation of collective values?

Governance

- What is the role of the various levels of government in rural innovation processes, taking into account the availability of public assets and the deployment of public funds (governance)?
- What new role allocation is required - and is desirable - between citizens and governments in structuring and managing the rural area?
- What qualities should civil servants and administrators be given in order to develop the new role of the authorities?
- What new role should businesses, research institutes and lobbying groups have integrated projects, and what qualities do they require?

3.2.3. Orchestrating international agri-knowledge networks

3.2.3.1. Challenges

In the future sharp reduction of the primary production and processing may occur. It is possible to compensate for the loss of these economic activities by developing

promising scenarios with different kinds of added values in terms of knowledge and services:
1. From producing to orchestrating
2. The Netherlands as an “experimental garden”

1: From producing to orchestrating
Global marketing and sourcing dominate the world stage for agricultural food. The big players have strategies built on efficiency and economies of scale with high-profile international consumer brands (Engelbart, 2002). Opportunities exist in developing services in supply networks. There is an increasing need for new services like the world-wide mobilisation of production areas, new marketing concepts, certification concepts underpinning standardised production and ICT for efficient and secure information exchange in the networks. There must be knowledge centres that enable the solid development of knowledge and its channelling to different actors in the network who perform different functions. Materialising such a scenario requires professional orchestrators. There is a need for collaborative network services focused on matching the supply of products/services in a global market with consumer demand. Dutch horticulture has proved that it is possible to attain a top position as an orchestrator.

2: The Netherland: as an “experimental garden”
The agricultural production cluster together with its knowledge infrastructure provides a basis for making the transition to high-quality agricultural food supply and technology networks. This makes it necessary to link up old and new core elements of the knowledge infrastructure. There are opportunities in using scarce agricultural land and the deployment of knowledge companies in the Netherlands for research and development focused on high-margin products with embedded knowledge as opposed to bulk production with low margins. Examples are breeding material, hi-tech production methods and management software. The Netherlands can become an “experimental garden” for new products in a responsive, fast and continuous R&D cycle. This transition will create a knowledge-intensive, innovative entrepreneurial climate that attracts internationally operating companies and results in the creation of brain clusters capable of organising and materialising new orchestrated services. The R&D cycle will be anchored in a network that is able to transfer production of sufficiently mature products to other countries but always under orchestration.

The Dutch food and non-food industry currently invests approximately EUR 32 billion per year in other countries (with an average year-on-year growth of 12% over the 1984-2000 period) (ZLTO, 2002). These investments are mainly in traditional acquisitions in order to produce economies of scale, synergy effects and concentration on core business. The managing boards of companies opt for this logical path because it fits in with their sphere of influence. At the same time it creates scope for developing an international orchestration function and the “experimental garden” concept. An external incentive in the form of Bsik is the only way to break away from the existing investment dogma. This incentive must demonstrate that there are also other promising avenues of development. The upshot will be a new investment climate by stimulating, arranging and facilitating system innovation processes. “Experimental gardens” and scientific bases for gained experience are necessary in order to climb to the next step on the development ladder of the Dutch agricultural food business.

3.2.3.2. Key questions
A situation must be avoided whereby pressure from society necessitates dismantling the economic cluster within the space of a decade. This makes it essential to address complex issues like those mentioned below.

Functioning of agro eco-systems

- From production to the international orchestration of goods flows. Which future-oriented sustainable commercial services concepts can be developed in order to take on the role of orchestrator in a liberalised market according to the "organisation of networks" principle?
- How can allowance be made for prevailing social issues like animal diseases and animal welfare in the context of international transport movements (Wijffels, 2001) and transport prevention.
- How can adequate food supplies be secured to meet current and future food demand and reduce external inputs.
- To what extent is maintaining local production, possibly in a modified form, crucial to the sustainable creation of an international orchestration function and to acquiring a position as “experimental garden”?
- Knowledge of product passport orchestration: what information do different types of consumers, companies in the chain and authorities need (and via which medium) with regard to food safety, plant health and animal health?
- What methods can be set up to manage decisions based on the weighting of effects?

Value creation in networks

- Development of economically viable and responsible farming systems, enabling local communities to protect and improve their livelihoods, safeguard their environment and improve their well-being.
- Where must value be added (at the beginning or at the end of the production chain)?
- What possibilities exist for interconnecting supply networks?
- In terms of scale, to what extent is it possible to benefit from uniform, standardised systems (ICT, quality control for food safety) and when should a customised approach be adopted (country, target group)?
- Knowledge of regionalisation, downsizing, local clustering and the marketing of regional products for local consumers: how should these matters be tackled? How do you make the link between international orchestration and local production (small and medium-sized enterprises, including farmers and market gardeners). What added value does participation have for the actors?
- Which knowledge competences need to be developed in the Netherlands, for which competences is it necessary to form alliances and how can international knowledge networks be made accessible in an effective way? Knowledge of designing, organising, marketing and arranging interactive multi-actor innovation systems in international supply and technology networks. Knowledge of creating profitable, responsive R & D mechanisms.
- Knowledge of preconditions maintaining the orchestration function in the Netherlands in a sustainable way. Or should the knowledge be acquired in other countries, in which case will there be a risk of losing the orchestration role in the longer term? What are the decisive factors in these deliberations?

Perception and social appreciation

- How can an export of (perceived) environmental problems, such as minerals and emissions like greenhouse gases be avoided?
- How can we obtain the scientific basis necessary for translating emotions into business practices?
- Knowledge of the switch from bulk production to high-value “experimental garden” concepts: what does this entail in terms of the competences and businesses of farmers?
- Knowledge of the importance of the culture component in international orchestration and acceptance by third parties of Dutch orchestration.

Governance

- How do these new economic activities square up in relation to WTO agreements, the Common Agricultural Policy, EU legislation, competition laws and national trade interests?
- What are adequate typologies of business models and performance indicators for the purpose of international orchestration?
- What are the requirements to be met by and the availability of ICT tools for orchestration?
- Knowledge of institutional embedding, the establishment conditions that need to be created and the investments that must be made in human assets.
- How can new forms of government control and responsibility be fleshed out?

4. Scientific relevance

4.1. Scientific/technological innovativeness

The scientific and technological innovativeness of this knowledge project has distrinct features in various ways, especially as:

- A change of paradigm: takes a different perspective on specific issues, producing new solutions.
- New focus: the themes addressed here can hardly be found on the national and international research agendas.
- An integrated and problem-oriented approach: never before was there an effort to deal with various aspects of the issue in all their interrelations.
- Elaboration or application of new concepts: recently developed theories and concepts are applied to the agrosector for the first time, which may lead to breakthroughs, on the one hand, and adjustment of concepts and models, on the other.
- Collaboration between disciplines: scientists from highly diverse disciplines work together on projects, thus producing cross-fertilization and developing new insights and concepts.
- Method: research and knowledge management are combined, intending to realise system innovations.

In table 1 the innovative character of the knowledge project is explained in more detail, starting from the different aspects mentioned above.

Table 1: Innovative character of the knowledge project

	Vital clusters	**Multifunctional rural areas**	**Orchestrating international agri-knowledge networks**
Change of paradigm	agrosector: from producing commodities in chains to supplying high-quality products in spatial clusters	rural areas: from monofunctional to multifunctional consumption space	agrochains: from physical manufacturing industry to international service provider
New focus	value creation in spatial clusters of businesses	arrangements to have collective services carried out by private businesses	orchestration and knowledge management in cross-border networks
Integrated and problem-oriented approach	geographical clustering, resource sharing, alliance building, symbiosis	redesigning agriculture and institutions at micro-, meso- and macro-levels	frameworks for the role of international network director
Elaborating or applying new concepts	Porters' cluster approach; industrial ecology, process architecture, cluster building	theory of collective goods; ecological economics	strategic network theory; global commodity chain approach
Collaboration between disciplines	sociology, agronomy, agroprocess technology, physics, systems analysis, administrative and organisational management	biology, public administration, political science, sociology, economics, psychology, law, ecology	economics, business administration, sociology, agricultural sciences, public administration, ICT

Method	developing an agenda, interactive networks, room for experimentation, learning by doing	organizing partnerships, learning by doing, experiments broader services	organizing international knowledge network, model designs

4.2. Project scope

What the project brings about is that strategic knowledge, networks and methods are developed to realise the transition to sustainable agriculture.

1. *Strategic knowledge:* selected objects of study (vital clusters, multifunctional rural areas and orchestrating international knowledge networks) do not have an established "pools of knowledge" in the selected fields a national or international context. The project comprises investments in developing this knowledge, especially in the fields of agro-ecosystems, value creation in networks, perception and social appreciation and governance.
2. *New networks:* The knowledge project brings about new partnerships between disciplines, between universities and research institutes, between research and education, between those demanding knowledge and those supplying knowledge.
3. *New methods:* The project helps to develop new methods that are designed to promote both interdisciplinary collaboration and transfer of knowledge into practice. Methods to be considered here include designing, interactive research and internet applications.

The scope of the knowledge project will be explained in more detail in the following sections.

4.3. Knowledge and skills to be developed

It is the ambition of this knowledge project to develop a body of coherent and application oriented generic knowledge. This section outlines that this body of knowledge can be built upon a variety of current scientific disciplines and by which organisational means we intend to render this field of knowledge durable.

We propose to call the field of activities comprising i) the development of new designs of agricultural systems; ii) their evaluation with respect to sustainability; and iii) the development of dedicated mechanisms and procedures for transition: Agricultural Transition Studies (ATS). Agricultural Transition Studies is a multidisciplinary endeavour that will address the issues related to the transition of agriculture towards sustainability on the basis of four dimensions.

1. Functioning of agro-ecosystems: How does the system function in a technical sense?

- What are its *physical* and biological properties?
  Issues addressed are of a technical nature: the nature of the production technologies, the use of energy, emissions to the environment.
- What are its *spatial* properties?
  Issues addressed concern spatial planning: land use, infrastructure, multifunctionality, spatial clustering; competing spatial claims.
- What are its *information* properties?
  Issues addressed concern information needs, the flows of information, the use of ICT.

2. **Value creation in networks: What are the benefits of the system?**

- What are the sources of added value?
  Issues addressed are scarce factors (competencies, proprietary technologies, unique selling points), joint production of private and public goods and services.
- How is added value distributed among actors in the production system?
  Issues involve: rights to benefits, distribution of power, relationships between private interests and public interests.

3. **Perception and social appreciation: How do people appreciate the system?**

- What are the public perceptions?
  Issues are of an ethical nature (the valuing of products or activities) or have to do with perceptions and appreciation of risk.
- How does the system affect human and social capital?
  Issues concern the development of new or the loss of traditional knowledge and skills, social and professional networks, and cultural values.

4. **Governance: How does the system function in a social sense?**

- What are its *social* properties?
  Issues addressed concern: private and public interests, systems of exchange (markets, contracts) and incentives, systems of governance, social networks, entry barriers.
- What are the relationships between the system and the social environment?
  Issues are: public policy, the institutional environment.

ATS draws its theories, methods and insights from the technical as well as the social sciences (see Table 2). It makes use of predominantly analytic approaches from the life sciences and disciplines like economics and sociology, but it also draws on prescriptive approaches from business sciences, spatial planning, information systems analysis and logistics. It brings together deductive, theory based science with inductive, participative learning and stakeholder involvement.

Table 2: Agricultural Transition Sciences as a multidisciplinary endeavour

	Relevant disciplines and approaches
Functioning of agro-ecosystems	Life sciences Technological sciences Systems analysis Spatial planning and landscape architecture Information systems analysis
Value creation in networks	Economics: micro-economics, industrial organisation, cost benefit analysis, welfare theory Business administration: strategic management, finance
Perception and social appreciation	Sociology: consumer theory, trend analysis Ethics: value clarification, pragmatism Communication sciences Business administration: marketing
Governance	Economics: institutional economics (property rights theory, contract theory, transaction cost theory, agency theory), public economics Business administration: organisation theory, governance theory Political sciences: public administration Sociology: organisational theory

4.4. Scientific approach/method

4.4.1. General approach

The central working method in this knowledge project is based on the concept of integrated design, as an important tool for enhancing communication between scientists from various disciplines (see textbox).

Integrated design

Design is a specific kind of problem-solving in which knowledge is synthesised to higher levels of integration: from process level to company level, from company level to supply chain level or from company level to cluster and orchestration level. Steps distinguishable in this trail include problem definition, target formulation, development of solutions, prediction of effects, selecting and implementing solutions. The gamma sciences are particularly important in the first and last phases. An integrated approach ($\alpha+\beta+\gamma$) is necessary in the analysis phase. In the model-driven phase in which the alternatives are developed a more discipline-oriented approach can be followed. This methodology of systems analysis allows scientists from various disciplines ($\alpha+\beta+\gamma$) to work within a common framework in order to design agro-ecosystems. Designs for agricultural systems differ from technical designs because living systems are involved. This integrated design approach needs to be embedded in the integrated programmes.

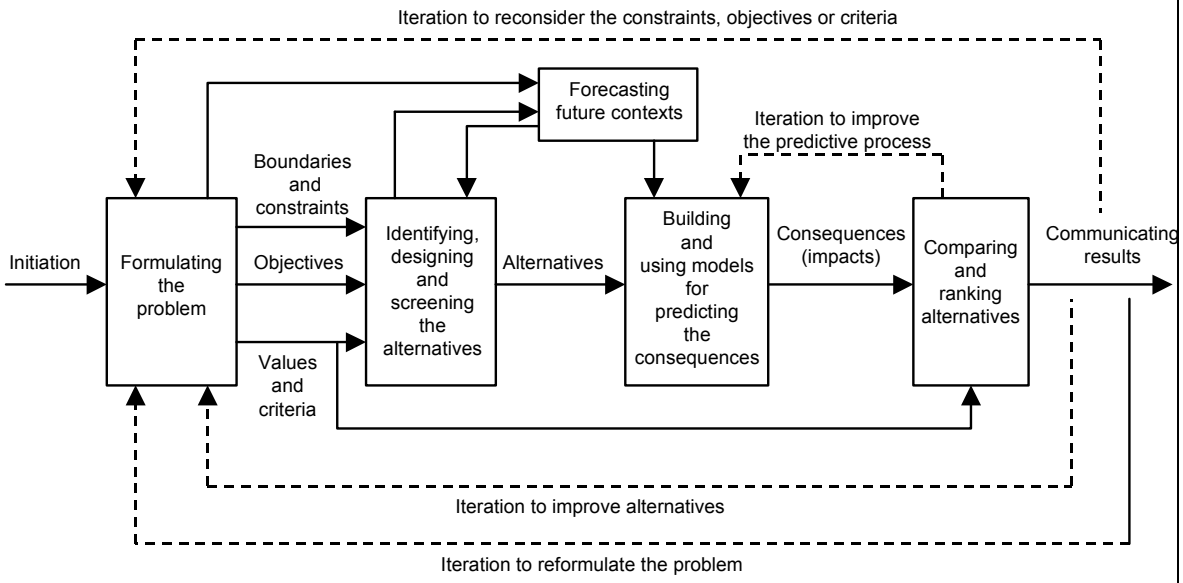

Figure 5: The methodology of systems analysis (source: Miser, H.J. and E.S. Quade (1985): Handbook of systems analysis) .

Scientific projects

They involve knowledge development aimed at strategic issues that play a role in the transition to sustainable agriculture. This type of research has a is fundamental/ strategic character. Scientific questions arise from long-term innovation targets for sustainable agriculture, as expressed in the main themes. Often, they involve the development of concepts, theoretical models, intervention strategies, institutional arrangements and technical modules that may bring sustainable agriculture closer. The scientific methodology will be determined predominantly by the developments of science and technology. This dynamic has a strong international dimension, taking place mostly beyond the agroknowledge infrastructure. The challenge is to utilize this scientific and technological dynamic to resolve issues in relation to making agriculture sustainable.

Integrated projects
Most knowledge resulting from basic/strategic studies cannot be immediately applied in practice. On the other hand, innovators in actual practice are frequently unable to formulate adequate questions for basic research. “Integrated projects” will be started, therefore, which include small-scale experiments with new concepts, methods and techniques. The focus will be on inductive research based on “learning by doing”. Thus, on the one hand, knowledge transformation and validation will take place in interaction with stakeholders; on the other hand, the social and technological experiments will give rise to new questions for basic/strategic research. The integrated projects also play a major role in realising the dissemination and transfer of knowledge developed. The inserted boxes in this section provide some illustrations of integrated projects. More detailed information can be found in Appendix 1. The specific questions in these projects will be developed into scientific projects to ensure a close link between the scientific and integrated projects.

Transition processes and system innovations are learning and exploring processes that are characterized by high degrees of non-linearity with considerable risks of damage. As a result of the coherence between the scientific projects and the integrated projects, a dynamic will develop that is typical of the non-linear nature of the transition and system innovation processes. Knowledge will start to work and flow.

4.4.2. Research programmes

4.4.2.1. Vital clusters
The "Vital clusters" theme will produce theories and new concepts for the development of sustainable clustered agro-production systems that meet society's changing demands. The key scientific question can be formulated as follows: how can development of vital spatial clusters of different kinds of high-output and knowledge-intensive agro-production systems promote intensified economic, ecological and social sustainability through improved co-ordination by coupling materials and energy streams?

Horst Agro-Ecopark in a “Four-leaf clover”
The overarching objective is to create clusters of mutually supporting production units in the agricultural sector in the North Limburg region with a transparent, sustainable and high-tech symbiosis of production processes (the Agro Ecopark concept) and join up and interconnect vertical co-operation in “Four-leaf clover”(*Klavertje 4)*. “Four-leaf clover” is a public-private partnership. Relevant issues are:
- How can the process be organised flexibly to allow interim evaluation and adjustment?
- Which sustainable combinations of functions (agro and non-agro) can be developed?
- Where does the balance lie between return, efficiency and vulnerability of agro-ecosystems?

The project will seek to answer this question by addressing the development of new production methods and products demanded by consumers, spatial organisation (clustering) and the harmonisation of processes and companies in geographical clusters. Clusters of businesses have successfully been created in various technological sectors (Porter, 1990). These are "geographical concentrations of companies, suppliers, related industries and specialist institutions that occur in a certain field in a nation, state or city". Clustering presents new opportunities for sustainable developments: economic development, ecological improvement opportunities, new roles for the business community, government and institutions; new structures for the relationships that exist between the business community, government and the knowledge infrastructure. Successfully developing industrial areas (including those in north-east and central Italy, Silicon Valley and Toyota City) have in common regional clusters of learning-based industries; they are clusters of knowledge, talent and innovative capability. The vision on logistics in agribusiness, set down by the Ministry of Economic

Affairs, the Ministry of Agriculture, Nature Management and Fisheries and the Ministry of Transport, Public Works and Water Management, defines agricultural business parks in the following way: "Locations that combine numerous logistical functions within agricultural chains (distribution, trade, warehousing) with facilities for production and processing. Agricultural business parks exist mainly to process and distribute products. To a certain extent these parks offer opportunities for production unrelated to land (glasshouse horticulture, intensive livestock farming)". It is precisely because science has developed mainly towards the development of specific chains that there is now insufficient knowledge about the possibilities and sustainability implications of a clustering of agro and non-agro activities.

Protein Highway A1
The purpose of this project is to help develop knowledge of how to achieve the system innovations necessary to cluster agricultural business and primary companies in the animal sector. This will unite the development of theoretical models and workable managerial and organisational concepts that enable reduction of the costs of trial-and-error associated with clustering.

Functioning of agro eco-systems
One of the mainstays of vital clusters is the principle of industrial ecology as pursued at sustainable industrial parks. The general goals of this principle are to contain the use of virgin raw materials and energy and reduce waste and emissions. In the case of agro-production clustering contributes to other goals, such as improving the quality of the landscape, reducing traffic congestion, using space more efficiently and making transparant chains and networks. Lambert and Boons make a distinction between two main types of co-operation in geographical clusters:
1. Mixed parks: co-operation in clusters with the aim sharing resources (including information, equipment and infrastructure) and forming alliances for the purpose of improving new technical links, economic profitability and other objectives in society.
2. Industrial complexes: co-operation with an emphasis on streams of materials and energy.

This second form already exists, especially in the chemical industry. The first form, particularly applicable to the agricultural sector, still gives rise to numerous scientific questions especially with regard to such matters as types of co-operation and mutual trust.

Work is underway in the integrated project “Sustainable agro developments in South Groningen" on forms of co-operation built on the "industrial complexes" principle, while concepts based on the "mixed parks" principle will be applied in a multi-functional region around the A1 motorway and Horst agro-ecopark.

The major challenges in agricultural process science, physics and systems science focus on the technical coupling of processes and streams. These challenges require a system designing approach whereby - after analysis of the wishes of customers and citizens by means of various scientific tools like theoretical analyses, models from various disciplines (optimisation models, eco-physiological models for crops (e.g. Kropff et al, 2000; van Ittersum et al, 2002) and empirical studies - production systems are designed and a check is made on the implications of the direct coupling of energy, minerals and carbon dioxide streams between agricultural production system in economic, ecological and social terms of sustainability. This project will use the designing approach described in section 4.4.1. in an interactive way with interested innovative entrepreneurs and other stakeholders. Ultimately, the entrepreneurs will have to invest in materialising the designs.

Published articles on cluster creation and national innovation systems show that this requires a strong knowledge infrastructure that responds to regional issues and develops new scientific approaches. This infrastructure is necessary for the articulation

of knowledge questions, the conducting project management in which the researcher (alpha, beta, gamma) and the client communicate effectively, and the dissemination of the results to ensure that knowledge actually leads to innovation.

Value creation in networks
Since agriculture causes environmental damage as a result of growing food to feed people, there seems to be a still-to-be-resolved conflict between human needs and environmental integrity (Aiken, 1984). A serious effort to develop alternative land use, farming systems and food systems for the 21th century should be initiated (Ruttan, 1991). Value creation in terms of sustainability goes beyond money alone. Besides economic value at all links in the chain, it is about ecological values (environmental effects through less waste, energy consumption, use of roads for transport, carbon-dioxide, use of space and social values (good working conditions, acceptable and safe chains, regional prosperity, etc.).
Trying to estimate wealth raises important conceptual, methodological, and measurement issues. A set of detailed indicators is required to identify and deal with problems and possibilities. Methodologically future work must also start addressing the issue of social capital. Moreover, the local and supranational effects must be adressed (Serageldin, 1996).
An important consideration is the perception of how companies transform towards sustainable business (Elkington, 1998; Keijzers et al, 2002). Another matter to the fore is the organisation of social involvement in and decision-making about the transitional challenge (Kaptein en Wempe, 2002) and the translation of sustainable business at strategic level (Keijzers et al, 2002; Marrewijk en Hardjona, 2002; Hupperts, 2001).

Glasshouse horticulture as a source of energy
Glasshouse horticulture is a large user of fossil energy in the form of natural gas. However, the sector has the potential to become a supplier of sustainable energy. In The Netherlands, the amount of sustainable sources of energy per m2is higher than the consumed amount of fossil energy. The goal of this project is to design innovative concepts (including innovative systems) to trigger a turnaround in established thinking and acting regarding utilisation of sustainable sources of energy. Issues are the design of local and regional 'energy webs' of suppliers and consumers of energy; and the replacement of CO_2 supply from fossil sources to alternative sources such as fermentation, residue from industry, etc.

Perception and social appreciation
Emphasising standards and values, mentality and socio-cultural variables is becoming more popular as a way of understanding businesses, citizens and consumers. Inglehart (1990) points to the importance that people today attach to intangible matters like environmental protection, political sway and consultation and, last but not least, personal development. While Inglehart displays considerable interest in post-materialism from the point of view of democratic voice and political activism, he formulates post-materialism widely in terms of "a greater emphasis on the quality of life". The community at large will ask manufacturers and consumers how they make allowance in their economic activities for the interests of people, animals and nature. Sustainable business aimed at obtaining a *licence to operate* is interpreted as being ecologically, socially and economically soud (Elkington, 1998). The scientific challenge lies in deepening the significance of sustainable business in the agricultural sector.

Governance
Mechanisms of self-management by users of natural resources can be explained from the point of view of the new institutionalised economic viewpoint (property rights) and from the point of view of the social network. The network perspective shows successful examples of self-management by mobilising social networks. Few new insights have been obtained so far into power and power distribution issues. The key issues in this regard are (1) understanding and influencing perceptions of power, (2) making differences in power work, and (3) orchestrating and influencing negotiations.

There are several concepts for self-management: the classic interpretation of common ownership, the theory of communicative action and "law and economy". In the final analysis, every form of management - whether self- management or management by government - derives its legitimacy from the arguments that validate this kind of management and the debate that takes place between individuals.

The role of government lies in recognising and protecting the natural wealth of resources. Based on the theory of communicative action, politicians and society must ensure that wishes and needs of citizens expressed in the debate in society are reflected in the formal institutions (Habermas, 1981).

The "law and economy" perspective addresses more specifically the elimination of unnecessary tensions between legislation on the one hand and the need of actors to co-ordinate their action effectively and efficiently on the other. This necessitates reducing transaction costs, helping solve distribution issues and creating for self-management conditions equal to those with public management.

The perspectives described above complement rather than exclude each other. The key question is how the control potential of economic instruments for achieving more sustainable management can be used more effectively (Van der Schans, 2001).

4.4.2.2. Multifunctional rural areas
Rural areas and agriculture are facing processes of radical change. These processes show a high degree of mutual dependency. The transition to a broad and versatile rural area can only succeed if agriculture also changes and new forms of rural activities emerge. Conversely, the transition to sustainable, profitable agriculture will benefit from a growing social demand for other services besides food production.

Flevoland Knowledge Estate
The Flevoland Knowledge Estate is an area-driven process searching for new and additional forms of financing green services. Some of the key knowledge questions are:

- How can rural entrepreneurs, the authorities and community organisations be mobilised to undertake the broadly-supported organisation and commercial operation of sustainable agriculture that serves towns?
- how can a knowledge network be created of urban-rural relationships in the region, the Netherlands and Europe to allow the Flevoland Knowledge Estate (and other initiatives) to generate a ripple effect?

The challenges for knowledge development mentioned in section 3 not only require applied and strategic research, they also ask for a deepening by fundamental research. Discussions with experts and a quick scan of the literature may provide an outline of relevant fundamental research issues, which will be treated in this framework.

Functioning of agro eco-systems
For the re-designing of primary production, fundamental research will have to aim at increasing insight into the social, economic and ecological significance of a broad spectrum of forms of rural development (Leeuwis, 1999, Oostindie et al., 2002). To this end, it is important to acquire insight into the specific relationships between local circumstances, the production and processing methods, the composition and quality of raw materials and the effects on the sensory quality of the end product (Makowski et al., 2001). The potential for synergy in diverse combinations of services in relation to the surroundings is an important focus for fundamental research (Brunori & Rossi, 2000). This will generate an important knowledge base for many experiments taking place throughout the country.

Value creation in networks
Rural value creation involves ecological and socio-cultural values as well as economic values; in other words, it concerns functional values, future values and experience values. Issues are the followiing:

- Which values can be discriminated? How do they relate to each other? Hooimeijer, Kroon and Luttik (2000) have tried to elaborate the concept of spatial value. We can build upon their efforts.
- Which methods can be used to determine the value of rural services and goods, under different circumstances? Three main methods are available: contingent valuation method, travel cost method and hedonic pricing (Bateman, 1994, Hillebrand and Mulder, 1997).
- How to can the provision of the different qualities of rural areas be matched with demands in society, in a way that serves the different values? Borgstein et al (2001) give examples of regional chains which are sustainable both from an economical, ecological and social viewpoint.

Agriculture and rural areas for a healthy society
The project's overall objective is to ensure that agriculture and rural areas in and around towns make the fullest possible contribution to the social, spiritual and physical well-being of residents (the public and companies) in urban areas. The project will be carried out in and around Amsterdam, Rotterdam and Deventer. Some of the knowledge issues:

- Which new designs can be developed for healthy, 'green' agriculture and what are the effects on economic, ecological and sociocultural aspects?
- What are suitable new financing concepts?

Perception and social appreciation

- Issues concerning experience (Weick, 1995, Hajer, 1995). What is experience, exactly? Of which elements does experience consist? How does the appreciation of experience come about? Which dimensions of experience can be distinguished? To which feelings does experience appeal? Where does experience come from? What is the connection between objective phenomena and subjective experience? How can the heightened interest for the experience value of the physical environment be used to reinforce the public acceptance of quality (future value)? There is a lack of theoretical knowledge surrounding the phenomenon of experience. See also G. Schulze (1992), R. Kaplan & S. Kaplan (1989), Hartmann & Haubl (1996), MacDermott (1976), Pine & J.H. Gilmore (1999).
- Reflexive communication. The proposed solution presumes a permanent dialogue between stakeholders in rural areas (Schön, 1983, Beck et al, 1994). That is difficult to realise, given the fact that those involved differ greatly. How can governments, for example, develop 'ears' for what is wanted at the bottom and simultaneously communicate what is possible in society's interest, without appearing to be overbearing?

Sustainable Rural Development project
In connection with the reconstruction in Gemert-Bakel several urgent matters ask for resarch and monitoring. A consortium of partners, among which Telos and the province is interested in:

1. Elaborating the concept of sustainable rural development and hence to establish what

Governance

- The development of new modes of governance, whereby a contribution is made to the scientific "growth industry of theories of governance" (Van Kersbergen & Van Waarden 2001). This specifically concerns scientific debates on multi-level governance (Köhler-Koch & Eising, 2000; Scharpf, 2000), management without government, such as network concepts (Rhodes, 2000) and self-regulation (Ostrom 1990) and the legitimacy and responsibility of governance. (Schmitter, 2001).
- Dealing with uncertainty. Three forms of uncertainty are under discussion: 1. Concerning developments in the surroundings; 2. Concerning the values of stakeholders (that are anyway subject to change); 3. Concerning the connection between tractable subjects (which can change over time) (Friend & Hickling, 1987; Faludi, 2000). Main issues are: the identification of uncertainties and the incorporation of uncertainty in policy and organisation (Lane & Bachmann, 1998; Hajer & Zonneveld, 2000). Secondary issues are, for example: How do you organise your ownership ratios in such a way that risks are acceptable to all the participants? What should be regulated by contract and what should not? How can the behaviour and performance of co-operating partners be supervised?
- The relationship between knowledge and operations, or in other words, between thinking and doing (Friedmann, 1987). The question is not simply how it can be arranged that the right knowledge be delivered at the right time to the right people; there is also the matter of the relationship between the knowledge requirement of decision-makers and the development of knowledge by scientists (Tress et al., 2003). And the fact that knowledge is available is no guarantee that it will be put to use.
- The relationship between individual and community interests. How can collaborations be organised so that maximum endeavour towards a common aim results while the wishes and desires of individual parties are also served (Ostrom, 1990; Klijn & Teisman, 1997; Scharpf, 1997)? What kinds of incentives are required for this?
- The relationship between environmental quality and process. The establishment of a shared ambition concerning environmental quality and the implications of this ambition during the process is crucial (Hidding & Teunissen, 2002; Van der Valk, 2002). There is urgent need on this point for a further methodology development that can secure these elements. Identification of the success and failure factors of interactive policy implementation, equally in terms of the conditions under which they can be applied, the phases in the process, the exclusion of interested parties and the democratic justification (Healey, 1997). Particular attention should also be paid to the question of how interested parties can become involved (Woerkum, 2000). For this, knowledge is required concerning their motivation and the barriers they experience.

4.4.2.3. Orchestrating international agri-knowledge networks

This programme will examine the theoretical relevance of issues surrounding knowledge and orchestrators in international supply chains and networks. We will also look at the establishment of theories concerning dynamic aspects of how continuous innovation can be sustained in a network. This subject is closely aligned to the debate

taking place in scientific journals on National Innovation Systems, country capability, cluster creation, network management and innovation management.

Functioning of agro eco-systems
A shift towards an international knowledge and orchestrator function for the Netherlands is a logical step given the ever-increasing pressure on the country's position as a primary agricultural producer and its knowledge potential. However, a transition of this kind requires new management methods and techniques. A great demand exists in the agricultural sector for knowledge of managing and controlling the kind of knowledge and orchestrator functions that are envisaged. A strong knowledge base needs to be present in the Netherlands to take on the orchestration function. Published articles on National Innovation Systems, country capability and cluster creation show that this matter is an absolute precondition for becoming an orchestrator. The literature has focused mainly on regional cluster creation within countries, however. It has been established that strong clusters in a national region form a strong basis for competitive strength. Far less is known about cross-border business-to-business value chains. In the context of this spearhead, it is particularly important to examine whether effects at regional level are also achievable at global level by using new management methods and ICT. It is not yet possible to answer this question.

Calendula, developing integrator roles in international agri-industrial network
The purpose of this project is to organise in a sustainable way a highly innovative, international agro-industrial network for renewable raw materials (“Calendula”). Several fundamental matters, such as designing the chain strategy (as opposed to business strategy), creating workable powers and responsibilities, building-in flexibility and responsiveness; overcoming differences in culture an integrating goods and information streams in an international context.

The orchestrator models developed in scientific publications will generally need to be analysed and modified in order to arrive at a model usable and workable within the agricultural setting. This will result in a context-determined orchestrator model focused specifically on the role of the orchestrator in international agricultural supply chains and networks. Consequently, the functioning of agro ecosystems will change radically. The knowledge questions that need to be answered concern the orchestrator, his network and the national context in which he operates.

A modernising aspect of the idea of "Netherlands, experimental garden" concerns how innovation can occur in international supply and technology networks. Little is known about this matter. We know from innovation literature that the knowledge possessed by suppliers, manufacturers and customers is essential in bringing about innovation. An orchestrator needs access to each of these parties. Some networks are already innovating internationally (like the aircraft-building industry) while others exhibit highly regional components (the flower industry). The nub of the problem is how a Dutch innovator can maintain access to all the international knowledge that he needs. Research into international technology networks has already cast some light on this matter. However, the research has not yet embraced the agricultural sector. Network literature also focuses heavily on the knowledge-development side. Not much attention has so far been given to the subsequent marketing of knowledge obtained in networks. Theoretical interweaving of concepts for developing and marketing knowledge in international agricultural networks may pave the way for a major improvement in network efficiency.

Besides answering the knowledge questions, this theme will yield a total innovation model in which knowledge developed traditionally in manufacturing industry will be used in the agricultural sector. Specific agricultural knowledge will need to be combined with the innovation models contained in scientific literature.

To date there has been scant research into innovation in international supply networks. Although a lot of research has been conducted into innovation in international technology networks, the lessons that can be learnt from that research cannot be translated one-to-one to supply networks.

Breeding in the supply chain: valued locally, competitive globally
The core business of livestock breeders is currently the upgrading and sale of breeding material. The uncertainty regarding social demands and limits as regards animal breeding - animal populations are a socially-sensitive issue – call for consideration of cultural and social angles when selecting breeding goals and the technologies to be used.

Value creation in networks
Scientific management journals examine inter-organisational networks from a variety of different perspectives. Araujo and Easton identify no fewer than ten different theoretical schools of thinking. The vast majority of these studies focus on the general characteristics of networks, their organic evolution, their structure and their development process (Moeller and Haninen, 1999). Far less attention is devoted to consciously constructed networks and their management (Moeller et al, 2002). In other words, there is a heavy emphasis on "networks of organisations" as opposed to the "organisation of networks". We also see that the dominant strategic management literature confines itself almost exclusively to industrial networks. Agricultural networks are analysed solely from the point of view of the traditional supply chain. This has left unanswered numerous theoretical questions that could help bring about a fundamental and complete modernisation of the agricultural sector.

The approach adopted to this theme implies that innovation networks can no longer be seen as isolated units with little if any interaction with their social, institutional and geographical settings. This approach may also yield answers to questions concerning the lack of market focus/demand-driven control of the agricultural sector and the absence of interdisciplinary and transdisciplinary networks at the interfaces of science, policy and operations. This approach further recognises the circumstance that developing knowledge of transition and system innovations is a complex, interactive and non-linear process in which organisation-transcending knowledge must be developed by a variety of different but cooperating actors working in unison.

Another question requiring examination is the long-term effect of an increasing focus on orchestrator functions on Dutch productivity, environmental conditions and employment opportunities.

Viewed from the perspective of society, the contribution which can be expected will be mainly in the field of long-term economic sustainability. After all, the Netherlands can only be an “experimental garden” in the long term if its innovation potential is assured. Unless this condition is met, it will be impossible to produce a viable model.

As regards ecological sustainability, a particularly important point is to what extent innovation in the Netherlands will cause a burden on the environment. The negative perception that many Dutch people have of biotechnology is an example of a factor that could impede establishment of an experimental garden function for the country in the field of genetic modification. This makes acceptance by society and perceived ecological damage major areas of study in this spearhead.

Perception and social appreciation
To what extent can an orchestrator confine himself to a purely orchestrating function (i.e. without also being a producer) and yet still retain his innovative capability? How great is the risk of a strong Dutch position as a provider of knowledge of agricultural production drying up because of the exit from the Netherlands of a substantial proportion of the primary production? How serious will the position of orchestrator be taken if the country no longer has its own agricultural production function? To what extent can other countries accept that they continue to be producers but no longer have any say in orchestration? These are important issues when it comes to taking on the role of orchestrator.

Acceptance by society is another factor that plays an important role. To what extent will we in the Netherlands accept the "exit" of a primary production function that is so important to society as a whole? In this context, how do you analyse the agricultural business sectors present in the Netherlands, especially as regards pigs, cows, poultry, potatoes, vegetables, fruit, flowers and plants? What criteria must be applied (for example, economic considerations, importance to society) to examine whether these sectors are suitable for taking on the function of an orchestrator and/or experimental garden? Is the transformation of the sectors desirable from a social point of view?

When networks are organised, we see the need to produce a model that finds a balance between self-organisation and design. The traditional design perspective for networks will need to make way for a new model in which design and self-organisation are kept in balance. To what extent will stakeholders accept relinquishing a rigidly hierarchical supply model and to what extent will they welcome the more flexible network model? Working in a flexible network model requires a departure from traditional hierarchical control mechanisms. In other words, are our companies ready to operate within a new model of this kind?

Remote horticulture
The Dutch glasshouse horticulture sector and notably its floriculture branch are highly successful in the international market. To stay in the leading position, a group of leading growers and mechanisation companies launched an initiative aimed at developing a system to create new horizons for glasshouse-grown products in the Netherlands and at the same time working remotely (in other countries) with integration/control from the Netherlands. The key issues in this project concern the role of integrator of the international production network and the question of technology as an enabler.

Governance
According to strategic network theory (SNT), a focal firm leads and coordinates a co-operative venture of complementary partners (Miles and Snow, 1994). This perspective is dominant in management literature, but little attention has been devoted to the social, institutional and geographical context in which a network is situated. In development sociology, especially in the Global Commodity Chain approach (GCC), a perspective has been developed that places networks in a wider framework by putting them in an institutional and geographical context. From the perspective of a strategic network, we can focus on the inter-firm relationships and on competitive dynamics, while the GCC approach provides us with a wider framework. The role of the government in particular needs to be examined.

Besides the substantive answering of knowledge questions, the "From producing to orchestrating" project will enable integration of the SNT and GCC and yield a complete theory of international networks. There will be a theoretical framework that brings together different disciplines and can be used to design networks.

At the level of the companies that fulfil the orchestrator role in international networks, little is so far unknown about which functions need to be present in an international

network and how those functions should be divided over the partners. Parkhe (2001), for example, describes a model of a network service provider who concentrates on databanks, matchmaking, data auditing and verification and an information clearing house. It remains open to question, however, to what extent a party can actually carry out these activities profitably and credibly. Scientific publications do not yet appear to have come up with ready-made answers to questions concerning the implementation, functioning and control of networks (Kickert et al, 1997). In the present context, we would like to develop a model for the institutional conditions, time-line, development process and control of the new networks. Little empirical information is available about the performance of consciously implemented networks. It is important to develop performance indicators for the purpose of evaluating the choices made in relation to transition. If it transpires that they generate insufficient results, it will be possible to develop other spearheads.

This leads us to a context-specific design model for international supply networks in the agricultural sector. In turn, the results and experience gained from developing a model and analysing transition will be usable in other sectors. Little attention has so far been devoted nationally or internationally to these aspects. Theories have always defined certain distinct aspects. Hardly any attention has been given yet to the design aspect. The only exceptions are Gomes Casseres (1996), although he does not look at supply networks, and Dyer (2000), who does not examine the international context. The cases will yield additional material for analysing the results and checking the generic usability of findings.

Ultimately, the findings of this theme will produce a marked improvement in managing, controlling and developing international supply chains and knowledge networks. Methods and techniques will be developed which together will form a total model that can lead the way in carrying out the desired transition.

4.5. Alternatives

Traditional linear research programmes that can be fully filled in, planned and estimated in advance, are not satisfactory in this context. They fail to do justice to the non-linear character of change processes. Furthermore, these types of research programmes lead to insufficient amounts of interaction between science, society and practice; consequently, making use of developed knowledge frequently leaves much to be desired. On the other hand, a blind focus on knowledge development in actual practice will not bring the desired results either because any scientific basis of that knowledge will be missing, which tends to be a necessary ingredient to achieve real breakthroughs. This is why it was decided to opt for a combination of basic/strategic knowledge development in scientific projects with knowledge development in practice by way of integrated projects.

4.6. Specific requirements

Agriculture and its supporting infrastructure have several specific qualities that define the organisation of the knowledge project.

Agriculture is characterized by:
- large differences between sectors in terms of innovativeness, market and social orientation, land used, etc.;
- strong regional differentiation as a result of physical and socio-cultural conditions;
- heterogeneity of businesses within chains (multinationals versus family firms);

- markets with many offering parties and a comparatively strong regulating role played by government;
- impact on many socially relevant fields of a highly collective nature, e.g. landscape quality, nature, water management, logistics, ethics, the quality of food, etc.

The implication for the knowledge project is that it pays a great deal of attention to achieving a well-balanced distribution of projects between sectors, chains and regions and a strong commitment of – regional – authorities, trade and industry.

The knowledge infrastructure aimed at agriculture has the following characteristics:
- Collaboration within the knowledge chain has been less strong following the collapse of the Research-Education-Extension threesome, which has contributed a great deal to developing large-scale industrial agriculture.
- Knowledge institutes that have grown independent tend to have a functional relationship with a single ministry, which hampers an orientation at social issues that transcend the boundaries of individual departments;
- Dominance of technical-economic disciplines, with a resulting preference for technological fixes as solutions to social problems;
- Prominent international position of the agricultural sciences.

These conditions emphasize the need for an approach as outlined in the knowledge project, building new relations, first within the knowledge chain from basic to practice-oriented research and second between the arts and social sciences and the natural sciences. Another implication is that it is necessary to broaden the impact of the knowledge infrastructure to include other departments, as proposed in the present knowledge project. Those efforts build upon existing strengths in scientific areas.

4.7. Relation with European research programmes

The issues discussed in the present business plan are not unique to the Netherlands. Other countries in Europe – and beyond – have similar problems. Although the Netherlands traditionally has held a strong global position in agriculture and horticulture it can keep that position only if the country can anticipate European and international knowledge needs when making the transition to sustainable agriculture.

The knowledge needs at European level are reflected in the main points of the sixth European Framework Programme (FP6). It shows a clear focus in the number of research fields, particularly in pillar A (“thematic priorities”). Close connections can be seen between several priorities of that pillar and the research themes within the knowledge project. Four thematic priorities of the FP6 are relevant here:
- sustainable development, changes at global level and ecosystems;
- the quality and safety of food;
- citizens and governance in a knowledge society;
- technologies of the information society.

It is even possible to associate the details of the thematic priorities as developed in FP6 with the main themes defined in this knowledge project, as is shown in table 3.

In summary, the main theme of vital clusters has much ground in common with themes on the integration of agriculture in natural ecosystems and, consequently, efforts to achieve sustainability in the agroproduction sector. The primary production of high-quality and safe components for food supply is an outstanding example of a theme that transcends national boundaries and whose knowledge development has great international implications. ICT possibilities are facilitating here; although being tools, their potential scope is worldwide. Realization will require permanent knowledge

development since existing knowledge gets out of date fast due to technological developments.

Within the main theme called rural services, knowledge needs are focussed particularly on adjusting globally available knowledge to specific regions, on the one hand, and on integrating regional knowledge (conditions, effects) and experience into integrated knowledge systems, on the other. The field of tension between globalization and regionalization is a social phenomenon that can be observed in similar forms in all member states throughout Europe. Knowledge development in this area, therefore, has great implications.

Building international networks offers significant perspectives to Dutch agriculture and horticulture. Compared with previous decades, important new dimensions will be added by having sector-transcending themes such as sustainability, logistics, food safety and potential ICT applications.

Seeing that the themes distinguished within this knowledge project and FP6 have common ground while at the same time being complementary, it is allowed to cumulate public resources.

FP6 priority	Vital clusters	Multifunctional rural areas	Orchestrating international agri-knowledge networks
nr 6: Sustainable development, global changes and ecosystems - environment and sustainable development	- integration of agriculture into nature and landscape, multiform landscapes increase biodiversity and contain disease pressure - strategic multipurpose use of scarce land - climate model development in relation to precision agriculture, process control and demand prediction	- multifunctional ecoproduction systems based on high-quality international knowledge with regional effects that are easily recognized by citizens and consumers - water management systems	- geographical reorientation and specialization of agroproducts and components making optimum use of natural and environmental conditions - transition to high-quality and knowledge-intensive products - tailor-made knowledge of high-quality production methods for worldwide application
nr 6: idem - transport	- multisector clusters for optimal logistic delivery and removal of components and products, combined with mobility issues	-availability of regional facilities, employment, use of rural areas and leisure -mobility while minimizing and combining transport flows of people and goods -combining and optimizing transport flows from both countries near national boundaries	- logistics-based, integrated global trade and transport systems based on new concepts and technologies while minimizing total energy consumption
nr 6: idem - sustainable energy systems	- multisector clusters of enterprises based on energy supply and demand - biomaterial as fuel		see previous item
nr 5: Food quality and safety	- robust agroproduction methods using advanced technologies and safe materials to get high-quality foods - agroproduction methods that are relatively insensitive to calamities such as disease - traceability of all materials and products throughout the chain - locally available knowledge and instruments for tests and analyses		- multidisciplinary employment of knowledge to develop and produce high-quality and manageable basic materials - globally uniform and transparent detection and control systems with coordinated organisational structures
nr 7: Citizens and governance in a knowledge society	- interdisciplinary studies to examine support for decision-making by local government bodies - transparent production processes and citizen commitment	- interdisciplinary studies to examine support for decision-making by local government bodies - mobilizing and integrating local knowledge and experience in knowledge systems	- transnational studies of qualitative and quantitative indicators - building a European knowledge infrastructure
nr 2: Technologies of the information society	- ICT-supported and demand-controlled production methods and logistic production processes	- transparent and interactive systems, open to citizens, translating globally available knowledge into regional implications	- building an international knowledge network, model designs providing information and instruments useful to citizens and consumers worldwide

Table 3: Relation between thematic priorities in the European Framework Programme 6 (FP6) and the main themes in this knowledge project.

5. Economic and social relevance

5.1. Social issues

The necessity for transition of agriculture towards sustainability is described in section 2 and 3. Our urbanized society values the quality of both its food and its environment. Safe and tasty food, produced while respecting nature, is highly appreciated. Also, the rural area is transformed into a multifunctional space, which require enormous adjustments on the part of agriculture as the sector using the greatest amount of land. Agriculture finds itself at a crossroad. The dominant goal of "producing food of adequate quality at minimum costs" changes into "contributing to a sustainable quality of life", thus making the environmental, social and intellectual capital part of a strategy to achieve sustainability. These various aspects are included in this knowledge project.

Future sustainable agriculture will have a multifunctional quality while being knowledge-intensive and socially and economically relevant. It is a robust system that fits in with a global structure, making sure that agriculture's current position as the only cluster of world stature in the Netherlands (quoted from Porter) can largely be maintained, while incorporating triple-P thinking (People, Planet, Profit).

The transition to sustainable agriculture and horticulture is a complex and difficult process of integrated innovation. It requires a reorientation in thinking, doing and feeling. It is about changing behavioural and cultural patterns, technological innovation, physical and economic adjustments and institutional innovation. This knowledge project covers these different aspects in a coherent way.

5.2. Challenges for the knowledge project

The agroknowledge infrastructure is strongly related with the sector's development. In several respects it carries, initiates and inspires the enormous technological and economic achievements of today's agriculture. Thus, the transition to sustainable agriculture cannot be accomplished without reorganizing and reorienting the underlying knowledge infrastructure. The advisory report recently published by the Council for the Rural Areas (RLG) provided an outline of the characteristics of the existing agroknowledge system and analysed the actions needed to realise a change of course (see box below).

1. The knowledge infrastructure dealing with agriculture, food and rural areas is essential to food production and trade and to the management of rural areas. The quality of life is involved (food safety, animal welfare, ecology and landscape).
2. Current production methods have a small support base, confidence in the integrity of food has decreased, and real innovation capacity is inadequately supported or improved by scientific know-how.
3. The focus of research and knowledge is one-sided; the focus is too much on technology and end-of-pipe approaches.
4. The knowledge infrastructure should restore relations with society and practice. Challenges are:
   - supplying public knowledge for the benefit of issuing rules;
   - promoting innovation and development;
   - combining basic and strategic research with the innovative capacity of actual practice;
   - safeguarding the critical role of knowledge, both intrinsically, organisationally and financially.
5. Three conditions must be met to achieve this:
   - room for experimentation is needed in practice: co-innovation, innovation of science and practice;
   - social and natural sciences must get interconnected;
   - the most fundamental discipline, i.e. food production at the beginning of the chain, must get fresh impulses. The existing knowledge repertoire is failing, fresh knowledge for sustainable agriculture is needed.

Adapted from: "Terug op de grond en weer tussen de mensen", Council for the Rural Areas, March 2002.

In summary, the knowledge infrastructure is facing the following challenges:
1. It needs to restore relations with practice, on the one hand, and with society on the other.
2. The dominance of the technical sciences needs to be broken by strengthening and integrating humanities and social sciences.
3. It is necessary to build a broad knowledge network with universities that have relevant expertise which, they are prepared to share and develop.

Aiming to support the transition to sustainable agriculture, this knowledge project faces the following challenges:
1. To reinforce relevant disciplines in the arts and to connect them with disciplines from the natural sciences.
2. To bring down the barriers between basic, strategic and applied research in order to create an integrated knowledge chain.
3. To strengthen collaboration between market sector on the one hand and public institutions on the other, for example in public-private cooperation.
4. To promote the exchange and dissemination of knowledge in learning networks.

The following strategy is adopted to realise those objectives:
1. To create networks in which both the knowledge chain, entrepreneurs, public administrators and citizens make their own contributions, based on their respective roles. The so-called "integrated projects" are a major vehicle to achieve this.
2. To promote strategic knowledge development in interdisciplinary partnerships in the knowledge fields described in section 4.3.
3. To develop and use new methods for knowledge transfer, examples being the agrocluster academy the agrocenter sustainable entrepreneurship and the *Duurteelt* agroportal.

5.3. Legitimacy of Bsik contribution

The innovations needed in the knowledge infrastructure do not emerge automatically. The market mechanisms are inadequate for this purpose. A coordinated stimulus is a precondition to start and speed things up. Major reasons to really give that stimulus include:

- Reorientation of the knowledge infrastructure is essential to realise the transition to sustainable agriculture and, consequently, to increase the contribution made by agriculture to the quality of life.
- Short-term direct economic interests (profit) of individual businesses, especially under difficult market conditions, will obstruct long-term investments in the triple P of sustainability (people, planet, profit).
- Parties still have little awareness of the need for an interdisciplinary approach that exceeds the boundaries of the different sectors.
- Investments at business levels may lead to less than optimum investments at macro-level.
- The complexity of the transition and its associated uncertainties is discouraging potential initiators.
- Creating new and innovative networks with various types of stakeholders is a protracted process that will not get started without any public support.
- There is hardly any room to experiment with new types of governance in those networks.
- Know-how needed to translate the concept of sustainability to agriculture is largely missing and the same applies to process-oriented knowledge in relation to transition management and system innovation processes.

The urgency of the required transition, combined with a failing of the market asks for other, innovative approaches, relying on public and private cooperation. The issue touches on the policy fields of various ministries (including LNV, VROM, EZ, VWS and V&W). These considerations make a strong case for a combined and interdepartmental incentive. The Bsik is very well suited for this goal.

> Essentially, two major bottlenecks occur in meeting social desires regarding “food and green” that require focused and collective action:
> 1. The powerlessness of - most primary – producers to organise effective types of cooperation aimed at improving quality (of products and production processes) and transparency in *“food chains”*.
> 2. The absence of clear and confidence-building perspectives for increased expansion of agrarian business operations based on an explicit evaluation of *“rural services”*.
>
> The analogy between the two bottlenecks can be found in the difficulties involved in giving clear expression to social demands and in making adequate adjustments in supply to meet those demands.
> *SER advisory report nr 02/09 : Innovatie voor duurzaam 'voedsel' en 'groen', 2002.*

5.4. Alternatives

Without Bsik impulse the fundamental reorientation of the agro-knowledge infrastructure will be very slow to develop. Existing instruments are inadequate for various reasons:

- The integrated approach required cannot be realised within the existing framework of incentives because of the dividing lines between sectors and conflicting short-term interests (business profits vs. sustainability).
- Although existing research funds (NWO, EU) lead to a deepening of basic knowledge, they are inadequate to bring about real change in the performance of the knowledge infrastructure.

- Although funds available for technological research and innovation (e.g. EET) lead to innovating projects, they are not based on broad and interdisciplinary collaboration; as a result, they rarely bring about permanent changes in the knowledge infrastructure.
- Although ministerial research funding is extensive, it is characterized by strong dividing lines between ministries and little flexibility, which makes it unsuitable for realising a coherent transition.
- Available innovation arrangements are leaning too strongly on current practice in order to achieve the necessary discontinuities.

To put things positively: Bsik is the only policy instrument that is specifically designed to build new networks and to realise research that transcends individual disciplines, while combining those activities with new social concepts that break through interdepartmental boundaries. And the knowledge project has all those qualities.

5.5. Economic and social results

The benefits of the knowledge generated in this project can be characterized as follows:

- Physical clustering of intensive agroproduction is a generally accepted strategy to combine several social and economic objectives. The knowledge base dealing with perspectives, conditions and best clustering practices has been strengthened so that businesses and government bodies can make well-founded decisions with minimum risks. Pilot projects in various countries will be used to put the knowledge on the international market.
- Rural services such as landscape, water and nature management, recreation and care services have become full-grown economic activities and effective arrangements have been developed to achieve adequate compensation for those social functions based on public-private funding. Knowledge developed in this area is broadly secured in international networks, also in view of the central role played by the EU in decision-making on the permissibility of those arrangements.
- Dutch agricultural enterprises throughout the chain increasingly succeed in acquiring strategic positions in international networks. This is due partly to the amount of knowledge built on initiating and orchestrating cross-border and heterogeneous networks for agricultural products and services and their performance. This unique knowledge is available in the form of validated direction models, network achievement standards and “best practice” definitions.
- Sustainable entrepreneurship is broadly understood and accepted throughout the sector of agriculture and accessible tools have been developed to have it realised in actual practice. They are already used by the first pioneers when the programme is being completed. Its thoughts and ideas have been secured in the form of education, training courses and ICT tools that can be accessed through the internet.
- As a result of their increased awareness, knowledge and options, consumers have more influence on the development of sustainable agriculture. Solid scientific intervention routes have been developed which are applied in various chains to increase the transparency of interrelations; as a result, consumers will have more direct possibilities to control.

The different achievables contribute to the realisation of sustainable agriculture. The actual measurement of sustainablility in an integrated concept is not yet possible. This programme aims at the development of criteria and monitoring instruments in order to evaluate the transition of agriculture towards sustainbility. For this purpose, the knowledge and experience of Telos in this field is used and developed further in this knowledge project. The developed concepts and methods will be used to monitor the effects of this knowledge project. The monitoring criteria are mentioned in section 6.3.

5.6. Sustainability and embedding

The aim to secure the results of the knowledge project in the economic structure and to make their impact felt is a guiding principle in the preparation and implementation of the entire project.

The result of this knowledge project is a virtual knowledge network, which is connected firmly to the universities of Wageningen, Tilburg and Eindhoven. This connection is supported by a small facilitating organisation. The universities mentioned are committed to this goal. Other universities and research organisations may join in during the coming years, when the project is executed.

This virtual network, the “Knowledge Network Sustainable Agriculture” includes Globus at the University of Tilburg, ECIS at the University of Eindhoven and a unit in WageningenUR (see text boxes). This knowledge network will act as a centre of competence for the Sustainable Agriculture Initiative (SAI), an international network for agribusiness and related industries. SAI is described in more detail in section 6.7. Thus, the international embedding of the Knowledge Network Sustainable Agriculture is ensured.

Globus
Globus, institute for Globalization and Sustainable Development, an inter-faculty institute at Tilburg University, is an expertise center for multidisciplinary research in the areas of globalization and sustainable development. Established in 1998, Globus is intended to function as a platform for critical debate among researchers, policy makers, decision makers, and other parties. Globus' main purpose is to promote high quality research, both at the national and the international level.

http://www.tilburguniversity.nl/globus/

ECIS
The Eindhoven Centre for innovation Studies (ECIS) aims to perform basic scientific research in the field of innovation. ECIS brings together researchers from various backgrounds including economics, management, sociology, engineering sciences, law and history, with a common interest in studies on technology and innovation. The research programme focuses on the analysis of the causes and consequences of innovation and technological change in organisations, networks, regions, economic sectors and national economic systems.
http://www.tm.tue.nl/ecis

6. Implementation

6.1. Structure

Overall structure
This knowledge project consists of three programmes:
A. Vital clusters: high-quality supply of food and agricultural products in our urbanized delta, meeting the high demands of post-modern society;
B. Multifunctional rural areas: enhancement of socially desirable functions of rural areas, including nature and landscape management, water management, care services, recreation, etc.;
C. Orchestrating international agri-knowledge networks: developing a orchestrating position in international agrifood networks.

For each of the three programmes knowledge development will take place along two lines (see section 4.4.):
1. Scientific projects
2. Integrated projects.

In addition, exchanging and disseminating knowledge will be important activities (see Section 8).

The activities for the three main themes are expected to result in developing and securing a cluster of knowledge areas within the knowledge infrastructure. This cluster, which is called Agricultural Transition Studies, includes the following knowledge areas:
1. The functioning of agro-ecosystems
2. Value creation in networks
3. Perception and social appreciation
4. Governance

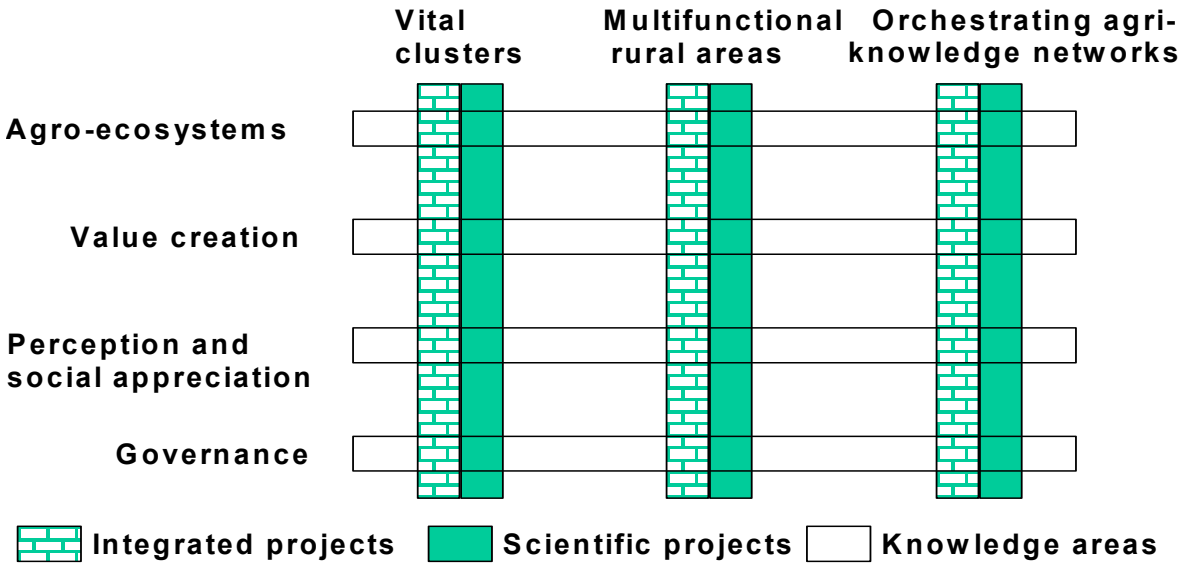

Figure 6: Main themes and strategic knowledge areas

The knowledge challenges arising from the “integrated projects” are input for basic/strategic studies to be conducted in the “scientific projects”, and conversely the results of the scientific projects are used in the integrated projects.

Agricultural Transition Studies
The connection of these three main themes and knowledge areas together with more specific knowledge development on transitions and systems innovations (NIDO/KSI – scientific programme) leads to Agricultural Transitions Studies.

To bring a new field like Agricultural Transition Studies to fruition and to exploit its results as they appear, it is necessary to structure the processes of knowledge development, sharing and dissemination. We intend to do this by starting up the following activities:

- To bring practitioners from different scientific disciplines together in projects with stakeholders.
- To bring these practitioners also together in a community of practice that meets on a regular basis to co-ordinate efforts and to exchange experiences and results.
- To develop and introduce a sufficiently general standardised case study approach to structure projects on the basis of common focal points, questions and issues.
- To develop standard reporting tools to codify procedures, experiences and results in empirical work and to use these tools to record project data.
- To collect standardised case reports in a data base and to disseminate these reports and data among researchers and other stakeholders.
- To perform meta-analyses on the basis of reported project results in order to arrive at a codified general scientifically validated understanding of issues of sustainability in agricultural production systems and of transitions towards new systems; to publish extensively on the basis of these meta-analyses.
- To use this validated knowledge on sustainability for the development of dedicated measuring and monitoring instruments that can be applied to evaluate the performance of agricultural enterprises (possibly within their agricultural production chain context) with respect to economic, ecological and social sustainability.
- To train consultants in extension services to use these measurement and monitoring instruments on a regular basis.
- To use these measurement and monitoring instruments to back up a certification system for social accountability in farming.

In section 7.2. the availability of qualified and motivated staff is described.

6.2. Phasing

Phase one (2004 and 2005)
During phase one the three programmes will be excecuted after they have been developed in more detail during the preparatory phase in 2003. The availability of highly qualified scientific initiators who also took part in preparations of the knowledge project will make it possible to make a quick start.

The projects are realised in new networks of researchers from various disciplines, most of whom will be from institutions which thus far have shown little structural collaboration or even none at all. The emphasis in this phase is on bringing together knowledge from various disciplines in order to produce innovative problem definitions, designs, concepts and tools (e.g. economics, new institutional economics, sociology, leisure sciences, environmental sciences, system analysis, modelling, agronomy, plant and animal sciences, technology) .

The strategic alliances with NIDO/KSI (when approved) and with SAI (Sustainable Agriculture Initiative) will be activated. The development of Agricultural Transition Studies will be activated as well and a framework for the body of knowledge will be developed.

Phase two (2006 and 2007)
In this phase the emphasis is on validating the resulting new knowledge by applying it in various integrated projects, which will result in adjusted views and new questions for basic/scientific research in the scientific projects. The networks built within the context of the knowledge infrastructure will be continued. The Agricultural Transition Studies will be anchored in a sustainable (virtual) knowledge centre, which is organised in such a way that it can serve the innovators in the transition to a sustainable agriculture. Also, a great deal of attention will be focussed on disseminating and communicating that knowledge among broad circles of stakeholders.

Transitions and system innovations are non-linear processes. It means that, during implementation of the knowledge project, new themes may arise that need to be initiated. It is important that the project has room for this. The decision-making process on starting new themes is described in section 7.3.

6.3. Indicators

As described above, the knowledge project has clearly distinguished phases. This is also expressed in the indicators and target values used in each phase to monitor progress (see table 4).

Table 4: Indicators and target values for the knowledge project.

Indicator	Target values Phase 1	Target values Phase 2
Contents		
Number of projects started	25	15
Number of new concepts/tools developed	30	50
Number of scientific publications	10	160
Number of concepts/tools applied	–	40
Networks		
Number of new public private partnership	25	40
Number of new participants		
- private parners	75	120
- knowledge institutes	5	10
- international knowledge institutes	3	5
Knowledge dissemination and transfer		
Number of educational/training modules	5	40
Number of media manifestations	50	200
Number of businesses applying knowledge	40	400

The socio-economic results of the knowledge project are elaborated in more detail below in terms of the standard classification for sustainability based on the Triple P (People, Planet, Profit) method. Telos, Centrum voor Duurzaamheidsvraagstukken [Sustainability Research Centre] was asked to further operationalise the results. Telos has a tried and tested method for measuring and explaining ecological, social economic capital. It is using this method to investigate the results yielded by the transition to sustainable farming. During the course of the knowledge project, Telos aims at compiling two reports in the form of a Sustainability balance sheet.

People: bringing farming into line with social values.

- Working conditions: multifunctional agriculture geared to the skills of workers at regional, national and international level.
- Animal welfare: improving animal welfare (health, natural behaviour, reducing stress) through innovative stock-keeping systems and by combining stock-keeping with rural services. Reducing the transport of animals through a spatial concentration of activities.
- Food safety: setting up food quality assurance systems in international networks, e.g. through certification.
- Transparency: improving the traceability of food through new ICT systems
- Local environment: A multifunctional rural area through a broad range of rural amenities. Valuing nature conservation as a rural service. Improving spatial quality by relocating agro-production to specific areas.
- Social responsibility: strengthening the interaction between urban and rural areas through a broadening and appreciation of rural services.

Planet: curbing the depletion of natural resources

- Transport: limiting freight transport through the physical clustering of production processes. Directing agro-supply chain processes in international networks.
- Energy: cutting energy consumption through a linking of product streams. Using agro-production as an energy source (biomass, greenhouse horticulture sector as an energy supplier).
- Air: reducing emissions of greenhouse gases, ammonia and other pollutants through technological innovations. Reducing odour nuisance through adequate spatial planning of agro-production systems.
- Soil: Multifunctional rural land-use with respect for regional characteristics.
- Water: reducing water consumption by closing water loops. Realising water recovery as a rural service through adequate remuneration. Ensuring that water has a recreational value in rural areas.
- Waste: promoting the recycling of materials by closing waste loops and linking product streams.
- Renewable raw materials: Forming international networks to establish links and to use product applications between the agro, chemicals and pharmaceuticals sectors.
- Biodiversity: increasing biodiversity by valuing the appreciation of wildlife and habitats as a rural service.
- Awareness: Raising awareness of sustainable farming through the transfer of knowledge to the education system and citizens/consumers.

Profit: sufficiently remunerative and innovative

- Adaptability to the market: building up a supervisory role in international agro-networks that serve the global market based on ongoing innovation in production, distribution and marketing. Forms of knowledge-intensive agro-clusters offering products and services in interaction with the market. Demand-led supply of rural services by professional retail functions.
- Practical functionality: generating a cost-effective supply of rural services with an appropriate financial price tag. Ongoing innovation in information supply, organisation and cooperation in international networks.

- Efficiency: improving the price-quality ratio of products and services.
- Strategic potential: new administrative concepts and institutional incentives for sustainable agro-systems with the capacity to optimally deploy knowledge and technology.
- Employment: boosting economic value and preserving the number of jobs in the agro-sector by offsetting the restriction of land-based production through the introduction of multifunctional rural services and a supervisory function in international agri-food knowledge networks.

6.4. Risk management

Causing discontinuity in knowledge infrastructure operations is a risky enterprise. The factors that are most critical for success are described below, as are the measures that have been taken to minimize risks.

Complexity
It is difficult to bring together stakeholders from various communities, cultures, disciplines, sectors, domains, orientations and value patterns. Achieving shared views on problem definition, challenge, research agenda, set of instruments and implementation is a complex process. Applying participative administration models following the arena model is a useful and well-tried method to manage that complexity.

Time/costs
The complexity of the transition challenge brings many uncertainties when schedules and cost estimates must be made for specific projects. This is why high-quality project management is employed to ensure that projects are prepared, implemented, assessed, adjusted and evaluated with great care. Guiding factors include budget, process time, number of participants and results.

Quality
Naturally, the intended interaction between scientists, practice and society within the context of the knowledge project must not be realised at the expense of scientific quality. In order to guarantee scientific standards, various checks and balances have been incorporated. Firstly, eminent scientific initiators have been appointed for the respective main themes. The initiators have authority, both among knowledge institutes, trade and industry, social organisations and government bodies. In addition, each main theme has a scientific advisory board. And finally, in response to a request made by the Partnership, NWO establishes an international panel of scientists; results will be reported anually to the panel. If needed, the panel may offer suggestions to improve the scientific quality of the knowledge project as a whole.

Investments
One of the risks is that designs and concepts will never leave the laboratorium or the drawing table. For this reason, potential investors are engaged early in development activities. For some projects, their social significance will be so great or their time horizon will be so long that it is necessary to find government bodies – or others - to contribute investments.

6.5. Relation with – pre-competitive – development activities

Manufacturing a first prototype for non-commercial purposes, developing demonstration or model projects or drafting and designing alternative products, processes and services constitute actions that are not part of the knowledge project. Naturally, those pre-competitive development activities may be spin-offs of the knowledge project. Although pre-competitive developments do take place in the integrated projects, they are used exclusively as a vehicle of knowledge development and to generate issues that can be investigated in the scientific projects.

6.6. Relations with other Bsik initiatives

Food and Food Integrity
This programme has been designed to develop pre-competitive and scientifically founded proof-of-principle projects aimed at increasing consumer confidence and their concern with what they eat and drink and at promoting sound and healthy dietary behaviour. The programme generates insights into consumer perceptions and behaviour as well as generic intervention routes that are based on consumer motivations and behaviour as well as their ways of handling food information. Following primary agricultural production, Food and Food Integrity takes up on the processing, distribution and sales of food, thus being a seamless and logical extension of this knowledge project.

National Initiative Sustainable Development / Knowledge Network System Innovations
The NIDO/KSI mission is to develop the basic knowledge and to develop, exchange and pass on the competencies that are needed to focus, initiate and keep going desirable socio-economic and sustainable system innovations and transitions. In addition, NIDO/KSI provides a facility to bring in transition knowledge to help other Bsik projects. It is used by the KnowledgeNetwork Transition Sustainable Agriculture.

System Innovation Land Use and Development of Urban and Rural Areas (SRG)
The purpose of this programme is to find the best possible combination for the dynamic of the economy, social-cultural values and ecological quality. To achieve this, a scientific exploration is made to find synergy between networks in physical space and between functions fulfilled by those networks for society and to find balance and control processes that may produce that synergy.
Lack of space is one of the key factors for the transition to sustainable agriculture. Generic spatial knowledge produced by SRG and domain-specific knowledge in the field of agriculture and rural area as produced by the present project will be linked. The intention is to make this happen in joint “integrated projects” at the interface of city and rural area.

Living with water
The main objective of the knowledge project is to initiate strategic and practice-oriented knowledge development in the field of water and physical planning in order to promote that the implementation of new water management can be realised efficiently and effectively while at the same time establishing a long-term knowledge infrastructure for the benefit of interdisciplinary research by disciplines of the humanities, natural sciences and social sciences in the field of water and physical planning. In the field of water, agriculture and nature joint project will start.

Arrachne
Arrachne acts as a knowledge network for chains and networks for the benefit of transitions; it is active in two domains: food and care. Arrachne contributes knowledge about how chains and networks tend to work and how they can be changed specifically to achieve common goals. Especially the scientific programmes 'Valuing in Chains and Networks' and 'Governance in Chain and Networks' will add important knowledge.

6.7. Sustainable Agriculture Initiative (SAI)

The Sustainable Agriculture Initiative (SAI) is a worldwide platform created by the food industry to actively support the development of sustainable agriculture and to communicate with various stakeholders about those developments. SAI supports agricultural practices and agricultural production systems that preserve the future availability of current resources while enhancing their efficiency. This will increase agriculture's contribution to meeting society's environmental, economic and social requirements as best as possible. It should be able to support economically viable and responsible farming systems which enable local communities to maintain their livelihood, safeguard their environment and improve their well-being. Knowledge development and knowledge sharing are key SAI activities. Founding members: Danone, Nestlé and Unilever. The number of participants increases rapidly. Recently Dole, Findus and McCaine joined SAI.

The knowledge consortium has concluded an agreement in principle with the Sustainable Agriculture Initiative (SAI) to the effect that the Knowledge Network Sustainable Agriculture will act as a Centre of Competence for this platform with regard to sustainable agriculture. In this way cooperation with a great number of internationally operating businesses and knowledge institutes is guaranteed.

7. Knowledge consortium composition and collaboration

7.1. Composition of the knowledge consortium

The knowledge consortium is broadly composed of executives from the communities of knowledge infrastructure, agriculture, agribusiness food industry, retail, nature, environment, recreation, finance and insurance. This is a necessary precondition to realise one of the project's primary objectives, i.e. to restore the connection of knowledge infrastructure with society and practice. It will also safeguard the relation with system innovation projects taking place in the transition arena. This will encourage that the programme's knowledge outcomes will have their impact on the development of sustainable agriculture.

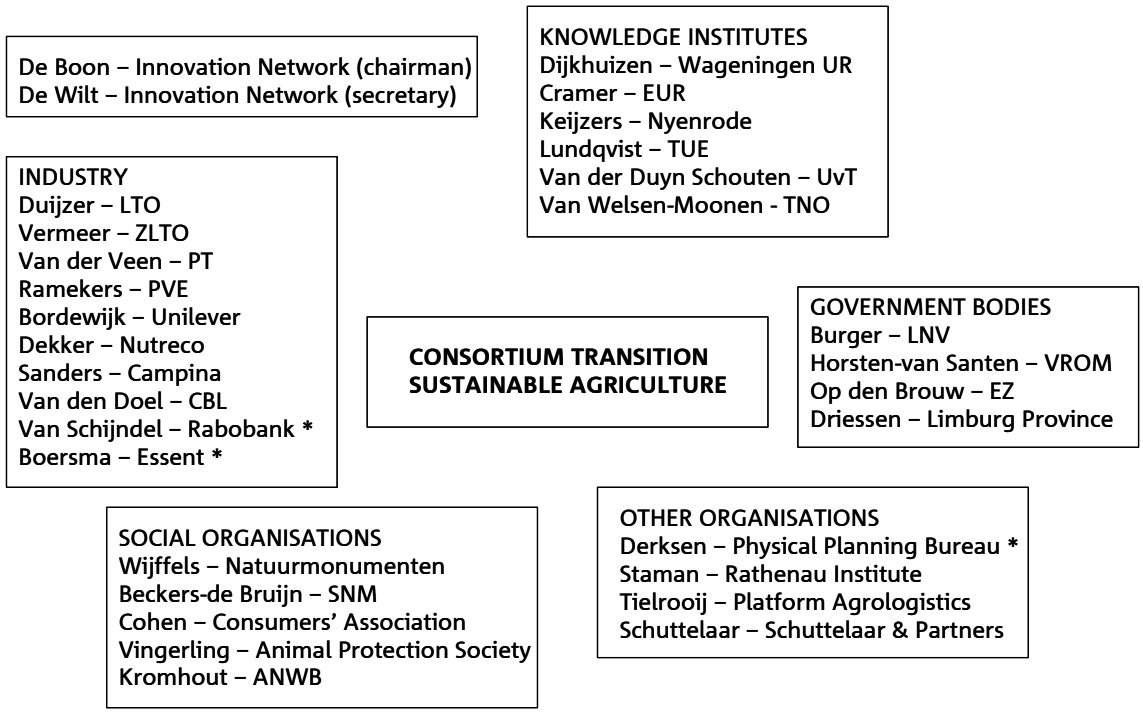

Figure 7: Composition of the Knowledge Consortium for the Transition to Sustainable Agriculture (To be confirmed).*

7.2. Availability of qualified staff

As its scope is considerable, the project makes great demands on the availability of staff, not only for conducting research, but also for project management and project support. It builds on existing strengths in the knowledge infrastructure and on existing structures for project management and support.

Four highly learned scientific directors have been appointed to take responsibility for the contents of the research programmes of the three main themes:

Main theme	Scientific director	Knowledge institute
Vital clusters	Prof.dr. M. Kropff	WageningenUR, Department of Plant Sciences
Multifunctional rural areas	Prof.dr. C. Leeuwis Prof.dr. Th.A.M. Beckers	WageningenUR, Communication and Innovation studies University of Tilburg, Leisure studies
Orchestrating international agri-knowledge networks	Prof.dr. G. Duijsters	Eindhoven University of Technology, Organisation Science

The relevant professorial CVs have been attached (see Appendix 2). All initiators have excellent scientific references and they have shown themselves to be successful leaders of huge projects. Since their backgrounds in terms of disciplines and work fields are complementary they build a strong team. For their part, the universities involved will provide a substantial part of qualified staff needed while cooperation with other universities and knowledge institutes – including internationally – will ensure that adequately qualified staff can and will be employed for the knowledge project (see also letters of commitment).

7.3. Structure and coherence of the project organisation

Philosophy and basic principles
Adequate implementation of the programmes requires that it builds on the existing knowledge and experience with respect to initiating, stimulating and facilitating system innovations as the building blocks of transition processes. In order to realise a discontinuity in the functioning of the knowledge infrastructure it will be necessary to establish a small and independent organisation. The result is a model which bields on existing structures and networks, on the one hand, while making separate arrangements for control and finance, on the other.

Implementing organisation
The project is placed with the Foundation Knowledge Network Sustainable Agriculture (in formation), which will give account. Responsible for governance of the projects is the board of the foundation (personal match with the Partnership for the Transition to Sustainable Agriculture).

The Bsik project on Transition Sustainable Agriculture will be led by an executive director who will be accountable to the foundation board.

Scientific directors will be appointed for executing of the three programmes, they will operate from the knowledge infrastructure and will be responsible for the realization of the programme involved. This will be laid down in contracts with the foundation. The scientific director will be assisted by programme coordinators at the project office, one for every programme (see organisation chart). Two small units will be available for secretarial, communicative and financial/ administrative support.
The appointment of the scientific directors and the approval of the programmes including the budgets are the authority of the board of the foundation.

Advisory councils will make contributions from the perspectives of science, society and international developments. The organisational arrangement is shown in Figure 8.

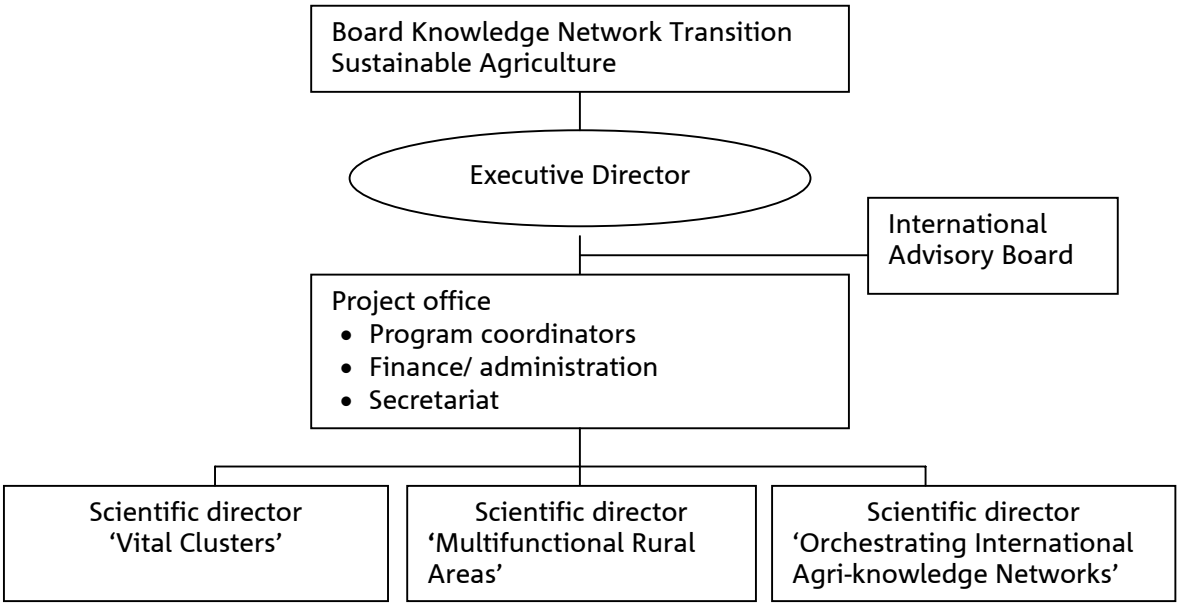

Figure 8: Organization chart

The organisation facilitates programme development and realisation. This is expressed in the following activities:

- Directing/managing programmes. In particular, realising an approach that transcends both individual disciplines and sectors by working together with related networks will demand a great deal of attention. It is one of the key tasks to be fulfilled by the organisation.
- Conducting explorative studies of promising innovations, feasibility studies and strategic research projects.
- Initiating projects aimed at designing and experimenting with system innovations.
- Initiating knowledge transfer projects in order to capitalize on newly developed and available knowledge that is still underused.
- Linking knowledge demand and supply, including active "scouting" and initiating projects (either bottom-up or top-down).
- Creating focus, coherence and balance between the various projects. Both new and current projects will be organised into a coherent, result-oriented and recognisable wholes.
- Creating and utilizing international networks in order to employ knowledge, technologies and methods developed elsewhere in system innovations.
- Ensuring adequate communication and public relations.
- Monitoring progress of the knowledge project.
- Ensuring sustainable reinforcement of the knowledge infrastructure to promote the transition to sustainable agriculture.

Executive Director

The executive director will be very much the "operational leader" of the project to the outside world. Depending on the nature of contact (informing, decision-making) and the discussion partner he or she may be assisted by the chairman of the Board.
He or she directs dissimination and communication projects. Authorities are agreed with the board of the foundation. The director's duties are specified in a job description.

Scientific directors
The scientific directors are responsible for implementing the programme and managing the research portfolio. The activities can be summarized as follows:
- design and organise key programme processes and to provide them with proper checks and balances;
- develop and carry out the research programmes of the project's portfolio;
- ensure sustainable development of the knowledge infrastructure based on the results of the scientific programme;
- deciding based on positive advise of the Social Advisory Counsil and Scientific Advisory Counsil the integrated and scientific projects.

The scientific directors will be assisted bij External Advisory Councils.

Programme coordinators
The programme coordinators will work closely together with the scientific directors. They have different scientific and social backgrounds and they possess the intellectual capacity, the experience, the networks and the authority that are needed to give scientific directors and project managers of subprojects maximum support and to guarantee synergy and coherence between subprojects and programmes. They also play an important role in management and dissemination of knowledge.

Secretarial, communicative and financial/administrative support
The programme is supported by a secretary with associated general tasks, a staff member for communication assistance and one or more staff members responsible for carrying out financial/administrative tasks and for monitoring the project in order to account to Bsik and the co-financers of the projects.

Advisory councils
The organisation is assisted by external advisory councils:
1. a social advisory council for every programme, its main task being to increase the focus of the programme on strategic issues (a time horizon of 5-10 years) of great social significance; the members of this advisory council come from networks of trade and industry, government bodies and social organisations and they all have an "interest" in the programme;
2. a scientific advisory council for every research programme, its main task being to monitor and increase the scientific quality of the programme. This council is made of prominent scientists from discipline fields that are of strategic importance to realising the programme's objectives;
3. one international advisory board for the knowledge project as a whole, its main task being to increase the programme's orientation to international trends, institutions and programmes.

The tasks of the advisory councils in their individual fields include:
- to generate, weigh and reformulate ideas and visions ("think tank");
- to advise on proposed themes, annual programmes and associated budgets, based on previously defined criteria;
- to assess subprojects based on previously defined criteria;

The advisory councils combine creative powers of thinking, intrinsic expertise and vision. Individuals taking seats on the councils do so as private persons and they have the ability to break away from existing frames of thought in order to make the necessary "leaps". They have broad strategic orientations and expertise, they believe in innovation and they have authority among stakeholders. They refrain from serving specific interests; rather, they are able to see programme activities in a broader context.

International panel of scientists
In order to realise a high-quality system of independent quality care the board has asked the Netherlands Organization for Scientific Research (NWO) to establish an international panel of scientists; they will get annual reports on findings. Once every year the panel will assess methods and results, making recommendations for improvement. After two years a mid-term review will be held which will also include site visits paid by the *international quality assurance panel* to some of he participating research groups. Within the context of the knowledge project frequent national and – especially - international workshops will be held to present interim findings and to benefit from external reactions.

7.4. Collaboration in the knowledge consortium

The knowledge consortium consists of collaborative leaders who share the ambition to make the transition to sustainable agriculture successful. Achieving a transformation of the knowledge infrastructure will be a prerequisite.

The consortium members will meet minimum four times per year to discuss the progress of the knowledge project, to make decisions on strategic issues and the allocation of budgets and to approve annual plans and reports.

During implementation of the knowledge project it is possible for new members to join the consortium if the board expects those members to add sufficiently to the innovating power and the quality of the project. Newly entering members need to meet the same requirements as do the members who have participated in the consortium from early on. If a party cannot agree with a decision made by the board in these matters the conflict may be solved through arbitration.

Experience with previous ICES/KIS-programmes has shown that successful project implementation results in independently growing types of cooperation between stakeholders, both short-term and long-term. The arena model and the programme are instruments to arrive at intensive types of cooperation.

Results will be secured in follow-up studies, research programmes and educational and training programmes, operational management, government policy programmes, etc.

7.5. Intellectual property

All knowledge fed into and developed by the programme is considered to be public knowledge. Acquired knowledge will be freely available, except for company-specific data which could damage the interests of one or more parties if they were made public. Market-conforming rates will apply to conference attendance, workshops or reports published.
In case one of the market parties wishes to participate only if agreements are made about protecting developed knowledge then the occasional possibility exists to apply a maximum lead time of one year.

8. Knowledge management and dissemination

8.1. Knowledge exchange, transfer and dissemination

There is a growing need for knowledge about how to initiate and facilitate a transition to sustainable agriculture, both in practice, policy-making, science and society at large. Developing new knowledge, as is done in the present knowledge project, is useful only if that knowledge will "flow" and "work" among entrepreneurs, government bodies and all others involved in the transition to sustainable agriculture. Thus, many project activities have been designed not only to develop both new and existing knowledge, but also to enrich and disseminate that knowledge and to make it broadly available. Major target groups include: agricultural entrepreneurs, executive managers in agribusiness, administrators and officials, scientists, knowledge intermediaries, trainers and teachers, pupils and students, social organisations, citizens and consumers.

The integrated projects are important instruments to make knowledge "flow" and "work" during the initial phases of developing and implementing new concepts. The integrated projects bring together scientific knowledge and the experiential knowledge of stakeholders around specific practical situations. In doing so, knowledge not only flows from science to practice, but also the opposite way. As a result, the social relevance of the entire knowledge project will benefit strongly. Communities of Practice will ensure that similar integrated projects exchange information in order to promote "mutual teaching". In addition, specific strategies are employed for different target groups as described below.

Practice
Within the project, knowledge transfer and competence development will be realised primarily by doing and experiencing. "Learning by doing" is a key concept here. Still, the integrated projects are not the only place where the development and dissemination of new knowledge and competence are realised. At least three new instruments will be developed and employed as part of the knowledge project to open up relevant knowledge in the field of sustainable agriculture for many thousands of agricultural entrepreneurs. Due to their special qualities the instruments clearly offer added value to the existing array of training courses, professional journals and internet applications. The instruments are:

1. the *Agrocluster Academy*, an inspiring environment to provide permanent reinforcement of the cluster's learning and innovating abilities by "learning things from each other and from outsiders".
2. the *Agro Centre Sustainable Enterprising*, an international knowledge network to bridge the gap between entrepreneurs and other groups in realising sustainability.
3. the "Duurteelt" project *Sustainable Cultivation*, an internet site offering information and tools for entrepreneurs to benchmark their businesses in relation to other businesses on several sustainability criteria. On the website they can also get advise on how to adjust their operations in order to produce in more sustainable ways.

The possibilities for creating synergy between the three mentioned initiatives will be further explored. The agrocluster academy, the Agro Centre, and the Duurteelt project will also be accessible for target groups other than agricultural entrepreneurs (citizens, consumers, policy-makers). In addition to those new instruments, existing possibilities such as senior secondary and higher vocational education will be used to disseminate knowledge, especially among starting enterprisers. To this end, custom-made

educational modules will be developed in joint consultation with the organisations involved.

Policy-makers
The primary aim of communicating with policy-makers is to increase the commitment and know-how of this category. Their commitment is essential in order to draw up and elaborate proposals and to disseminate results (knowledge transfer). People's minds need to be prepared for a discontinuity in thought and action. Naturally, this will make high demands on the professionalism of communication. Proper channels and manifestations include publications in professional journals, interviews, newsletters, symposia, workshops, the Internet, etc.

Science
Within the context of scientific and integrated projects, knowledge is exchanged through partnerships between scientists from various disciplines. In view of the great share of basic strategic research in the knowledge project, a great deal of attention will be focussed on reporting results in scientific and professional journals. In addition, it will be with some regularity that interdisciplinary scientific conferences are organised, both nationally and internationally. Several of those conferences focus on strategic knowledge areas for sustainable agriculture: (1) the functioning of agro-ecosystems; (2) value creation in networks; (3) perception and social appreciation and (4) governance.

Society
Innovations in the context of the project can be expected to have a great impact on society. Consequently, they need to be socially accepted. It is important that communication with society is started early so that it is possible to keep abreast of expected innovations and their resulting products and concepts. On the other hand, it must be avoided that innovations run an undesired course, giving cause for prejudice or bias. After all, this would considerably reduce their chances of being socially accepted. It is essential that society can contribute in the early phases of development. Citizen committees, interactive Internet and the mass media will be used to achieve this.

More general means of communication to be employed as part of the knowledge project include newsletters, symposia, workshops, the Internet, etc. The process of exchanging and disseminating knowledge as well as developing competence and communication will get the professional support of a specialist in the field, who will be employed at the executive office.

8.2. Description of activities

Agrocluster academy
The aim of the Agrocluster Academy is to facilitate agrocluster entrepreneurs in activities where they learn and discover, either individually or jointly, things that are starting points for them to undertake or give rise to innovating actions. The Academy will focus particularly on so-called "darers" (enterpreneurs who are natural pioneers and innovators, being curious and creative) and "doers" (enterprisers who, once they have seen something new and successful, do not hesitate to take quick and resolute action). The number of "darers" is estimated to be about 5% of all entrepreneurs, which is a total number of about 5,000 entrepreneurs. The number of "doers" is estimated to be about 15%, with a total of 15,000 entrepreneurs at most. The primary group targeted by the academy are the "darers". In addition, though somewhat less extensive, the Academy offers programmes for "doers" as well.

Academy products include:
- (invitational) working conferences (40-80 participants);
- (invitational) mini-conferences, round-table meetings, workshops and brainstorming sessions (with 10-15 participants);
- best-practice communities and networks.

All products are designed to serve specific goals and target groups and their substance and design are adjusted to specific system innovation and transition aspects.

Around these products the Academy offers:
- information front-office facilities, for example *intake*, *information* and *referral* (reception desk, telephone, the Internet) for individual users;
- facilities for discussion meetings, conferences and workshops;
- *(virtual) support facilities* for sharing knowledge and skills (e.g. through Internet technology) and for building and maintaining networks and "communities of practice";
- communication about initiatives, plans, progress and results in media appropriate to the cluster (brochures, leaflets, mailings).

The Agrocluster Academy will start with the cluster of horticulture, which has shown itself now broadly committed to the horticultural cluster academy. The intention is to make other sectors follow later. In the future the Agrocluster Academy may be extended to grow into an Agrocentre Sustainable Enterpreneurship if there is a sufficiently strong support base among stakeholders.

The Agrocluster Academy seeks to discover, explore and develop (the latter two more strongly than the first one).
• *Discovering* what markets (consumers, distribution channels) want, what competitors and trendsetters in other sectors do, what kinds of demands and conditions are made by society;
• *Exploring* what is going on in the market and in society, the technological possibilities that are available, the solutions for strategic issues that present themselves in the fields of ICT, logistics, employment, light, energy, water and space;
• *Developing* new concepts based on acquired understandings, either competitively in partnerships within or – when appropriate – outside the chain or pre-competitively for the cluster as a whole. Developing is primarily a task of market parties; the Academy will confine itself to initiating and stimulating illustration or demonstration projects.

Typical qualities of the Academy's scope include:
• *Looking ahead*: starting from a view of the future – the cluster position envisaged for the year 2020 – rather than from its current position, i.e. the status quo. Having this idea of the future, efforts are made to find ways, possibilities and desirable developments;
• *From outside inwards*: being taught by each other and by external sources, by what happens elsewhere, in society and in other economic sectors;
• *Pro-active*: addressing the present based on a view of the future: affecting, producing, enforcing and adjusting developments rather than being reactive;
• *Collective*: aimed at collective entities (business colleagues, trade partners, chain relations) rather than focussed on broadening or deepening individual participants. Entrepreneurs teach entrepreneurs: "The entrepreneur is the acting subject rather than a passive object".
• *Exploring and discovering:* making joint efforts to shed some light on potential and necessary developments. The Academy facilitates debate to enable entrepreneurs – in varying combinations – to make their decisions.

The Agro Centre Sustainable Enterprising
The Agro Centre seeks to:
- explore concepts and tools for sustainable strategy formation;
- organise an international knowledge network;
- support the transition proces towards sustainable agriculture.

The centre provides new scientific methods and tools to be applied by all entrepreneurs within the chain and region. Concrete result is a knowledge development and diffusion structure to support sustainable agricultural entrepreneurship.
Involved participants – among others - are Erasmus University Rotterdam, Wageningen University and Research Centre, University of Amsterdam, University of Minnesota, Danish Agricultural Advisory Centre, Swedish Dairy Association.

Duurteelt ("Sustainable cultivation")
As for sustainable agriculture, little knowledge is available that can be applied in practice. Although science, consultancies and government develop knowledge, it is frequently impossible to apply that knowledge directly to the daily practice of agricultural entrepreneurship. In addition, all available knowledge is product-related. The underlying reasons can be found in the history of sector structures: all crops, products and animal species have their respective – cooperative – consultative structures. The project intends to make available integrated and business-comprehensive knowledge by developing, filling and maintaining a database that can be accessed through the Internet.
Using high Internet penetration will promote applications of sustainable agriculture whose economic, social and ecological aspects are well-balanced.
The Internet tool will play a central role in opening up available and new knowledge, in making chains transparent and in supplying government bodies with company data.

"Duurteelt" (Sustainable cultivation)
Usually, armers do not have direct access to existing knowledge and they certainly lack the ability to translate scientific knowledge into practical knowledge. This project provides them with the tools to make the change to sustainable entrepreneurship. In addition, the project gives farmers an opportunity to directly control strategic research. Sustainable entrepreneurs will formulate the key questions.

"Duurteelt" will perform various information and knowledge functions:
Information: Visitors of Duurteelt.nl can get information about sustainable agriculture by consulting existing knowledge that is offered at a single, centralised address. This is made possible through the Knowledge Centre and the Information Desk. A great number of knowledge and information providers will contribute.
Communication: Using the Forum it is possible for farmers to communicate with colleagues, suppliers and clients. The selection of colleagues, suppliers and clients can be based on postal codes, making it possible even to consult the "neighbours" electronically.
Tests: A self-assessment questionnaire can be used to test the knowledge and experience of individual farmers and to get some tips. The self-assessment questionnaire offers farmers an opportunity to quantify sustainability parameters at sector level. An adequate understanding of those parameters provides chain parties with guiding information for setting priorities in improvement trajectories. Benchmarking enables farmers to compare their knowledge and methods with those demonstrated by colleagues. The benchmark results enable agricultural entrepreneurs to make an annual report, dealing also with environmental management.
Creation
The Expert file offers farmers the possibility to retrieve knowledge and information not yet available in "*Duurteelt*" from elsewhere or to have it created. In reality, it implies that they have access to: (a) knowledge saved in reports and documentation elsewhere; (b) experiential knowledge not yet opened up (e.g. in the minds of innovating farmers); (c) emerging knowledge (current projects and studies); and (d) experts to let them create knowledge.

All questions and answers are saved electronically in a file. This will give an overview of the need for knowledge as felt by the primary sector. The knowledge infrastructure may take advantage of it: improved understanding of the need and demand for knowledge will increase its ability to anticipate. The knowledge to be developed can then be adjusted to farmers' demand, in the right tone of voice and with the right translation into practical matters.

In this project several companies and research institutes cooperate, including Heineken, Ahold, Unilever, LTO, BCG, Wageningen UR, Leiden University, CTB, RIZA, Alterra, several commodity boards, LTO, environmentalist groups and – commercial - organisations such as Koppert, Groeinet, HLB, Gewis en Opticrop.

Integrated projects
Innovating, experimenting and practical learning take shape in integrated projects. They are experimental environments within specific practical projects where innovating designs and processes are developed in interactions between practice, policy-making, citizens and science. Integrated projects constitute powerful instruments for both creating, merging and disseminating knowledge. They are also outstanding venues to enrich scientific knowledge with practical knowledge. Illustrations of integrated projects are described in text boxes; they are developed in more detail in Appendix 1.

Education and training
Regular education remains an important channel of knowledge transfer, both for young people and for the working population. One element of the knowledge project, therefore, is to develop course material and to organise and facilitate training classes and courses. They are intended to serve a broad range of target groups, varying from senior secondary vocational education (MBO) and small and medium-sized enterprises to MBA courses. They will also promote that the knowledge project is strategically secured, thanks partly to the role played by participating universities.
The project will also be connected to the green knowledge net, an initiative taken by OC&W to bring schools, museums and libraries together through the Internet. Almost the entire field of education will be gradually connected to this knowledge net, although higher and university education are not included. The latter institutions will be reached in other ways, as described above.

Scientific publications and conferences
Apart from disseminating developed knowledge in scientific publications, mostly international journals and books, there will be frequent thematic conferences, especially dealing with the four main knowledge themes distinguished within the transition to sustainable agriculture (see section 4.3.). They will be held particularly to present and elaborate the results of scientific projects. A distinguishing element as compared with traditional scientific conferences that are focused mainly on a single discipline is the great variety of participants' discipline backgrounds. The conferences will also have an important task in establishing new networks and in attracting national and international scientists to the knowledge project.

The Internet
The knowledge project also entails that an Internet site is developed to make knowledge in the field of sustainable enterpreneurship directly available and manageable for entrepreneurs in agriculture. This is done in the "Duurteelt" project. The Internet site to be developed will offer information and tools so that businesses will be able to benchmark themselves in relation to other businesses on several sustainability criteria while the website can also advise them on how to adjust their operations in order to produce in more sustainable ways. The Internet tool may play a central role in opening up available and new knowledge, making chains transparent and supplying government bodies with business data.

Mass media
In order to reach the general public the knowledge project will make use of newsletters, media publications and presentations (newspapers, radio, TV). Public debates and the Internet will be used to achieve high levels of interactivity so that the public can make its own contributions to the knowledge project, if desired.

8.3. Problems in knowledge dissemination

Current types of knowledge transfer and dissemination such as formal education and training have several disadvantages in view of the drastic and complex nature of the required transition to sustainable agriculture:

1. One-way traffic from those carrying knowledge to those receiving knowledge. Frequently, current methods of knowledge transfer are grafted on the teacher-pupil model. As a result, they tend to be without the necessary interaction and knowledge exchange that does justice to the nature of the transition to sustainable agriculture as a shared [process of exploring and learning.
2. A biased focus on cognitive elements. Current types of knowledge dissemination frequently have a one-sided focus on “knowing things” whereas it is important for transition processes to have the “willingness” and the “ability” to do things.
3. Sectarian dividing lines between target groups. Current types of knowledge transfer and dissemination frequently are characterized by a one-sided focus on either actual practice, policy-making, society or scientists. It is important to break through those divisions and to make knowledge flow and work.
4. Fragmented approach: Current channels of knowledge dissemination often deal with smaller elements of issues found in the transition to sustainable agriculture. They often lack the necessary integration of knowledge at relevant levels of scale (business, regional, national).

Therefore this knowledge project develops and uses new methods of knowledge transfer, as explained in section 8.2.

8.4. Alternatives

The types of knowledge exchange, transfer and dissemination used in the present knowledge project are unparalleled as a result of their broad range of methods employed and their strong emphasis on “learning by doing” and interactive types of learning to make knowledge “flow” and “work”. The integrated projects, the agrocluster academy, the agrocentre sustainable entrepreneurship and the “Duurteelt” project are the key instruments here.

8.5. Indicators

Major indicators for measuring progress in knowledge transfer and dissemination include:

- number of stakeholders participating in integrated projects;
- number of participants in programmes of the agrocluster academy and the Agrocenter Sustainable Entrepreneurship;
- number of those using front-office information facilities provided by the agrocluster academy, including intake, information and referrals for individual employers;
- number of those using the support facilities to share knowledge and skills (e.g. through the “Duurteelt” project);

- number of communications about initiatives, plans, progress and results in the appropriate media (brochures, leaflets, mailings);
- number of participants in workshops, round-table discussions and brainstorming sessions;
- number of education and training modules on sustainable agriculture;
- number of students following those training classes and courses;
- number of scientific articles and conferences;
- number of non-scientific publications.

9. Financial budget

9.1. Project budget

The project has been subdivided into the three programmes (Vital clusters, Multifunctional rural areas, Orchestrating international agri-knowledge networks). Each programme is a set of scientific research projects (including programme management by a scientific director) and integrated projects. Table 5 shows the costs per programme per year. Knowledge management (case bases, toolkits) will be an important integral part of the programmes. A scientific director will be responsible for developing and carrying out a programme. He/she will also hold responsibility for embedding the programme in the knowledge infrastructure.

Besides these programmes, there will be generic activities that transcend the scope of individual programmes. They are (with their share in the costs):

- dissemination of knowledge (by means of a website, newsletters, conferences, participation in SAI, Agro Cluster Academy, *Duurteelt*, etc); 45% of the costs of the generic activities;
- core project development of Agricultural Transition Studies (development of a vision, exploratory studies, definitions of domains, development of a common language, definitions of concepts, participation in NIDO/KSI, etc); 25% of the costs of generic activities;
- general projectoffice costs; 30% of the costs of generic activities.

On top of the general project office costs (which account for 5% of the total estimated project costs) there will be specific expenses incurred for supporting the scientific directors. The total project office costs will not exceed 10% of the total estimated project costs.

Use of the capacity of public knowledge institutions will account for 70% of the total estimated project costs.

The project will run from 18th February 2003 to 31st December 2007. The first year - 2003 - will be used to make preparations for the project, including setting up the project organisation and preparing the programmes in co-operation with the scientific directors. The project organisation will be ready towards the end of 2003 to make a flying start with the programmes from January 1th 2004.

Table 5: Costs of each programme per year (x EUR 1,000)

Programme	**2003**	**2004**	**2005**	**2006**	**2007**	**Total**
Vital clusters		5,000	5,000	5,000	5,000	20,000
Multifunctional rural areas		4,500	4,500	4,500	4,500	18,000
Orchestration of international agri-knowledge clusters		3,250	3,250	3,250	3,250	13,000
Generic activities	300	2,150	2,150	2,150	2,250	9,000
Total	300	14,900	14,900	14,900	15,000	60,000

Table 6 shows the costs itemised according to groups of activities and groups of stakeholders.

Table 6: Costs of each activity per stakeholder (x EUR 1,000)

Activity	Knowledge institutions	Companies	Project-office	Total
Scientific projects	17,100	1,710	190	19,000
Integrated projects	20,360	7,280	2,860	30,500
Research management	1,500			1,500
Generic activities	4,020	2,030	2,950	9,000
Total	42,980	11,020	6,000	60,000

9.2. Link with application form

Table 7 shows the costs itemised according to the type of costs defined in the application form.

Table 7: Costs of each programme per type of cost (x € 1,000)

Programme	Salary costs	Cost of labour	General overhead	Costs of machines	Costs of dissemination of knowledge	Total
Vital clusters	11,275	1,475	6,370	120	760	20,000
Multifunctional rural areas	10,145	1,325	5,470	105	685	18,000
Orchestrating international agri-knowledge networks	7,325	960	4,140	80	495	13,000
Generic activities	2,750	2,545	2,650		1.055	9,000
Total	31,495	6,305	18,900	305	2.995	60,000

9.3. Funding

Table 8 shows the ratio of distribution that will be used to allocate costs to the different programmes.

The co-financing of the knowledge institutions consists of hard commitments (70%), soft commitments (20%) and still to commit (10%).

It has been estimated that 50% of the financing from private parties will consists of cash contributions and 50% of contributions in kind.

The other parties consist mainly of lower governments and organisations associated to them.

Together, the private sector parties and other parties form the knowledge demandside. The board members of the Foundation Transition to Sustainable Agriculture have given commitments on behalf of the knowledge customers amounting to 75% of the required co-financing. Of this, three-quarters is hard and one-quarter soft. The

remaining co-financing (25%) will be committed in the course of the project. A good procedure has been developed for this in a number of ICES/KIS-2 projects, including KLICT.

The contributions from the other parties produce cumulative subsidies in excess of 50% of the project costs. This is permissible because the project Transition to Sustainable Agriculture is aligned to the 6th European Framework Programme (section 4.7.).

An optimum VAT position is being pursued for the project within the constraints of the existing legal frameworks so as to allow the efficient use of available funds.

Table 8: Funding (x EUR 1,000)

Programme	Knowledge institutions	Private parties	Other parties	Bsik	Total
Vital clusters	5,200	4,700	1,200	8,900	20,000
Multifunctional rural areas	4,750	4,100	1,000	8,150	18,000
Orchestrating international agri-knowledge networks	3,250	3,000	800	5,950	13,000
Generic activities	1,800	200		7,000	9,000
Total	15,000	12,000	3,000	30,000	60,000

9.4. Specification

Table 9 states the size of the requested Bsik subsidy per year and per programme.

Table 9: Specification of Bsik grant (x € 1,000)

Programme	2003	2004	2005	2006	2007	Total
Vital clusters		2,225	2,225	2,225	2,225	8,900
Multifunctional rural areas		2,025	2,050	2,050	2,025	8,150
Orchestratin international agri-knowledge networks		1,500	1,475	1,500	1,475	5,950
Generic activities	300	1,675	1,675	1,675	1,700	7,000
Total	300	7,425	7,425	7,425	7,425	30,000

9.5. Alternatives

The unique combination of scientific research, integrated projects and knowledge dissemination in the programmes does not qualify in any other way for any other investment grants. Because of the multi-client, the knowledge project is unlikely to receive spontaneous funding from the private sector. The inter-disciplinary and multi-client nature of the project makes it ideally suited to BSIK subsidy.

9.6. Indicators

The indicators for measuring and monitoring progress and results will be defined at the start of the project. Targets will be set and subsequently monitored based on these indicators, which will be the included in the annual plans that Foundation Transition to Sustainable Agriculture will draw up each year.

There will be indicators for the development of knowledge:
- indicators for content (number of published scientific articles, number of new concepts and tools developed, etc);
- indicators for networks (number of new networks, number of new entrants, etc);
- indicators for knowledge dissemination and transfer (number of training/education modules, number of references in the media, etc)

Other indicators will be devised for the development of sustainability, by means of the Telos monitoring system. This is a new item that will be made part of the project (section 6.3)

Strengthening of the knowledge infrastructure and development of Agricultural Transition Studies will take place proportionately throughout the term of the project.

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List of abbreviations

ANWB	Royal Dutch Touring Club
ATS	Agricultural Transition Studies
Bsik	Decission subsidies investments in knowledge infrastucture
CAH	Dronten Professional Agricultural University
CBL	Dutch Bureau for Provision Trade
CTB	Board of the Authorisation of Pesticides
ECIS	Eindhoven Centre of Innovation Studies
EET	Economy, Ecology and Technology
EU	European Union
EUR	Erasmus University Rotterdam
EZ	Ministry of Economic Affairs
FP6	The Sixth European Framework programme
GCC	Global Commodity Chain
ICES	Inter-departmental Commission on Economic Structure
ICIS	International Centre for Integrative Studies
ICT	Information and Communication Technology
INRA	Institut National de la Recherche Agronomique
KIS	Knowledge Infrastructure
KLICT	Chain Networks, Clusters & ICT
KSI	Knowledge Network System Innovations
KUN	Nijmegen University
LEI	Agricultural Ecomic Institute
LNV	Ministry of Agriculture, Nature Management and Fisheries
LTO	Agricultural and Horticultural Organisation
MBA	Master of Business Administration
MBO	Senior secondary vocational education
NIDO	National Initiative Sustainable Development
NM	Foundation for Nature Conservation and Environmental Protection
NMP-4	The fourth National Environmental Policy Plan
NWO	Netherlands Organisation for Scientific Research
OC&W	Ministry of Education, Culture and Science
PT	Horticultural Commodity Board
PPP	Public Private Partnership
PVE	Commodity Boards for Cattle, Meat and Eggs
R&D	Research and Development
RIZA	Institute for Inland Water Management and Waste Water Treatment
RLG	Council for the Rural Areas
RUG	University of Groningen
RUL	University of Leiden
SAI	Sustainable Agriculture Initiative
SENSE	Socio-Economic and Natural Sciences of the Environment
SNM	Foundation for Nature Conservation and Environmental Protection
SNT	Strategic Network Theory
SRG	System Innovation Land Use and Development of Urban and Rural Areas
TELOS	Sustainabality Research Centre
TNO	Netherlands Organisation for Applied Scientific Research
Triple-P	People, Planet, Profit
TSA	Transition Sustainable Agriculture
TUD	Delft University of Technology
TUE	Eindhoven University of Technology

TUT	Twente University of Technology
UvA	University of Amsterdam
UvT	Tilburg University
VAT	Value Added Tax
V&W	Ministry of Transport and Public Works
VROM	Ministry of Housing, Spatial Planning and Environment
VU	Free University Amsterdam
VWS	Ministry of Public Health, Welfare and Sport
WTO	World Trade Organisations
WUR	Wageningen University and Research Centre
ZLTO	Southern Agricultural and Horticultural Organisation

Appendix 1: Integrated projects

Vital Clusters

Horst Agro-Ecopark in a "Four-leaf clover"

Background, nature and objectives
Agro-eco parks intend to integrate several goals: creating space by clustering activities, closing material cycles, transforming supply chains into networks, intensifying market-driven co-operation, connecting knowledge nodes to production and link agro and non-agro production. This requires collaboration between companies and the knowledge infrastructure. In the North Limburg,the overarching objective is to create clusters of mutually supporting production units in the agricultural sector with a transparent, sustainable and high-tech symbiosis of production processes (the Agro Ecopark concept) and join up and interconnect vertical co-operation in "Four-leaf clover"(*Klavertje 4)*. "Four-leaf clover" is a public-private partnership that will build platforms from which businesses, authorities, community organisations and researchers will identify new perspectives and initiate system innovations. Embedding the Host Agro Ecopark in "Four-leaf clover" will link the key economic glasshouse areas of 'Siberia' and the "California" Agro Production Park to the activities of ZON Freshpark and Trade Port Venlo. Goals are to satisfy the wishes of consumers (attractive, healthy and safe food) and the public (quality of life, environmental protection and animal welfare). Modernisation of the region's knowledge infrastructure will be the decisive factor in achieving this transition and forms the heart of the project. The developed instruments in terms of methods and knowledge will be transferable to other situations in the Netherlands and beyond.

Key knowledge questions
- How can the process of designing regional clusters be organised flexibly to allow interim evaluation and adjustment?
- Which public-private partnerships and other institutional arrangements can be developed to cover risks associated with specific investments in relationships?
- How can the decision-making processes for planological embedding of agro-ecoparks be designed so as to make allowance for the interests of the public and other stakeholders?
- How can innovations be reinforced through the local presence of practical applications and knowledge institutions?
- How can innovations (output material, chain production systems, processing) be designed for relevant sectors to create more value (people, planet, profit)?
- Which sustainable combinations of functions (agro and non-agro) can be developed?
- Which process modules and links can be developed to interconnect companies and processes in order to close material and energy cycles sustainably?
- How can the sustainability of the supply chain be improved through faster and more precise monitoring and control?
- Where does the balance lie between return, efficiency and vulnerability of agro-ecosystems?

Anticipated results
- A new knowledge infrastructure with co-operation arrangements between regional stakeholders in knowledge networks.
- Pilot projects for creating links and process integrations between agro production chains in and around the 'California' area.
- Organisational knowledge of sustainable agro concepts.

Participants
Wageningen University and Research Centre, Agro-Knowledge Centre South (pending establishment), Ministry of Agriculture, Nature Management and Fisheries, Rabobank Maashorst, Province of Limburg, Municipality of Horst aan de Maas, Heveco champignons, Maurice Ammerlaan kassenbouw , Livar, STOP, Steenks, Saweco, LLTB, ZON Freshpark, Municipality of Venlo.

Protein Highway A1

Background, nature and objectives
Clustering primary production and agri business companies in the livestock sector is one way of improving spatial quality and accessibility in the Netherlands. Such a step would enable simultaneously achieving objectives for the environment, rural quality, quality of life and economic opportunities. The prospect of advantages for the various stakeholders is an important condition for mustering support for this kind of clustering. The purpose of this project is to help develop knowledge of how to achieve the system innovations necessary to cluster agricultural business and primary companies in the animal sector. This will unite the development of theoretical models and workable managerial and organisational concepts that enable reduction of the costs of trial-and- error associated with clustering.

Key knowledge questions
- Which system innovations will contribute to sustainable spatial reorganisation of the agro food sector in regions with strongly interwoven agricultural and non-agricultural functions?
- How can existing small-scale rural values be utilised on a large scale to achieve a more direct and versatile form of agriculture, with the public being not only end-consumers of products but also co-financers of production methods?
- Which new control mechanisms and process models can be developed to bring about spatial/economic processes of change, maintain their momentum and keep them on course?
- What can we learn regarding the strategy, organisation and objectives of a cluster, the creation of clusters, the control of cooperation, continuity and cluster dynamics?

Anticipated results
The project seeks to offer a new élan and growth prospects in the animal food supply chain along the A1 motorway by creating agricultural business parks at junctions. Specific goals are to:
- create a spatial clustering of agro production at or around motorway junctions, reduce the spatial squeeze by means of logistical innovations and shorten and optimise the supply chain;
- relieve the strain on the finely-meshed infrastructure and reduce transport;
- build new economic mainstays through *imagineering* concepts (rural park);
- spatial organisation for cluster innovations (utility sharing, utilisation of residual streams).

Participants
Gelderse Ontwikkelingsmaatschappij, Overijsselse Ontwikkelingsmaatschappij, Province of Gelderland, Province of Overijssel, Ministry of Agriculture, Nature Management and Fisheries (Eastern Region Directorate), Wageningen UR, NIZO Food research, Centre for Protein Technology, TNO-MEP, University of Twente (Enschede), Arcadis, Buck Consultants International, Rijnconsult, KLICT, University of Tilburg.

Design of sustainable animal husbandry

Background, nature and objectives
Prominent matters in society's debate about the keeping of animals need to be translated into design requirements to optimise livestock farming sustainably. The exact content of these issues is not always clear, however, and often difficult to translate into design requirements. Similarly, the ethical setting casts little light on the question of what really sways people, among other things because emotional dimensions often remain obscured. One way of enriching the ethical vocabulary is to look upon expressions of emotion and involvement as value indicators. Sustainable animal husbandry requires the creation of added value concepts. Therefore, new designs and innovative strategies are needed. Methods will be embedded by means of a quality system. Innovations will be materialised effectively by using process performance indicators. This approach will improve integrated management and will incorporate corporate social responsibility as a quality indicator and chain strategy. With this in mind, this project will develop new concepts for socially acceptable and viable animal farming systems. Interactive and design research will enable the views of members of the public to be translated into outlines for designing production systems. The main objective of the project is to build new sustainable concepts of systems for keeping animals.

Key knowledge questions
- How can society's influence be incorporated in a network of companies, authorities and social actors as a legitimised and legitimising source of values and knowledge for the design process?
- How can impressions (visual and oral) form a foothold for evaluating and predicting views concerning animal welfare?
- How can ethics, metaphor research, social psychology and animal science be brought together with a view to integrating in design the matters raised in the debate in society?
- Is it possible to put into practice concepts like naturalness and robustness without the end result (i.e. the design) being rejected by the public and consumers despite all "objective" arguments to the contrary?
- What process performance indicators are usable for system development?
- What constitutes a good balance between affiliation and autonomy in issues concerning the orchestration of the supply chain?
- Which concepts are suitable for selecting partners for sustainable business in networks?
- Which strategic innovations (technological and organisational) are necessary to achieve sustainability?
- How should the architecture of quality systems be organised to support corporate social responsibility?
- How should international networks be developed with a low threshold for an international exchange of knowledge?

Anticipated results
- A conceptual framework and research methods for designing sustainable animal farming systems.
- A design network including the business community, organisations in society and knowledge institutions in the fields of knowledge of animals, accommodation and society.
- A knowledge base and instruments for sustainable system transitions.
- Creation of a responsive international consortium of companies and knowledge institutions that will develop and exchange knowledge at a global level and set up a total quality system.

Participants
Breeding organisations, builders of animal accommodation, fodder companies, community organisations, Wageningen UR and partners including the University of Amsterdam, European Dairy Farmers, Campina, Friesland Coberco Dairy Foods, Nestlé, CBL, LTO, University of Utrecht, IKM (Belgium), DLG (Germany), DBV (Germany), DAAC (Denmark), SDB (Spain), EOTC (EU), Belgian Farmers Union.

Sustainable technology

Background, nature and objective
The project will develop design concepts for a transition in agricultural production. It will generate expertise used for the required transition of Dutch and comparable transitions in other countries. Common characteristics are:
- a change from traditional technology push towards new forms of participatory technology development and technology assessment.
- a shift from standard, mass production towards a production system with smaller production units that respects biodiversity and natural ecological variability.
- a production system with near zero emissions to the eco system, high quality labour conditions and reduced labour where this is required in respect of availability and cost.
- an agro- food production system that flexibly adapts to changes in the market and in the production environment. This flexibility requires also new institutional arrangements.
- a system that provides producers and consumers with adequate information on applied production methods and quality characteristics.
- innovative data gathering systems, automation, small scale processing will realise a flexible, but implicitly more complex production system in a cost efficient way.

Key knowledge questions
- What are perceptions of consumers regarding the use of technology in the production of food and other agriculture products (alienation, transparency)?
- How can technology help make agricultural chains sustainable, bearing in mind consumer and public perceptions of technology?
- How can technology contribute to ecological agriculture?
- What type of technology is needed in order to strengthen the competitiveness of regional or small-scale production?
- How can precision technology (sensor technology, automation, robotisation) facilitate system transitions?
- How can ICT contribute to the information and communication requirements of producers and consumers?

Anticipated results
The project will provide producers with technology that stimulate sustainable production methods. The approach of the project is, apart from participation of non-agricultural disciplines, to incorporate alpha and gamma sciences in the development of systems. Participation of interest groups is essential in the design process. Attractive labour conditions are essential for a sustainable production structure, and the required competences of farmers must be in harmony with those available. In an expertise centre for high tech flexible production technology, scientists from different disciplines will cooperate with developers from the industry. This includes the farmers and managers from the industry as well as representative NGOs. There will be cooperation with German and Belgian research groups.

Participants
Wageningen UR, Wilhemina Polder, ZLTO, Vertis, META (Centrum Methodische Ethiek & Technology Assessment, TNO, Astron, UvT, Eindhoven University of Technology, University of Delft, Product Board Arable Farming, NAK, Agro Vertis, INNOVA B.V.

Sustainable chain innovations in the fruit sector

Background, nature and objective
The fruit sector contributes significantly to the Dutch economy. However, competition from especially the Southern Hemisphere is increasing due to new varieties and marketing concepts. This project aims to strengthen the chains and Dutch orchestrating role in chains by demand driven development of:
- New varieties suited to North West European growing conditions.
- Adequate quality control of production and storage, including required chain transparancy

The preferences (among which taste) of the NorthWest European consumer prevails while worker and food safety aspects are stressed. The project contributes to the transition to sustainable and demand driven fruit chain. The project combines genomics technology with sensoric appreciation studies and consumer profiles, whereas consumer acceptation of genetically modified fruit with appealing novel characters will be evaluated as part of the chain approach.

Key knowledge questions
- How can qualitative and quantitative consumer attitude be interrelated with technology development?
- How can alternative biotechnological methods speed up the development of varieties, enabling efficient consumer response (ECR)
- How can genomics technology be used for “breeding by design” leading to environmentally friendly fruit production?
- Can “clean gmo technology” be instrumental in gaining consumer’s confidence in genetically modified production, and how can this technology be made available to the fruit chain?

Anticipated results
- Improved system for total quality control with regards to food safety and taste
- Innovative breeding methods (“breeding by design”) ensuring the chain’s capacity for ECR (efficient consumers response)
- Environmentally friendly production and consumer-oriented fruit chains
- Improved cooperation between the producion chain and the knowledge infrastructure
- A signifiacnt contribution of the fruit sector to landscape quality.

Participants
Innova Fruit B.V., Wageningen UR, PT (Dutch commodity board for horticultural products); NIPO; DNA (Dutch Nursery Association), extension workers; producer’s unions in the Netherlands, Belgium and Germany.

Sustainable agro-developments in South Groningen

Background, nature and objectives
Agiculture and ural areas in the northeast of the Netherlands are undergoing major changes. The arable sector in the Veenkoloniën is confronted with unfavourable economic prospects. This threatens the liveability of the area. The regional authorities and local population are urgently seeking new opportunities.
In close proximity of the Veenkolonën, the South Groningen Industrial Park is being developed. The park includes several agro industrial companies with sustainable links

(according to utility sharing and industrial symbiosis principles). For economic and ecological reasons, the companies are keen to expand this form of co-operation by attracting in new companies. This amounts to the development of an Agrobusiness Park.
The posibilities of creating synergy between these initiatives will be investigated. This requires intensive collaboration between companies, the regional population, farmers, the authorities and the knowedge infrasructure.

Key knowledge questions
This project ties in seamlessly with the development of "vital clusters":
- Which new opportunities can be developed through the presence of different forms of agro-industrial activity in a cluster?
- Which sustainable links are possible between agrobusiness parks and agricultural/non-agricultural activities?
- What prospects exist for new combinations of crop growing and industrial processing (gluten free grain, proteins from lucerne, etc.)?
- Which new network organisations can be developed to design agro-industrial ecosystems?
- How can relationships in production chains be exploited for integral production optimisation?
- How should the creation of new technology address the tensions between social responsibility and the propagation of different views by different sections of society?

Anticipated results
- New sustainable economic and ecological prospects for the *Veenkolonien* and comparable regions.
- Strengthening of business activity at the South Groningen industrial park.
- Sustainable co-operation between the cluster and the knowledge infrastructure.
- New forms of recycling materials for (ecological) farming and horticulture.
- Optimised effectiveness of production practices (agrobiocon)
- Set up of communication and deliberation forum for organisational, technological and other agro production-related innovations (agrogen)

Participants
Stichting Bedrijvenpark Zuid-Groningen, Ten Kate Vetten B.V., Avebe, Vlapro, Applied Food Biotechnology, Province of Drente, Province of Groningen, Municipality of Vlagtwedde, TNO-Inro, Wageningen UR

Glasshouse horticulture as a source of energy

Background, nature and objective
Glasshouse horticulture uses a lot of fossil energy in the form of natural gas. In this process, carbon dioxide becomes available that can partly be used in the glasshouse, but a major part is emitted. If glasshouse horticulture is to become a sustainable sector that helps achieve climate goals, it will need to drastically reduce its consumption of fossil energy and emissions of carbon dioxide. The sector has the potential to become a supplier of sustainable energy because in The Netherlands per m2, the amount of sustainable sources of energy is higher than the consumed amount of fossil energy. The goal of this project is to design innovative concepts and systems in the field of "The glasshouse as a source of energy" to trigger a turnaround in established thinking and acting regarding utilisation of sustainable sources of energy.

Key knowledge issues
- The effective use and storage of natural energy in a year-round energy system , where the essential production conditions are guaranteed.
- Re-design of the glasshouse system (construction, coverage, company processes)
- Conversion of low value to high value energy forms (improvement of the energy quality)
- Design of local and regional 'energy webs' of suppliers and consumers of energy
- Replacement of CO2 supply from fossil sources to alternative sources such as fermentation, residue from industry, etc.

Various strategies have been developed based on far-reaching energy saving, maximum use of sustainable energy and combinations of these two measures. This approach raises knowledge issues concerning the design of glasshouses, increased energy quality and co-operation with third parties in local or regional energy webs.

Anticipated results
The project will help cultivate a sustainable, vital and respected horticultural sector by the year 2020, not only as a producer of horticultural products, but also as a source of sustainable energy for the sector itself and other energy consumers. With this concept, the horticultural sector will contribute to the reduction of the consumption of fossil energy and the international energy measures by a drastic reduction of CO2 emission. Taking this inspiring concept as leading subject, new knowledge questions and new connections in the knowledge infrastructure will be generated.

Participants
The initiators and main participants are:
- Innovation Network Rural Areas and Agricultural Systems
- Stichting Innovatie Glastuinbouw (SIGN)
- LTO Nederland
- The Horticultural Marketing Board

Parties also involved in the development of this innovation programme:
Fiwihex BV, Almelo (patent owner of a revolutionary heat exchanger), Kema Sustainable Energy BV, Arnhem; Projectbureau Duurzame Energie, Arnhem; Alpha Power Systems, Oosterbeek
Parties that will co-operate in distinct elements of the project include IMAG, PPO Glasshouse Horticulture Wageningen UR, General Electric (Bergen op Zoom), North Atlantic Technologies, The Hague (heat exchanger manufacturer), Shell Global Solutions and Mecanoo architects, Delft. Lek installatietechniek BV, Ter Aar, Habo BV, Bodegraven (energy systems).
Questions about urban and rural planning of 'energy webs' are elaborated by the architects of Meccanoo, Delft

Integral control of cultivation in closed glasshouses

Background, nature and objective
In present glasshouse horticulture, climate control involves consumption of large amounts of fossil energy. The sun as source of energy is hardly used. The closed glasshouse concept offers adequate and sustainable solutions . In this concept, the input factors (CO2, heat, light, and water(vapour) can be controlled independently. The aim of this project is to open up and integrate the possibilities of control during the growth of crops in closed glasshouses, combined with sustainable energy and water management (inclusive energy deliverance to third parties).

Key knowledge issues
- Technical and managerial boundaries of sustainable energy management in the closed glasshouse concept
- Year-round tuning of demand and supply of horticultural products
- Quantifying sustainability of total new production systems, based on 'precision horticulture'

A closed greenhouse and a present greenhouse differwith respect to:
1. independent control of water vapour
2. changed air circulation in the greenhouse climate
3. high CO_2 concentration applied at high light-levels
4. energy-efficient control algorithms

Anticipated results
The project will contribute to a sustainable, vital and respected horticultural sector. The following product will be delivered:
- Sustainable energy management in glasshouse horticulture in 2020
- Optimal growth and development of crops for demand driven market
- Quantification of the total benefits of sustainability of the system on company, regional, national and international level
- Spin-of to other horticultural sectors

The results will improve the international competitive position of the horticultural sector. The concept is also a promising export product.The ambition is to produce control strategies for the most important glasshouse crops (tomato, cucumber peppers, rose, Gerber, and potting plants). As soon as these strategies are available, demonstration projects will be set up together with stakeholders.

Participants
WUR partners: PPO-Glasshouse Horticulture, IMAG, PRI, Alterra, LEI, TNO Delft, Van der Zande Advies, Ecofys.

Multifunctional Rural Areas

The Green Room in the Green Quadrant

Background, nature and objective
This project will create a balanced development of agricultural production, the rural area, culture, recreation and other commercial activities. This concept will take the form of a newly developed estate called the Green Room near Tilburg. The estate will include a consumer centre for agro and garden products plus a centre for nature education and cultural activities. It will be set in the Green Quadrant, a context of nature and arable farming, where the agricultural function supports the entire area. Economy, culture and nature will form the mainstays of a profit for non-profit concept. The numerous and varied spatial developments around a large town raise important issues regarding multifunctional and multipurpose land use.

Key knowledge questions
- What is the perception of citizens of the agricultural sector and the rural area?
- How to create spatial and economic prospects for agricultural enterprises given a substantial increase of other functions and sectors in the same area?
- How can the area's agricultural diversity lead to added value in arrangements for agro products, green services, combinations of care and nature education in regional value chains?
- How can economic and ecological functions be combined in a balanced way that allows them to contribute to social cohesion and reinforce cultural identity?
- How can local government create scope for bottom-up initiatives, acting as a facilitator rather than a director, and yet still retain its responsibility?
- How to create the competences that civil servants and administrators need in order to bring about structurally different governance and responsibilities?

Anticipated results
This will be a reconstruction pilot project. Carrying out the project will offer fresh prospects to the 15 to 20 agricultural enterprises and also strengthen the economic structure. Farmers, residents and other stakeholders will take initiatives focussed on social safety, nature management and activities undertaken from the Green Room. This joint approach and responsibility will prevent spatial fragmentation of the area, create understanding and involvement on the part of citizens towards the agricultural sector and cultivate social ties between stakeholders in the area. Residents of the adjacent institution for mntally retarded people contribute to the activities in the Green Room and Green Quadrant. Setting this kind of example will create opportunities for numerous other regions.

Participants
Agricultural businesses, local residents, Municipality of Tilburg, De Meierij Reconstruction Committee, Brabant Nature Museum, ZLTO, Forestry Commission, Amarant Care Institution, Tilburg Water Supply Company, De Dongestroom Water Board.
The following knowledge institutions will participate: Innovation Network and Habiforum. Parties that may join in include Wageningen UR, University of Tilburg, NHTV, TNO-Inro.

Towards a dynamic and liveable national landscape

Background, nature and objective
The combined Hoeksche Waard municipalities have adopted a vision of the future of the island Hoeksche Waard (HW) as a piece of Dutch rural area counterbalancing the urban development of Rotterdam and towns along the River Drecht. The vision was produced through interactive workshops with community organisations, businesspeople and administrators. HW has set the following goals for a dynamic and liveable island with the quality of a national landscape:

- conservation and reinforcement of ecological, cultural/historical and rural qualities;
- increased opportunities for residents, recreation-seekers and tourists to experience the qualities of HW at first hand;
- retention of the arable farming as a mainstay of the landscape;
- guarding of the quality of life by maintaining the typical rural structure of this island;
- increasing water storage capacity in Hoeksche Waard (the storage percentage must increase to 4% of the surface area).

Key knowledge questions

- Despite the shared vision, the simultaneous pursuit of such a broad spectrum of goals gives rise to numerous knowledge questions:
- how to keep intact the identity of HW, while meeting dynamic requirements and strengthening the regional economic structure?
- how can arable farming be transformed in such a way that it continues to contribute to the maintenance of nature and rural area while at the same time being a profitable line of business?
- how to create innovative entrepreneurship in a setting where entrepreneurs from different sectors work together in networks towards the shared goal of HW as an area?
- how to initiate and manage value chains in a rural area?
- what changes are needed in the roles of the authorities, the public and the business community in order to bring about breakthroughs towards sustainable modernisations?

Anticipated results
HW wants to establish a local development company to play a facilitating role between the demand and supply sides of knowledge and to initiate and finance projects that help achieve the defined goals. This project will identify promising areas and participants for agricultural nature management on the island, with a value chain being created in at least one pilot project. Arable farming will produce nature and rural area products in addition to agricultural produce sold under normal market conditions. Other companies in the value chain will focus on transport and accommodation of visiting recreation-seekers and tourists, which will structurally reinforce the regional economy.

Participants
EU, Ministry of Agriculture, Nature Management and Fisheries/Southwest Directorate, Province of South Holland, De Groote Waard Water Board, six Hoeksche Waard municipalities, Ruimtelijke Inrichting Hoeksche Waard, WLTO, agricultural businesses, Stichting Rietgors Agrarisch Natuurbeheer, Hoeksche Waards Landschap, Agri-business, Nature Conservation Board, Forestry Commission, Department of Public Works.

Flevoland Knowledge Estate

Background, nature and objective
The Flevoland Knowledge Estate is a regional process searching for new and additional markets for green services. Wageningen University & Research Centre and other knowledge institutions (CAH, Warmonderhof) manage more than 1,400 hectares (approximately half) of the Flevoland Knowledge Estate (the area within the triangle of Lelystad, Swifterbant and Dronten) and will be able to use the results of the process, in conjunction with their own initiatives, as an innovative example of developing and disseminating knowledge.

Key knowledge questions
- How can rural entrepreneurs, the authorities and community organisations be mobilised to undertake the broadly-supported organisation and commercial operation of sustainable agriculture?
- How can the economic, social and ecological functions desired by businesses, nature organisations and the public be combined spatially into an ecologically sustainable and visually attractive landscape?
- How can innovative multifunctional agricultural systems be designed that integrate functions demanded by society?
- Hhow can a knowledge network be created of urban-rural relationships in the region, the Netherlands and Europe to allow the Flevoland Knowledge Estate (and other initiatives) to generate a ripple effect?

Anticipated results
- An area organisation for an innovative area-driven process of the knowledge estate.
- A Public Private Partnership to arrange the financing of green services and other social functions for the area.
- A spatial design that embeds a vital agriculture in an ecologically sustainable and visually attractive landscape.
- Examination and establishment of a Community of Practice (CoP) for the "urban-rural relationship";
- Monitoring of possibilities for urban-rural relationships and keeping a watch on creative processes in other areas in the Netherlands and other countries.

Participants
Wageningen UR will be the accelerator in the start-up phase. The area organisation will later take over the role of accelerator. The area organisation consists of businesses: association of companies (pending establishment); Forestry Commission, Directorate of Domains; authorities Province of Flevoland, Municipality of Lelystad, Municipality of Dronten, Zuiderzeeland Water Board, Ministry of Agriculture, Nature Management an Fisheries; knowledge institutions: Wageningen UR, CAH, AKC, Warmonderhoef, NLTO, Flevolandschap, Environmental Federation.

Agriculture and Rural Areas for a Healthy Society

Background, nature and objective
The project’s overall objective is to ensure that agriculture and rural areas in and around towns make the fullest possible contribution to the social, spiritual and physical well-being of residents (the public and companies) in urban areas. The project will be carried out in and around Amsterdam, Rotterdam and Deventer. Numerous parties in and near these cities are keen to make better use of agriculture and rural areas and bring about modernisations. Many of the parties do not yet know each other because they operate in different worlds.

Key knowledge questions

- What are the best possible forms of interaction with the stakeholders in the transition process?
- What new designs exist for healthy, 'green' agriculture and what effects will they have on economic, ecological and sociocultural aspects?
- What are suitable new financing concepts, including methods to measure the effectiveness of the concepts?

Anticipated results
- Development of sustainable, socially-anchored, multifunctional agriculture.
- Departure from established thinking, focusing on combinations of sustainability principles.
- Creation of innovation networks consisting of companies, community organisations, knowledge centres and policymakers (national, provincial and local; healthcare, agriculture, welfare);
- Creation of a European field network.

Participants
Wageningen UR, NIDO, University of Utrecht Trimbos Institute, NIZW, National Centre for Constructive Work, Agriculture and Care, University of Nijmegen, ICIS FORUM, Landzijde, WLTO GLTO, various care institutions, farmers, Stichting Kinderboerderijen Nederland, Green Forum, Spectrum, IMCO, Noord Hollands Landschap, municipalities of Amsterdam, Rotterdam and Deventer, provinces of Overijssel and North Holland, Stichting IJssellandschap, Stimuland, Rabobank, Schiphol, Woningbedrijf Amsterdam, Ministry of Agriculture, Nature Management and Fisheries and the Ministry of Health, Welfare and Sport.

Sustainable rural development

Background, nature and objective
The approach to rural issues involving lack of space, food safety, pollution and the degradation of wildlife habitats and landscape call for far-reaching changes based on a cohesive and innovative strategy. We need an approach that is geared to the long-term and that takes account of changing circumstances and new insights. Telos wants to support these types of processes by providing knowledge on the links between ecological, economic and socio-cultural aspects, their long-term effects and the relationship between them and national and international developments. It will also be focusing attention on new possibilities (innovations) as a way of solving problems and tackling transition processes.
In the Sustainable Rural Development project the reconstruction in Gemert-Bakel is taken as a case. The aims are as follows:
- To elaborate the concept of sustainable rural development and hence to establish long-term goals in interaction with stakeholders.
- To investigate, using the sustainability survey, what (autonomous) developments will contribute to sustainable rural development.
- To compile a sustainability impact report (SIR) of reconstruction plans in de Peel.
- To evaluate the reconstruction process.

Key knowledge questiosn
- Hw to support the decision-making process in the reconstruction process?
- How can models and concepts be developed to investigate policy options and their effects on sustainability?
- How can knowledge be disseminated in inter-organisational networks and how can this encourage communication between policy, research, citizens, the private sector and civil society organisations?
- Are our spatial planning instruments effective enough to shift development towards sustainability?

- How can innovations in other spheres be encouraged to make the leap to sustainable development?

Anticipated results
- A thematic elaboration of agriculture, space and landscape, habitats, wildlife and the environment, the economic role of the rural area.
- A normative framework as a long-term strategy for the transition to sustainable farming.
- Mature conceptual and calculation models developed using the sustainability survey to yield quantified insights into the interaction between ecological, economic and social and cultural processes
- Development of a system for monitoring the transition towards sustainable rural development, including *early warning* indicators and targets for the longer term, in an appealing and accessible interface (*dashboard*).

Participants
University of Tilburg, network organisation TELOS (Noord-Brabant Province, UvT, TU-E, Pon Institute), Provincial Committee on Rural Areas, De Peel reconstruction committee, Centre for Interactive Policy Development, Research Network on Transition Management.

Orchestrating international agri-food knowledge networks

Freshparks at multimodal nodes in Europe

Background, nature and objective
Over a period of several decades the Dutch hoticulture sector has built up a strong position in the production, international trading, transport and distribution of fresh products. Internationally, the Netherlands fulfils a pivotal role. Developments indicate that the way this pivotal position is fulfilled will change in the years ahead. Questions have arisen about the nuisance caused by excessive road transport and it is becoming increasingly easy (if physical streams are detached from information streams) to route international goods directly to large European consumer centres. This could result in the creation of a "network of pivots, nodes or freshparks" in Europe. Establishment of a European network of this kind may have major consequences for the structure of the Dutch sector and the way in which parties operate within it. Pointers in this direction are already visible at a few places in Europe. The purpose of this project is to analyse the effects of creating a network of freshparks, develop firm concepts and establish a tie-in with the Netherlands Experimental Garden knowledge programme.

Key knowledge questions
- How to develop total concepts for controlling international network systems of freshparks or nodes for several parties with different interests and working methods?
- How to create sustainability and dynamics of regional, national and international streams of fresh products?
- How to develop forms of co-operation in freshparks that have added value for often competing parties with diverging interests?
- What are consequences of internationalisation of the horticulture sector for the Dutch knowledge infrastructure?

Anticipated results
The primary result will be a clear picture of the chances of success of the freshpark concept as a node for product streams close to centres of population in Europe. Secondly, the project aims to establish concepts for international consortiums for the development and running of freshparks The Dutch knowledge infrastructure will become more and more international in this field, with new knowledge alliances being formed.

Participants
The project clients represented in the steering committee are Van de Geijn Partners B.V., Frugi Venta (importers and exporters of fruit and vegetables), VGB (Vereniging van Groothandelaren in Bloemgewassen), VBN (Vereniging van Bloemenveilingen in Nederland), Horticultural Marketing Board.
The knowledge institutions involved in the project are: EUR, Wageningen UR and TUE. Innovation Network Rural Areas and Agricultural Systems and Stichting Innovatie Glastuinbouw are interested in the project because it contributes to modernising and strengthening systems in the horticultural sector.

Development of an orchestrator's control room for the aquaculture experimental garden

Background, nature and objective
The chain-oriented, demand-driven breeding of fish (aquaculture) is unique. The purpose of this project is to create an international orchestrator function by defining the required supply of information and developing essential ICT tools.

Key knowledge questions
- How can a sustainable orchestrator function be developed and used as a way of adding value to co-operation?
- How is the orchestrator function developing in relation to networks, in relation to intelligent network concepts (strategically and tactically)?
- Which orchestrator functions are distinguishable, bearing in mind the three P's?
- What requirements must be met in terms of information management and supporting ICT tools?
- What will be the consequences for each link in the network if they choose to take on one of the orchestrator functions?
- What elements of current legislation impede creation of orchestrator functions of this kind? How important is the culture component of international orchestration? What are the key success factors for forming alliances?
- How to create platforms and consortia to stimulate thinking and acting in terms of orchestrator functions and accelerate the process of learning from each other?

Anticipated results
- A generic model and ICT architecture for an orchestrator's control room, widely usable in agriculture and embedded internationally.
- A working orchestrator's control room as a prototype for aquaculture.
- An institutional approach to management, maintenance and enlargement of the orchestrator's function.
- A new network of co-operating among companies in the aquaculture sector, knowledge institutions, ICT service providers and third parties.
- Broad awareness of the possibilities ICT offers for supporting the orchestrator function.

Participants
Stichting Aquacultuur Zuid Oost Nederland (applicant), Anova Food, Van Rijsingen Beheer, Nutreco, Rabobank, Holland Aqua, E-water group, fish breeders, international distribution channels (mainly European), ICT service providers, knowledge institutions Eindhoven University of Technology, Wageningen-UR, University of Tilburg, University of Amsterdam and TNO.

Remote horticulture

Background, nature and objective
The Dutch glasshouse horticulture sector and notably its floriculture branch are highly successful in the international market. In due course, however, the sector will be confronted by mounting problems caused by the insufficient availability of personnel and increasing pressure from foreign rivals. This development prompted a group of leading growers and mechanisation companies to launch an initiative aimed at developing a system to create new horizons for glasshouse-grown products in the Netherlands and at the same time working remotely (in other countries) with orchestration from the Netherlands.

Key knowledge questions
The key issues in this project concern the role of orchestrator of the international production network and the question of technology as an enabler:
- which orchestrator concepts are important when running an international production network?
- how can an orchestrator function be fulfilled in a production network and how can an orchestrator function be structured?
- how to achieve in this kind of consultative setting the control over production and product quality?
- what role does the enabling technology play? Matters include:

- possibilities to control/automate production techniques and glasshouses (including growth appraisal systems, harvesting systems);
- objective quality measurement systems in combination with guarantee systems;
- interconnection of sales systems via the Internet.

Other issues to be addressed in this programme will be related to exploitation of innovative knowledge for world-wide applications.

Anticipated results
- Models for controlling product(ion) quality in an international network context.
- Design of automated horticultural systems operated on the basis of remote control (via the Internet).
- Favourable prospects for Dutch growers and supply chain parties with international aspirations.
- Opportunities for high-quality production in developing countries.
- Orchestration of world-wide production and sales chains.
- A platform for exploitation of innovative knowledge for applications abroad.

Participants
Product Board for Horticulture, Mechanisation companies, Growers, Eindhoven University of Technology, Wageningen UR, Let'sGrow Com bv, DynaChain bv., LEI, Plant Science Group, John Grin (UA), G. Noga en F. Lipert Univ. Bonn, Veiling ZON, Inovafruit bv, the Greenery, Fruitmasters, GBU/UVA in Duitsland, Edeka kaufgesellschaft GmbH.

Calendula, developing orchestrator roles in an innovative, international agro-industrial network

Background, nature and objective
The purpose of this project is to:
a. organise a sustainable highly innovative, international agro-industrial network for renewable raw materials ("Calendula"). It will be completely demand-driven with a high degree of interdependence between the partners;
b. develop the orchestrator role necessary for the chain to function properly. This role will be focused on five fundamental matters:
- designing the chain strategy (as opposed to business strategy);
- creating workable powers and responsibilities;
- building-in flexibility and responsiveness;
- overcoming differences in culture;
- integrating goods and information streams in an international context.

Key questions
Organising and orchestrating an innovative, international agro-industrial network constitutes a system innovation in its own right. Other system-innovating aspects concern:
- how to integrate and recombine best practices from the industrial and agro sectors;
- how to redefine and redesign industrial products based on vegetable - i.e. renewable - raw materials;
- how to develop chain strategies in an international context?

Anticipated results
- Designs for an innovative, international agro-industrial network.
- Knowledge of how a sustainable orchestrator role will be fulfilled in a chain of this kind.
- A system for utilising genomic knowledge of plants to create new output material for Calendula as an example of a crop capable of producing high-quality raw materials for new sustainable agro-industrial networks.

Participants

DSM Resins; Zwolle, Van Wijhe Verf; Zwolle, Wageningen UR, Plant Research International, Eindhoven University of Technology, Les Aromes du Maroc; Casablanca Van de Bunt, Amsterdam.

Breeding in the supply chain: valued locally, competitive globally

Background, nature and objective
Dutch livestock breeders occupy a strong international position and currently serve more than 35 countries. Given the changes occurring in the Dutch market, the international component becomes more important in ensuring business continuity. The livestock sector faces enormouschallenges in this regard:
1. A great diversity exists in cultural developments worldwide. The business community in Northwest Europe must develop towards increased sustainability. At the same time, production in other markets is being intensified considerably, with cost price playing a dominant role. Any company that opts for Northwest Europe as its base must combine two conflicting worlds.
2. The core business of livestock breeders is the genetic modification and sale of breeding material. It is necessary to anticipate developments in market and culture on a time horizon of 10 to 20 years into the future. The uncertainty regarding society's wishes and limits as regards animal breeding (animal populations are a socially-sensitive issue) makes it necessary to consider cultural and social angles when selecting breeding goals and the technologies to be used.
3. A strong tendency exists towards demand-driven chains. This points towards linear chain relationships. When making product streams flexible (e.g. bacon to the United Kingdom, chops to Germany, spare ribs to the United States), the demand-driven approach becomes extremely complex, especially when quality aspects like production method also play a role. The livestock breeding organisations have mastered the basis of production and have always played a pivotal role in the data logistics of the first part of the chain. The role can be expanded to that of a data-based orchestrator of production networks. This creates an opportunity for the breeding sector to take on a chain orchestrator role. To do this it will be necessary to give careful consideration to the degree of alliance with other players in the chain.
Tackling these challenges requires a stronger definition of research questions in an interdisciplinary context. Generic and business-to-business options can then be elaborated as a distinct activity.

Key knowledge questions
- How can the present physical animal product streams be expanded to include information management streams that lead to a role as an international network orchestrator? What roles will other parties in the chain and society play in this setting?
- How will a chain role be financed in the case of unaffiliated actors in the chain? How can revenues from global operations be channelled back to home base?
- What strategy must be adopted to be credible and worthy in socially-responsible business context domestically, while at the same time being a competitive player in the world market? As an international player, how to gear corporate social responsibility to the different regional contexts?
- How can human and culture-oriented expertise be used to design breeding programmes and to expand the chain role?

Anticipated results
- Implementation of appealing examples of animal production chains directed globally by means of ICT applications.
- Broadening the task of the breeding industry from supplier to orchestrator of international animal production networks, in order to consolidate and build upon the global role.
- Creation of a fixed link between the technical side of business and human-oriented sources of knowledge.
- Demonstration of successful businesses built on the triple P concept: ensure they are viable and, if possible, expand them to global level despite a highly competitive business environment.

Participants
Pigture group/ Topigs bv; IPG bv; Dumeco; PVE; Ministry of Agriculture, Nature Management and Fisheries, Wageningen UR; University of Amsterdam; Nijenrode University / University of Tilburg; ICT knowledge partners.

Exploitation of Dutch knowledge of sustainable production and sustainable products

Background, nature and objective
The Netherlands is at an advanced stage of designing sustainability systems for all kinds of agricultural products and also has an important export market. The export of a combination of the products and knowledge would give the Netherlands a unique position in addressing the demand for better products and greater sustainability now in evidence worldwide. The most suitable subject for research in this field is the Dutch potato.

Potatoes (seed potatoes, starch potatoes and eating potatoes) are one of the Netherlands' principal agricultural export products. They are becoming increasingly important in the world, have greater potential than any other bulk food to provide high-quality nutrition and can be grown under all kinds of different climatological conditions. Potentially the potato can make a significant contribution to solving the world's food problem. However, the potato still has a few problems of its own, that stand in the way of sustainable production. The Netherlands is in the process of making "knowledge jumps" towards the sustainability of potatoes through unique national initiatives like Genomics and the Phytophthora Umbrella Plan in which the entire potato industry, Wageningen University + Research Centre and the government have joined forces to create a sustainable potato supply chain in the Netherlands.

The purpose of this project is to use the potato as a case in examining the alpha, beta and gamma conditions that must be met for the successful combination of export product/sustainability knowledge.

Key knowledge questions
- How to obtain economically and ecologically sustainable production as local conditions elsewhere in the world differ considerably from those in the Netherlands?
- Which socio-culturally factors determine the acceptance or non-acceptance of the Dutch potatp?
- Assupply chains increase in number and complexity, due to growing differentiation in consumers' demands, which concepts are suited to orchestrate those chains?

Anticipated results
- Creation of international research networks between Dutch interdisciplinary groups and foreign research institutes at local level. Knowledge of the local growing practices, business, chain and logistical conditions; knowledge of critical socio-cultural, political, economic and infrastructure factors that enable acceptance/optimum sustainable production of potatoes.
- Creation of networks between the Dutch potato supply chain (growers and traders), Dutch research and international research leading to professionalisation of the local production column (growing, distribution and consumer market) to create a market for the production and sale of sustainable potatoes.
- Businesness models for other combinations of export product/sustainability knowledge.

Participants
Research: Wageningen UR, foreign research institutions; authorities: Ministry of Agriculture, Nature Management and Fisheries; Ministry of Economic Affairs; Ministry of Education and Science; Ministry of Foreign Affairs; World Bank, FAO; industries: Verenigde aardappelexport (NAO), VAVI, Avebe, international parties in the supply chain.

SASCA, Standardisation of Sustainable Agriculture

Background, nature and objective
In today's global environment in which an increasing number of organisations is linked to each-other by means of interorganisational relationships and networks there is a growing need for standardisation and certification. In spite of this eminent importance, individual organisations have been unable to come to long-term agreements on the standardisation of sustainable agriculture. In order to establish such a common interface in which these organisations can cooperate effectively under standardised conditions there is a strong need for a service organisation that investigates, positions and implements sustainable labels for agricultural production chains. The establishment of such an institution may provide an important stimulus to the development of truly international agro-clusters and networks.

Key knowledge questions
- What are he requiremnts to promote transportability of labels from one area/commodity to another?
- How can the three P's (people, planet and profit) be quantified and integrated in SASCA?
- How can lables (e.g. Eurepgap vs Fairtrade) be compared using techniques such as life cycle analysis (LCA)
- What are suitable certifying procedures?
- How is collaboration with institutions realised and embedded in institutions?
- How is embedding realised of SASCA in political bodies (United Nations bodies such as WTO), how is accreditation accomplished?

Anticipated results
- Development of knowledge on new certificates, labels and standards (alhpa, beta gamma interactions)
- Eliciting demands and queries and communication

Participants
WageningenUR, TUE, TNO-STB, EUR, UvT, NMI, Nestlé, Unilever, SaraLee/DE, Cargill, ConAgra, Levi Strauss, Auction Aalsmeer, NAK, CIES, SAI, GEMI, GRI, SKAL, VWA.

Longlist of integrated projects

The list below presents the integrated projects per theme. Not all the projects are elaborated in the business plan. A choice was made based on scientific and social relevance. Due to the open character of the knowledge project there is a possibility to start integrated projects which are not mentioned in the longlist.

Theme 1: Vital Clusters

No.	Integrated project	Project leader/ participants
VC001	Design of sustainable animal husbandry	European Dairy Farmers (lead company), Campina, Friesland Coberco Dairy Foods, Nestlé, CBL, LTO, University of Utrecht, ID Lelystad, LEI, IKM (Belgium), DLG (Germany), DBV (Germany), DAAC (Denmark), SDB (Spain), EOTC (EU), Belgian Farmers' Union.
VC002	Protein Highway A1	Gelderse Ontwikkelingsmaatschappij, Overijsselse Ontwikkelingsmaatschappij, Gelderland Province, Overijssel Province, Ministry of Agriculture, Nature Conservation and Fisheries (Eastern directorate), Wageningen UR. NIZO food research, Center for Protein technology, TNO-MEP, Universiteit Twente in Enschede, Arcadis, Buck Consultants International, Rijnconsult, KLICT, Universiteit Tilburg.
VC003	Sustainable agro-developments in South Groningen	Stichting Bedrijvenpark Zuid-Groningen, Ten Kate Vetten, Avebe, Vlapro, Applied Food Biotechnology, Drente Province, Groningen Province, Vlagtwedde municipality, TNO-Inro, WUR
VC004	Horst Agro-Ecopark in a "Four-leaf clover"	WUR, Agro-Kenniscentrum Zuid (in formation), Ministry of Agriculture, Nature Conservation and Fisheries, Rabobank Maashorst, Limburg Province, Horst aan de Maas municipality, Heveco champignons, Maurice Ammerlaan kassenbouw, Livar, STOP, Steenks, Saweco, LLTB, ZON Freshpark, Venlo municipality.
VC005	Designing stock-keeping facilities incorporating social values	Breeding institutes, stabling organisations, animal feed companies, civil society institutions, WUR, UvA.
VC006	Towards sustainable and high quality potato products in the Netherlands	WUR (KE-Plant, KE-Groen, KE-Agrotechnologie & Voeding, KE-Maatschappij) (lead company), Centre for BioSystems Genomics, Louis Bolk Institute Ministry of Agriculture, Nature Conservation and Fisheries, Ministry of Economic Affairs, Ministry of Housing, Spatial Planning and the Environment, regional authorities, Masterplan Phytophthora, LTO, HPA, VAVI, Avebe, Plantum, Agrodis, Nefyto
VC007	Glasshouse horticulture as a source of energy	LTO Nederland and the greenhouse horticulture commodity board (lead companies), Fiwihex, Lek installatietechniek, Habo, Stichting Innovatie Glastuinbouw (SIGN), IMAG WUR, General Electric, North Atlantic Technologies, Shell Global Solutions, architectenbureau Mecanoo, Kema Sustainable Energy, Projectbureau Duurzame Energie, Alpha Power Systems.
VC008	Certificate for Sustainable Enterprise	LTO, Agro Centre for Sustainable Entrepreneurship
VC009	Sustainabe technology	WUR, ZLTO, Vertis, META, TNO, Astron, UvT, TUE, TUD, TNO

VC010	Sustainable chain innovations	Innova Fruit B.V., Wageningen UR (Wageningen UR Plant Science Group: PRI, PPO, University); ATO; Wageningen UR Societal Issues Group; PT (Dutch commodity board for horticultural products); NIPO; DNA (Dutch Nursery Association), production extension workers; producer's union in the Netherlands, Belgium and Germany.
VC011	Integrated control of cultivation in closed glasshouses	WUR partners: PPO-Glasshouse Horticulture, IMAG, PRI, Alterra, LEI, TNO Delft, Van der Zande Advies, Ecofys.

Theme 2: Multifunctional rural areas

No.	Integrated project	**Project leader/ participants**
RA001	The Green Room in the Green Quadrant	Initiator of de Groene Kamer (lead company), agricultural businesses, local residents, Tilburg municipality, Reconstructiecommissie De Meierij, Natuurmuseum Brabant, ZLTO, state forestry department, Amarant care institution, Tilburgsche Waterleidingmaatschappij, Waterschap De Dongestroom. Habiforum, poss. also WUR, UvT, Alterra, LEI, NHTV, TNO-Inro.
RA002	Towards a dynamic and liveable national landscape	RIHW (lead company), EU, Ministry of Agriculture, Nature Conservation and Fisheries/south-west directorate, Zuid-Holland Province, De Groote Waard polder board, six municipalities in the Hoeksche Waard, Ruimtelijke Inrichting Hoeksche Waard, WLTO, agricultural businesses, Stichting Rietgors Agrarisch natuurbeheer, Hoeksche Waards Landschap, Agri-business, Natuurmonumenten [Nature Conservancy], state forestry department, Department of Public Works and Water Management
RA003	Sustainable rural development	UvT, netwerkorganisatie TELOS (lead company), Noord-Brabant Province, UvT, TU-E, Pon-instituut, Provinciale Commissie Landelijk Gebied (PCLG), De Peel reconstruction committee, Centrum voor Interactieve Beleidsontwikkeling, Onderzoeksnetwerk Transitie-management
RA004	Flevoland knowledge estate	WUR will take the lead during the start-up phase of the regional process. The regional organisation will then take over this lead company role. It consists of: Ondernemersvereniging (in formation); state forestry department; Dienst Domeinen, Flevoland Province, Lelystad municipality, Dronten municipality, Zuiderzeeland polder board, Ministry of Agriculture, Nature Conservation and Fisheries, WUR, CAH, AKC, Warmonderhoef, NLTO, Flevolandschap, Milieufederatie
RA005	Agriculture and rural areas for a healthy society	WUR, NIDO, Utrecht University, Trimbos Institute, NIZW, Landelijk Centrum OpbouwwerkStichting Landbouw en Zorg, Nijmegen University, ICIS FORUM, Landzijde, WLTO GLTO, various care institutions, farmers providing employment to disadvantaged groups, Stichting Kinderboerderijen Nederland, Groenforum, Spectrum, IMCO, Noord Hollands Landschap, municipalities of Amsterdam, Rotterdam and Deventer, Overijssel and Noord-Holland Provinces, Stichting IJssellandschap,

		Stimuland, Rabobank, Schiphol, Woningbedrijf Amsterdam, Ministry of Agriculture, Nature Conservation and Fisheries and Ministry of Health, Welfare and Sport
RA006	Breakthroughs in rural areas	TRN, ANWB, SBB, LTO
RA007	Financing through blue services	Arcadis (lead company), Union of Polder Boards, LEI, WUR, UvT
RA008	Regional modulation, eco-services, rural accessibility	Arcadis (lead company), LEI
RA009	South Limburg, a dynamic rural region	Limburg Province (lead company), 20 municipalities, polder board, water treatment board, LLTB, regional district, water supply company, Chamber of Commerce, tourism sector organisation, environmental organisation, Vereniging Natuurmonumenten, SBB.
RA010	Green funds and green enterprise	Schipluiden municipality (lead company), Delft municipality, The Hague municipality, WLTO, Agr. Natuurvereninging Vockestaert, In Natura, Natuur Monumenten, Zuid-Holland Province
RA011	Urban agriculture	The International Institute for the Urban Environment (lead company), Eemlandhoeve, LEI, Alterra
RA012	Farming linked to urban areas and the built environment	Agrarisch Kennisnetwerk AKN-ZH (de Netwerkraad) (lead company), Praktijkonderzoek Plant en Omgeving, Lisse, Boskoop, Praktijkonderzoek Veehouderij in Zegveld, DLV Adviesgroep NV, WLTO-Advies, Van der Zande Advies, Florpartners, Welland College, Hogeschool Delft, TNO-TPD, LEI.
RA013	Integrated land farming and water storage	Wageningen UR, University of Amsterdam, Noord Holland Province, municipality of Slootdorp, water district board, ECN, TNO, Ecofys, LNV, EZ (NOVEM), VROM, Grontmij, Horticultural Commodity Board, Interpolis, RIZA, RIVM.

Theme 3: Orchestrating international agri-knowledge networks

No.	Integrated project	Project leader / (proposed) participants
IN001	Flor-I-log	FloraHolland (lead company), Koninklijke Tuinbouwbedrijf Lemkes, Sierteeltvervoerders, growers, ICT service companies, ATO, TNO, TUE.
IN002	Freshparks at multimodel nodes in Europe	Van de Geijn & Partners, Frugi Venta, VGB, VBN, horticulture commodity board, EUR , WUR en TUE
IN003	Development of an integrator's control room for the aquaculture "experimental garden"	Stichting Aquacultuur Zuid Oost Nederland (lead company), Anova Food, Van Rijsingen Beheer, Nutreco, Rabobank, Holland Aqua, E-water Group, fish farms, TUE, WUR, UvT, UvA, TNO.
IN004	Remote horticulture	Horticulture commodity board (lead company), Mechanisation companies, growers' initiatives, WUR, TUE.
IN005	From seed to eco-jeans: an integrated agro-fibre chain	Vandijke Semo (lead company), Beerepoot Consultancy, Plant Research International, Hempron, IAF Reutlingen, TUE.
IN006	Standardisation of Sustainable Agriculture (SASCA)	ATO and Plant Research International (lead companies), Nestlé, Unilever, SaraLee/DE, Cargill, ConAgra, Levi Strauss, Auction Aalsmeer, NAK, CIES, SAI, GEMI, GRI, SKAL, VWA, WUR, TUE, TNO-STB, EUR, KUB, NMI.
IN007	AKIC: Agro Knowledge and Information Centre	WUR and PTC (lead companies), NIZO, TNO voeding, TNO MEP, TNO INRO.

IN008	Calendula: developing integrator roles in an innovative international agro-industrial network	Van de Bunt Keten Regisseur (lead company), DSM Resins, Van Wijhe Verf, Les Aromes du Maroc, WUR, TUE.
IN009	Sustainable innovative ornamental plant chains	Plantum NL (lead company), WUR (Plant-based knowledge team: WU, PRI, PPO; Social issues team: WU, LEI), horticultural commodity board, GornamenT.
IN010	Breeding in the supply chain: valued locally, competitive globally	Pigture group/ Topigs bv, IPG bv, Dumeco, PVE, Ministry of Agriculture, Nature Conservation and Fisheries, WUR, UvA, Universiteit Nijenrode / UvT and ICT knowledge partner
IN011	Exploitation of Dutch knowledge of sustainable production and sustainable products	Verenigde aardappelexport (NAO), VAVI, Avebe, International chain players, Ministry of Agriculture, Nature Conservation and Fisheries, Ministry of Economic Affairs, Ministry of Education and Sciences, Ministry of Foreign Affairs, EU, World Bank, FAO, WUR (KE-Plant, KE-Groen, KE-Agrotechnologie & Voeding, KE-Maatschappij), TUE, foreign research institutes
IN012	Commercial exploitation of transgene ornamental plants	Plant Research International (lead company), Agriom BV, TUE
IN013	Innovative clearance system for companies in the Fair Trade agro-network	Strohalm (lead company), Fair Trade, Solidaridad, Wereldwinkels, Redes de Cooperacao, LEI, Utrecht University, Universitario Feevale
IN014	Expertise Centrum Botrytis: establishment of an (international) chain-wide knowledge network and development of decision support systems	WUR (ATO, PRI, LSG, PPO, IMAG, LSG, Phytopathologie), Dept Laser en Molecuul fysica, KUN Plantum, VGB, PT, VBA, BVH, Flora, Intergreen, Van Amerongen and Suurbier
IN015	Innovation centre for the meat and fish sector and associated chains	ID-Lelystad (lead company), Nutreco-agribusiness and aquaculture division, Dumeco, Cebeco-Plukon, Van Drie groep, Anova Food, Stork-PMT, SMEs, Central organisation for the meat sector, livestock, meat and eggs commodity boards, Vereniging Vleeswarenindustrie, Vereniging Kokswaren en Snacks, fish commodity board, animal feed commodity board. Utrecht University, WUR (Universiteit, ATO, ID, RIVO), TNO Voeding
IN016	Knowledge Platform	HPC, LEI, WUR (lead company), Let's Grow.com, DynaChain, LEI, Plant Science Group, UA, University Bonn, Veiling ZON, Inovafruit, the Greenery, GBU/UVA (Germany), Edeka kaufgesellschaft GmbH.

Appendix 2: Curricula vitae scientific directors

Prof.dr. Martin J. Kropff

Scientific training

1989	PhD (*cum laude*) in Agricultural and Environmental Sciences, Wageningen Agricultural University. Supervision: Prof. C.T. de Wit, Prof. E.H. Adema, Dr. J. Goudriaan Quantification of SO_2 effects on physiological processes, plant growth and crop production.
1984	MSc in Biology (*cum laude*), State University Utrecht, The Netherlands

Professional positions

1984-1990	Agroecologist, Wageningen Agricultural University, Department of Theoretical Production Ecology
1990-1995	Systems agronomist, Deputy Programme Leader at the International Rice Research Institute, Los Baños, Philippines
1995-1998	Professor of Applied Plant Ecology and Weed Science, Wageningen Agricultural University
1998-	a. Professor of Crop and Weed Ecology, Head of the Chairgroup, Wageningen Agricultural University
1998-2002	b. Scientific director of the C.T. de Wit Post Graduate School for Production Ecology and Resource conservation of the Wageningen Agricultural University.
2001-	Managing Director/Director General of Plant Sciences Group of Wageningen UR. This includes three organisations: Plant Research International, Applied Plant Research and the Department of Plant Sciences of the Wageningen University.

Professional activities (selection)

1987-	Chairman/member of the scientific committees of int. symposia Task leader for tropical crops in IGBP core project Global Change and Terrestrial Ecosystems and member of the GCTE crops committee
1994-1998	Task leader IGBP core project Global Change and Terrestrial Ecosystems
1995-	Chair of external review panel for int. institutes
1995-	Member editorial boards of the Agricultural Systems, Netherlands Journal of Agricultural Sciences Weed Research, Journal of agronomy and crop science
1996-2002	Chairman of the Royal Society for Agricultural Scientists in the Netherlands
1997-	Vice president and since 1999 President of the European Weed Research Society and chairman of the scientific committee of the EWRS
1998-	Member of the academia dei Georgofili, Florence, Italy
1999-	Member of the Hollandsche Maatschappij voor Wetenschappen
1999-2002	Chairman of the selection committee for WOTRO-NWO proposals
2002-	Chairman of the WOTRO-NWO policy advisory board
1984	Courses in agroecology, systems analysis and design etc.

1990-	Currently (Co-)Supervision 28 PhD students in the field of Crop Ecology and Weed Science, Environmental Characterization and Soil Science. Completed: 1 in 1994, 1 in 1996, 2 in 1997, 2 in 1998, 2 in 2000 1 in 2001.

Publications and presentations

- about 100 papers in refereed journals, 12 books, 60 refereed book sections, 30 publications in proceedings and course texts and about 40 other publications and reports
- more than 30 keynote addresses and invited presentations and more than 100 other presentations to conferences and symposia
- Citations since 1995 in Int. Journals: over 1150

PhD students

15 PhD students finalized their study and 18 PhD students are currently (co-) supervised .

Prof.dr. Cees Leeuwis

Education / Professional studies

August '84 - June '88: M.Sc. programme in Rural Sociology at Wageningen Agricultural University. Main subjects:
- Comparative Sociology of Agrarian Development
- Research Methodology
- Communication and Innovation Studies

The study-results were evaluated in a graduation 'cum laude' (with honour).

October '88 - December '93: Working on a Ph.D.-thesis on the use and development of computer-based systems for decision support at the Department of Communication and Innovation Studies at Wageningen Agricultural University.
These efforts were completed with a doctoral degree 'cum laude' (with honour). Promotors were Professor Niels Röling (Communication and Innovation Studies) and Professor Norman Long (Sociology).

Membership of Professional Bodies:
- Member of the Board of the International Course on Integrated Pest Management at IAC;
- Chairman of the Programme Committee for the international MSc-programme “Management of Agro-ecological Knowledge and Social Change”.
- Member of Coordinating Committee of the ZIMWESI programme (Zimbabwe programme on Women Extension Sociology and Irrigation) funded by Nuffic (Wageningen coordinator of the programme between 1994 and 1997).
- Co-organiser of a.o.:
  - European Seminar on Knowledge Management and Information Technology (1989)
  - Congres: Integrated design in agriculture (1998)
  - Zimwesi end of phase 1 seminar: 'Social struggles over water and land' (1997)
  - Workshop on Critical Assessment of Modelling Approaches in Integrated Crop Management, at the 5th ISHS International Symposium on Computer Modelling in Fruit Research and Orchard Management (1998)

Publications
Scientific books and published studies: 8
Articles in refereed journals: 14
Publications in scientific books and proceedings: 45
Research reports: 11
Articles in professional journals: 20

Prof.dr. Theo A.M. Beckers

Scientific training

1959 - 1966	Social geografy and sociology at the University of Nijmegen.

Professional positions

1968 - 1976	Teacher at the Dutch scientific Institute for Tourism and Recreation,
1976 - 1988	Associate Professor, Agricultural University, Wageningen
1987	Professor in Leisure Sciences, University of Tilburg
	Director of Research School
	Dean of the Faculty of Social Sciences
	Director of Globus, the Institute for Globalisation and Sustainable Development
	Scientific Director of Telos, the Brabant Centre of Sustainable Development
	Founder of the Knowledge Centre for Rural Development
	Member of the Council for Rural Areas

Prof.dr. Geert Duysters

Scientific training

1995	PhD from the Maastricht Economic Research Institute on Innovation and Technology (University of Limburg). Supervisor, Prof.dr. J. Hagedoorn
1990	Master of Business Administration University of Limburg.

Professional positions

2000-present	Full Professor of Organization Science, Eindhoven University of Technology
2000-present	Scientific Director of the Eindhoven Centre for Innovation Studies (ECIS)
1999-2000	Associate Professor of Technology Management, Eindhoven University of Technology.
1998-1999	Chairman of the Dept. of Strategy and Logistics, University of Maastricht
1998-1999	Senior Manager, KPMG Alliances (part-time), International Headquarters, Amstelveen
1996-1999	Associate Professor of Strategic Management at the Department of Strategy and Logistics of the Universiteit Maastricht
1995-1996	Assistant Professor of International Business Strategy at the International Business Department (University of Limburg)
1994-1994	Researcher at the Maastricht Economic Research Institute on Innovation and Technology (MERIT)
1990-1994	PhD student and researcher at the Maastricht Economic Research Institute on Innovation and Technology (MERIT)
1993	Visiting PhD-student at the Science Policy Research Unit, Brighton, England

Professional activities (selection)

2000-present	Member Global Board Association of Strategic Alliance Professionals
2000-2002	Chairman Research Team Economics and Business (KLICT)
2000-2002	Member Chain and Network Research Team (KLICT)
2000-2001	Chairman of the Faculty Council, Eindhoven University of Technology
1999-2001	Chairman European Chapter Association of Alliance Professionals (ASAP)
1999-2001	Management Team of Organization Studies (Journal)
1998-1999	Chairman of the Dept. of Strategy and Logistics Maastricht University.
1998-2000	Member of the Evaluation Commission Economics and Business Studies NWO-ESR
1998-1999	Member Merit Institute Council (MIR)
1997- 1999	Track coordinator: Track “International Strategy and Organization”, Maastricht University.
1997	Chairman of the working group “Tracks and Blocks”, Maastricht University
1997	Re-organisation coordinator International Business Studies, Maastricht University
1996-1997	Member of the Faculty Council, Maastricht University
1995-1997	Member of the Overall Test Committee (Faculty of economics and business administration, University of Limburg).
1993-1994	Member of the Scientific committee (Faculty of economics and business administration, University of Limburg).

Publications and presentations

- about 80 papers in international journals and book sections (35 of which are double-blind refereed), 2 books.
- about 25 keynote addresses and invited presentations and more than 70 other presentations to conferences and symposia

PhD students

2 PhD students finalized their study and 6 PhD students are currently (co-) supervised.