

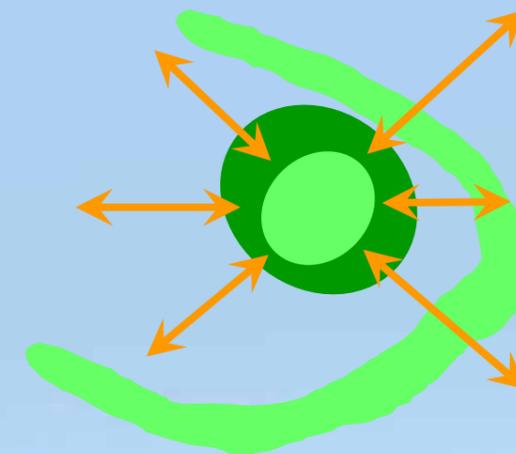
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# Master plan Greenport Shanghai Agropark

East head of Dongtan,  
Chongming Dao, Shanghai  
People's Republic of China

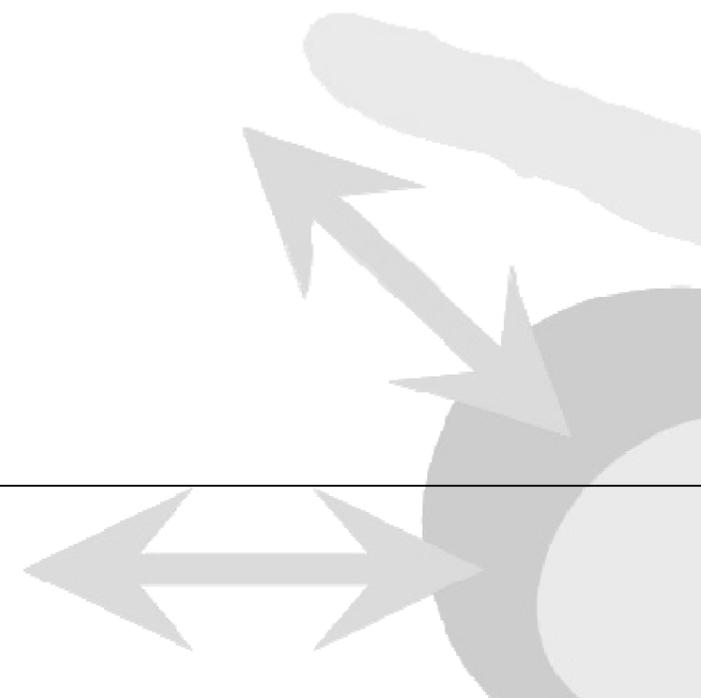


Better city  
Better Agriculture  
Better Life



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Greenport **Shanghai Agropark**



# Master plan Greenport Shanghai Agropark

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*If you don't reach for the stars, you will end with hands full of mud.....*



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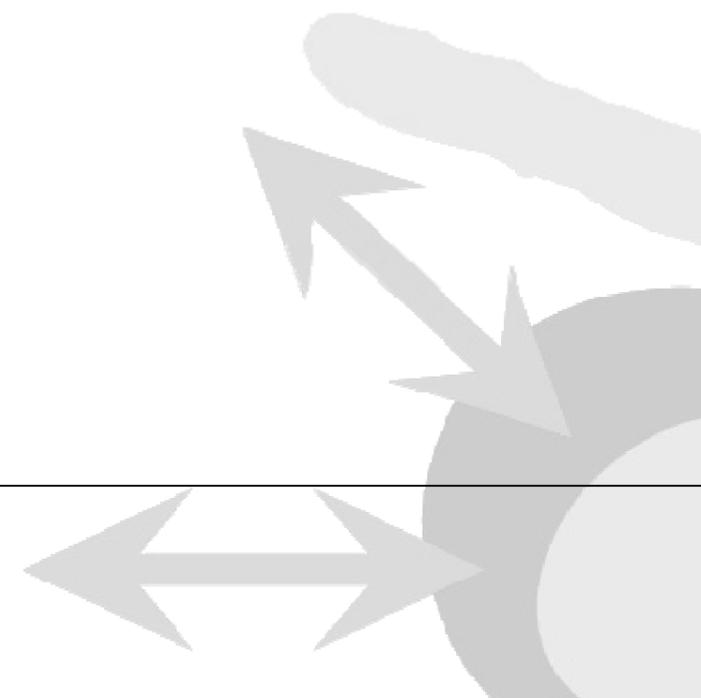
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Greenport Shanghai is the innovative and ambitious exploration of how Chinese metropolitan agriculture will jump into the 21st century: circular, sustainable and profitable

Commissioned by TransForum Agro & Groen  
Shanghai Industrial Investment Corporation  
Alterra Wageningen University and Research Centre

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Greenport **Shanghai** Agropark



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# Summary

## China

China is a transitional economy, a rapidly developing country with a high demand for self-sufficiency in technologically innovative, sustainable agriculture. There is vital need for new forms of intensive agricultural production in which food is produced near the centers of urbanization, without causing serious environmental impact.

Agro park development in China represents a new dimension of Chinese metropolitan agriculture.

## Shanghai

Shanghai in the lower Yangtze Delta, with its circa 18 million inhabitants, is a first class city in the world, and has a speed of development that is enormous. The urbanization pressure in this lower basin and eastern coastal area is high and therefore the need for innovative agriculture near its urban areas. There is a demand for good food, produced in a healthy and transparent way, answering to the dire needs of sustainable development with circular production systems and processing methods. These requirements for optimal food production are clearly formulated by the Chinese government, as they are top priority in Dutch policy and research for agricultural developments.

## Chongming Dao

Shanghai is already the richest city in China but green space is a luxury to urban dwellers. Therefore Shanghai government decided that the development of the present rural Chongming Island, an 80 km long island in the fore coast of the rapidly expanding city will be developed coming years as an eco friendly island, where sustainability issues are leading. This island will be connected in 2009 with Shanghai city with the completion of a bridge-tunnel connection, shortening traveling to merely thirty minutes. The pressure on land use developments is very high. As the island of Chongming it is the last green space of Shanghai, the government made it clear the role of Chongming is to be the "green lung" of Shanghai. Its development based on the best available knowledge on sustainable development for living, working, city building, recreation. Nature, socio-economic development and agriculture.

## Assignment for metropolitan agriculture

The Shanghai Industrial Investment Corporation (SIIC) as a private company, funded by the city of Shanghai, has been appointed to develop Dongtan, the east head of the Island with a total size of 86 km<sup>2</sup>. With the special approval of government, SIIC spearheads the first major development on Dongtan area of Chongming as a test

case for this sustainable green development. The metropolitan agriculture, showcase of world class circular ecological agriculture in the form of an agro park in the north zone (27 km<sup>2</sup>), is one of the four main functional zones. It is situated next to the development of a completely sustainable garden city in the southern part (17 km<sup>2</sup>), an education and clean energy demonstration centre in the middle zone and the natural conservation area in the east zone, safeguarding an important Ramsar wetland with a buffer zone of freshwater wetland (24 km<sup>2</sup>) for education and recreation purposes. To realise the policy of innovative agropark development, its planning and a high chance of efficient and effective implementation of the Greenport Shanghai Agropark, an international Chinese-Dutch combination initiated the Agropark planning and development in July 2006.

The Shanghai Industrial Investment Company, TransForum Agro & Groen and Alterra, Wageningen University and Research worked together in a general strategic alliance, to develop an Agropark in this front garden of Shanghai, on Chongming Dao.

## Three coherent plans

To this purpose SIIC invited the Shanghai Jiao tong University to develop the Strategic Plan, the Nanjing Agricultural University to realise the industrial Plan and Alterra Wageningen to develop the Master plan. Within the 3 coherent plans, with its underpinning knowledge studies, new principles for peri urban or urban rural planning are being elaborated.

## Process oriented approach

The master planning, based on the latest thinking on agropark development and metropolitan agriculture follows the approach of multi actor, multilevel and multi cultural participation, in which cooperation took place between Chinese and Dutch government officials, Dutch Agro-entrepreneurs and international team 15 Dutch key specialists and Chinese researchers. Its way of working based on the newest knowledge of development policy as strategy for planning versus the more traditional control planning. The criteria for evaluation of every part of the planning procedure, from master planning towards implementation and exploitation are based on criteria and indicators for sustainable development.

## Networks, structural and optional elements

Within the master plan design principles are developed and explained with three underpinning networks, obligatory structural elements and optional elements that are illustrated, calculated and visualised in scenarios. The realisation of the agropark will be

based on the input and demands of the future entrepreneurs and user groups, as well as on the fundamental structural elements and networks that form the basis for sustainable development.

## Demonstration, Trade, Production and Processing

Production and processing, Trade and the Demonstration of production, processes & networks form the main functions of the Agropark. High quality training, research, living, tourism and leisure and nature are derived from these main functions.

The main technical innovation lies in the heart of the Park, in which the Central Processing Unit combines all flows and recycles nutrients, water, energy and biomass, and CO<sub>2</sub> and converts the "wastes" into maximal use of resources, cost reduction and quality improvement of through waste management and recycling of valuable materials and energy. This CPU is the added value for the agropark environmentally and profit wise.

## Quality of the work landscape in hardware, software and orgware

The agropark finds its innovation in its large size in production potential for food and processing, in the esthetics of the working environment, in the multifunctional approach for trade, demonstration and production/processing, in its computerised precision production systems. As well as its planning is based on fundamentally sound principles of landscape ecology, integrated water resources management, climate proofing and sustainable infrastructures and the newest insights on leisure and living in a sound and agreeable environment. As such it represents the three P's of sustainable development, planet, people and profit.

In the master plan development the aspects of the hardware have been paralleled with strategies towards knowledge development and -valorisation, as well as with the organisational/ political developments towards the complex implementation of the Greenport Shanghai Agropark. This comprises its international and intercultural business planning and corporation building.

The time pressure on realization of this Modern Greenport Shanghai Agropark before the Expo 2010 gives this Master plan a special load; there is decision making needed on choice of investments and investors, inputs and outputs of enterprises in the park that will determine the way infrastructure investments in the park will have to be made. It asks for careful establishment of this industrial agro cluster in harmony with the eco-city and the wetlands. The low ecological footprint of the total Dongtan area can only be established in close connection between its parts of urban spaces, agropark and nature areas.

Wageningen-Shanghai July 2007

# 1. Introduction

## 1.1. Preface

Greenport Shanghai is a project initiated by the Shanghai Industrial Investment Company, TransForum Agro & Groen and Alterra, Wageningen University and Research to develop an Agropark in the front garden of Shanghai, on Chongming Dao. The project is driven by the necessity in China to make the transition from present agricultural practice to intensive agricultural production in its urbanizing areas, with high input, high efficiency and high output.

The urbanization pressure in this part of the world is enormous, as is the demand for good food, produced in a healthy and transparent way, answering to the dire needs of sustainable development with circular production systems and processing methods. These requirements for optimal food production are clearly formulated by the Chinese government, as they are top priority in Dutch policy and research for agricultural developments.

The development phase for this Master plan is short termed, the first realistic implementation should start in 2008 to be realized in 2010 as a demonstration area and foothold for trade, based on the structural options of infrastructures, networks, density zoning and central axis as described in this Master plan. The step by step development of the production and processing area will be based on sound entrepreneurial and political investments and gains and its linked social and urban developments. This Master plan realization steers towards a horizon of 2015. It is continuous development and . dependent on speed of realization of the structural, non optional aspects, the successful investments and developments by all key stakeholders and the quality in which the prescribed sustainable development can be realized.

In an agropark agricultural production and processing take place in the most sophisticated, highly technological industrial way. The agropark "Greenport Shanghai" developed in this project can be considered as a system innovation in the field of urban agro-food production and processing. It consists of spatial clustering of the total chain of production, spatial clustering of different agro-productions, spatial combination of agro-processing and non-agro functions like energy production, waste and water management. The scale increase that is characteristic for agropark production enables the application of principles of industrial ecology, such as mutual use of waste and by-products. Moreover it reduces transport and veterinary risks and improves animal welfare.

Greenport Shanghai is part of Ecocity Dongtan. Therefore the balance between aspects of planet, people and profit, that forms the basic principle of sustainable development, has been the leading principle for the design and development of this agropark.

Planet means a shift from focus on production chains towards a focus on flows of energy and matter.

People means a shift from focus on the technical system towards a focus on organisation and knowledge management, communication, information management, training and capacity building. It also means a shift from hierarchical planning to governance in networks, also social and cultural.

Profit means producing a reasonable return by focusing on integral production network for improved chain relations, cost reduction and quality management.

Production and processing within the park are combined with demonstration to meet the high demand for recreation and education of the visiting citizens of Shanghai, the expected increase in Chinese and foreign guests for touristic, business, recreational, educational or research purposes. Another important feature of the park is trade and auction in raw materials and semi-processed products, necessary because the service agriculture products that the park is aiming to deliver usually have a complex composition of which only a part will be produced within the park itself.

The Master plan for this agropark has been based on five features: 1. Integrated network design answering to the needs of production, processing, demonstration, trade and recreation, 2. Modern metropolitan agriculture, 3. High tech infrastructure, 4. Sustainable development and 5. Profit.

The agropark Master plan design will step towards realization and operationalisation within 3 years from now, to be realised as highlight for the Shanghai 2010 World Expo and the international exhibition Floriade 2012 in The Netherlands.

The ambitions of this Master plan Greenport Shanghai Agropark Dongtan are high, the consortium of Shanghai Industrial Investment Company, TransForum and Alterra Wageningen University and Research have gathered a wide scope of specialists and experts, Dutch as well as Chinese, which have worked in close cooperation in an integrated, interactive way. These results of the multi level (global, regional, national and local), multi actor (government, knowledge institutes, enterprises) and multi cultural approach, to come to the integrated design of the agropark, resulted in this 27 km<sup>2</sup> Master plan.

## 1.2 Instruction for reading

Chapter 1 is the introduction of this Master plan

Chapter 2 will lead you through the background reasoning for this assignment, the historical context why Chinese and Dutch organisation work together for this Master planning and how the working process has been done.

Chapter 3 gives you the physical and spatial context in which this Master plan Greenport Shanghai Agropark can be situated, as connection point within the different spatial scales.

Chapter 4 explains the need and challenge of the paradigm shift in planning practice within the urban-rural arena of metropolitan areas, for which this Master plan forms a pilot. Here the innovation strategy is based on the interaction and learning process between Chinese and Dutch approaches and an intensive dialogue between current Chinese and Dutch practices. It explains the meeting the requirements of sustainable development with regard to 'planet', 'people' and 'profit'.

Chapter 5 shows and explains the actual integrated design of the Master planning with its basic *structural elements* as density zoning, spatial gradients, central development axis, and networks. This comprises the infrastructure, principles of integrated water management, landscape ecology, the string of functional hotspots and routings for all target groups. This basic framework forms the matrix for the *flexible options* that are described in this and the next chapter.

Chapter 6 illustrates the basic philosophy behind the demonstration park, the trade park and the agricultural production and processing of the agropark. This chapter shows the different flexible options and elements which can be developed in the agropark. These are described, visualized and calculated in the form of four scenarios.

Chapter 7 looks towards implementation of joint business planning, formal planning and knowledge development of Greenport Shanghai Agropark.

## 2 The assignment: Historical backgrounds



*This chapter 2 will focus on the fit of Dongtan agropark project within the agriculture mission of China and Netherlands and how it answers to the goals of the key participating parties, as the Shanghai Industrial Investment Company (SIIC), TransForum Agro & Groen and Alterra of Wageningen UR. It gives insight into the working process in which continuous involvement of multi parties was organised and facilitated.*

### 2.1 Historical Perspectives of Agriculture in China.

China is the largest country in the world but the per capita the arable land area is only one-quarter of the average of the world. For that reason food security has always been on the top of the list of national issues since the founding of the People's Republic of China in 1949. After the opening of China in the late 1970s, China's food security became a popular subject among agriculture economists of the world, because the food security issue of China is directly linked with world food prices. To ensure the stability of food production, the Chinese government created a "grain production responsibility system" that goes through the chain of command from the government at central level to province, to city, to county, to village and to each and every peasant family requiring a certain amount of production contributing to the public grain reserve.

The sense of food security also created a Chinese mentality about the importance of "food self-sufficiency" percolated from central to local level. With the liberalization of the economy and the free market system in China starting from the 1980s, food production increased and stabilised because peasants were motivated to produce more for more income. But nobody believes the new system is a cure to China's food problem because of the land pressure problem to China.

Actually the new system has its own shortfall when it is unchecked. Higher production of food is often accompanied by the higher use of chemicals, both in the forms of fertilizer, agroicides and growth enhancing agents that can cause pollution to the ambient environment, including water bodies and soil, and also affects human health. While the State Environmental Protection

Administration (SEPA) has done much on the control of point source industrial pollution, the agriculturally induced diffuse non-point source pollution control issue has not been addressed.

### 2.2 The Politics of Agriculture in Shanghai.

For Shanghai as a mega-city, it is not difficult to understand how the food self-sufficiency problem can be a haunting issue to its leaders. An example is the the issue of pork production in Shanghai, where pig farms in the urban area are highly undesirable, because of the pollution problems. In the last twenty years, many pig farms in Shanghai were asked to leave the city but at the same time the government of Shanghai still wants to maintain about 50 percent self-sufficiency on pork. Another emerging urgent problem is food safety. Motivated by profit, banned antibiotics and growth enhancing chemicals are still found in the animal food and meats. Because these protein foods are produced by individual farmer dispersed in the country side, so the compliance program can hardly cover all the producers. Within the perspective of the above, it is not difficult to understand why the government of Shanghai is looking for innovative ways of achieving more local production or higher level of self-sufficiency of food, and safer food at the same time. The introduction of the agropark concept in the late 1990s appears to shed new light of sharing the concerns of the government. To date there are about twenty agro parks around suburban Shanghai and most of them are involved with the production of vegetables. Animal production is not popular because of the difficulty of dealing with animal waste. Another concern on agroparks is its economics; high up front investment and long pay back period.

### 2.3 SIIC and the Significance of Agro park to Shanghai.

Shanghai proudly moves into the 21st century like a star city in the world. The agriculture of the city is also setting new and ambitious targets. The innovations in agropark development are going to be instrumental to its realization. The development of Dongtan on Chongming islands is an opportunity to create a dream Agropark in Shanghai. SIIC is

selected by the Shanghai government to be the developer of Dongtan, and as such SIIC was entrusted the task of building the most ecologically friendly real-estate development on Dongtan, including the agropark. In the past year, in which the conceptual thinking of the Dongtan agropark Master plan developed, it compelled to accomplish a number of objectives, as follows:

- Being in line with the national strategy of Three Rural Issues Stipulated in the Eleventh Five Year Plan of the Government and the Three Rural Issues refers to Agriculture, Countryside and Peasantry
- Increasing food production of both plants and protein at local level, thus reducing import from other places,
- Producing safe and high-quality food,
- Creating more jobs, especially for those migrating from the rural areas,
- Developing a model of sustainable agriculture and/or circular agriculture economy, including energy efficiency and use of renewable energy,
- Establishing coherence in the urban-rural areas,
- Offering more green space for Shanghai,
- Serving as a trade center for domestic and international agriculture produces,
- Setting standards for food quality and conducting certification,
- Creating a demonstration, research and education venue for modern agriculture, and
- Serving for the purpose of tourism and leisure, and finally but not the least
- Showing to the world a Sino-Dutch joint effort of agropark innovation in the World Expo 2010-Shanghai.

For Shanghai, the search of innovative and appropriate agropark model is still going on and this is also the reason of the involvement of Alterra of Wageningen University and TransForum in the Dongtan Agropark Master planning.

## 2 The assignment: Dutch interests

### 2.4 Dutch Agriculture in the Globalization.

There are good reasons why the Dutch are interested to get involved in the project. The Netherlands has a strong agro-food sector. The post-war development of knowledge was directed towards high-productivity agriculture. While this approach was successful, it is now leading to over specialization, environmental pressure and encroachment of public spaces. The agro-food sector is running into ecological and social barriers; a switch to sustainable production and the maintenance of livable rural areas is badly required. At the same time, the Netherlands must continue to hold its own against international competition.

With the continuing development of the WTO Dutch must look beyond its borders. There is the conviction that there is a market for Dutch agricultural enterprises in China and countries in Asia. Agriculture trade is not only with respect to end-products but certainly also in relation to the production of planting and breeding materials and knowledge. Dongtan agropark brings Dutch agro-production into the spotlight, revealing what it can offer, and it can therefore generate a large amount of business. In short, for this bilateral cooperation, the Dongtan agropark is going to be a demonstration park for China and showcase for the Netherlands.

### 2.5 Wageningen University and Research.

The last 10 years research institutes from Wageningen University have developed the concept of Agro parks in the Netherlands as well as international, together with the Innovation network and supported by the ministry of Agriculture, Fishery and Food Safety. Agro parks are not only industrial complexes for food production but centre points of regional development, in which not only intensification but also extensification of land use takes place which induces land use shifts for the better. This so called "the space pump principle" induces concentration of industrial (agricultural) functions, meanwhile freeing the rural landscape of unwanted or polluting practices and creating new space for new functions more appropriate for the rural circumstances and wants. WUR invests together with TransForum in the further development of Green port Shanghai Agropark and

Agro parks elsewhere in the world, based on the available integrated knowledge and generic principles of Agropark development, knowledge on agricultural production, on work and technical processes and on process management of complex regional developments. In itself the working process of the multi actor/multi cultural process for agro park development is the arena for transdisciplinary action research, which forms focus of the co called Wageningen approach of WUR.

### 2.6 TransForum Agro & Groen.

In response to the new challenges in the Netherlands on the transitions within agriculture, TransForum was created. A new way of coming up with innovations in agriculture is its priority. This calls for new alliances between entrepreneurs, governments and researchers. TransForum brings such alliance about. In this way a new knowledge network is established that satisfied two requirements: Close partnership between research and practice and cooperation among divergent disciplines to come up with integrated practical solutions.

From the Dutch point of view it was also recognized that such an alliance should not be just a domestic effort, it must also work international. Shanghai Dongtan agropark development was identified to be a good testing case. The development of an agricultural park entails an exchange of expertise on two sides. It is not only about the techniques and methodology used in agricultural parks, but it is also about regional planning, about environment, about the development of international networks and new forms of cooperation, especially those involving small and medium-sized enterprises. The goal is the development of a knowledge value chain, by which Dutch and Chinese knowledge institutions together educate the people who will later work in the agricultural parks and conduct research, and in doing so, generate new demand for similar knowledge institutions. For this reason partnered with TransForum is Shanghai Industrial Investment Company, the developer of Dongtan area. Leading in the provision of technical and knowledge support for TransForum is Alterra Wageningen UR and its circle of experts and on the SIIC side



Shanghai Jiao tong University and Nanjing Agricultural University form the knowledge partners.

### 2.7 Mission Statement

Greenport Shanghai is the innovative and ambitious exploration of how Chinese metropolitan agriculture will jump into the 21st century: circular, sustainable and profitable.

..... If you don't reach for the stars, you will end with hands full of mud.....

### 2.8 SWOT.

To prepare the Master plan, a strategy has been devised based on a jointly executed SWOT analysis within the Chinese-Dutch working team, following the SWOT executed by Nanjing Agricultural University. This analysis found the opportunities and threats. The approach adopted to address these opportunities and threats show a number of strong characteristics, but also weaknesses that have to be conquered.

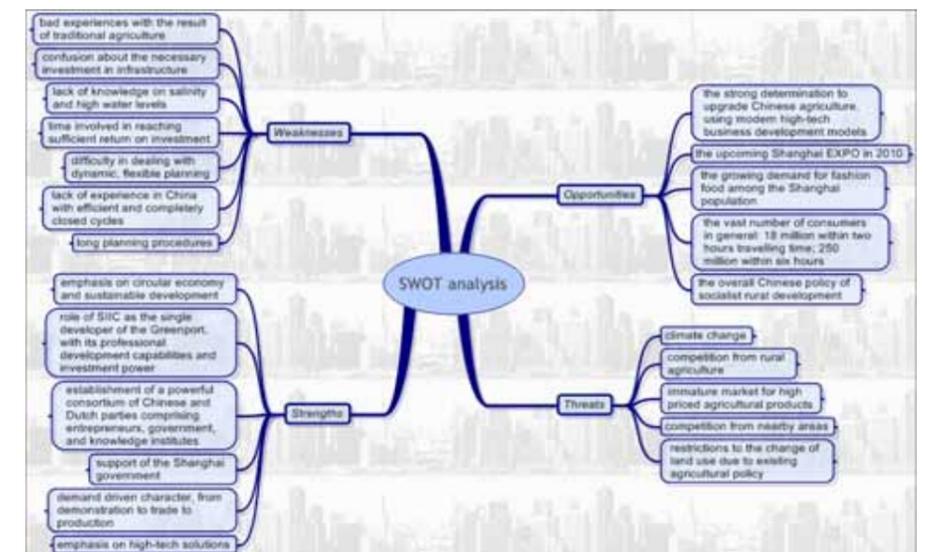


Fig joint SWOT analysis for Greenport Agropark Dongtan

## 2 The assignment: Working process

### 2.9 Working process

The Master planning to develop Greenport Shanghai Agropark was commissioned by a consortium of three partners, SIIC, TransForum and Alterra Wageningen, in which parallel development of three main components, Hardware, Software and Orgware [1] of the Master planning was executed.

The Master plan is not a blue print, but is being developed as a working process to answer to the realisation of wise policy aiming at sustainable development of land use, in which planet, people and profit aspects are equally dealt with. This can only be accomplished through complying with well established rules, standards, criteria, boundary conditions within the Chinese situation and answering to the planning principles of participative development policy that is part of the Dutch approach. Essential in this approach is the continuous involvement of entrepreneurial, governmental-political and knowledge partners during all steps of the working process.

The clearly defined goal to develop a Master plan for the Agropark was reached by an open transparent, iterative approach for design, with participation of all key players, facilitating development of commitment, team spirit, cooperation and governance of relations within a learning attitude. Leading principles in every step were arrangements and alignment of vital coalitions of responsible stakeholders and integration of explicit knowledge and tacit knowledge.

The way to reach a vital consortium that will develop and realize the Master planning is by building the network of Dutch and Chinese knowledge institutes, entrepreneurs, investors, governmental and non governmental organisations step by step on all working levels and all phases of the process.

The working process has been designed to facilitate the interactivity of the three assigner organisations, the design team and the reference/advisory boards group to build and continuously improve and enrich the design of the Master plan, to make it fit and realistic for future investors and entrepreneurs and for possibilities for knowledge valorisation and exchange. The methodology that was used follows theories of the design approach, the layer approach as design principle, the landscape dialogue, based on the use of the principles of the knowledge spiral [2].

This participative approach as developed in Wageningen UR for Agropark development and Master planning has been used to build the working organisation consisting of the advisory boards, steering group and project group of key specialists in the Netherlands as well as in China. The advisory boards on both Chinese and Dutch side were organised with participants that are embedded in formal governmental or entrepreneurial or scientific organisations, coming together regularly.

The design team consisted of 16 Dutch key specialists (agriculture, production processes, hydrology, ecology, urban and rural planning and regional planning, design and visualisations, communication and organisation and business issues (hard soft and org ware components) and their counterpart specialists in China. To embed the results of the master planning within the Chinese context and mechanisms on issues of system, organization, management and risk evaluation, close collaboration occurred with the two Chinese Universities of Jiao tong and Nanjing Agricultural University, involved in the strategic and industrial planning. The development of the three plans simultaneously and in interaction will guarantee this complementarity of the 3 plans in this. (see chapter 4).

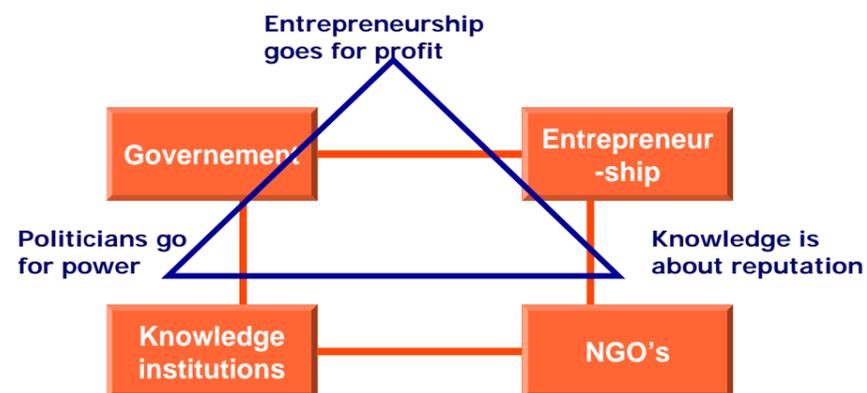


Fig Interests of the key actors in participative planning

There are three phases to be distinguished in the development of the Agropark, with a horizon of 2015:

- Master planning (end 2006-may 2007),
- Implementation (2007-2008), in which basic infrastructures, structural elements and first entrepreneurial investments will take place.
- Operationalisation (2008-2015).

The Master planning has delivered newsletters and a brochure in which the three main parts of the Agro park Master plan for the circular agriculture economy were decided as **“Bridge between cultures: from demonstration and trade to full swing to win win.”**

The three main parts consist of:

- Demonstration park for China and showcase for the Netherlands
- Trading facility for products, facilities and processing and knowledge exchange
- Functional agricultural production and processing units with the Central Processing Unit as “The heart, liver and kidneys” of the Agropark

The Master plan of the Agro Park (this report) is accompanied with basic knowledge studies on CPU (central processing unit), organisational aspects, knowledge management, learning process (evaluation and monitoring) and planning methodology.

[1] Hardware means all aspects that have to do with the physical components as infrastructure, nature, housing, industry, soil, water etc. Orgware deals with organisational and institutional, financial and legal or procedural aspects; Software consists of knowledge management and knowledge dissemination, dealing with intercultural aspects and management of creativity and emotions;

[2] Reference for use of the Design approach, the layer approach as design principle and working according to the principles of the Knowledge Spiral (see Van Mansfeld 2004, Smeets 2004, Oenema 2006, Kolb, 1975, Nonaka & Takeuchi, 1995)

## 3. Context

*This chapter explains the levels of connection and the relationships of Greenport Shanghai Agropark within its international, national, regional and local contexts.*

### 3.1 Six levels of connection

Greenport Shanghai Agropark can be positioned in its context on six different levels with different significances of connection and interaction at the various levels.

1. On world level, internationally there are the links with all the parts of the agricultural chain of the world, in production, processing and trade and in relationships with knowledge centres. These are with the Netherlands, but certainly not alone, as there are already Chinese, French, Italians, Japanese and New Zealanders active in agriculture developments in Dongtan.
2. On national level within China there are the linkages to the rest of China. Shanghai has always strived to be an example for the rest of the country, in this case in the development of Dongtan Ecocity and of industrial agriculture. This characteristic will not only be upheld by the agricultural park itself, but will also be translated into quality assurance and expertise development.
3. On regional level within the Southern Yangtze Delta in close relation to its metropolis from Shanghai to Nanjing; there is the link to Shanghai with its 18 million potential customers for products from Greenport Shanghai. The World Expo being organised by Shanghai for 2010, offers an excellent opportunity to put the Dongtan eco-city and the associated agricultural park on the map.
4. On regional/local level within Chongming Island the agricultural and recreational developments on its east head will influence strongly the developments and planning of Dongtan. The water management and climate risk management as well as waste management and energy flows will have to be interconnected within the island as a total, for which the agropark can function as an accelerator. If the development of land dependant agriculture will need more space on Chongming Island, reservation area

#### Chongming Island:

- Water infrastructure
- With other cities on the island (energy, waste)
- With agricultural businesses

#### Shanghai Metropolis

- Expo 2010
- Transport agrologistics
- High quality foodproducts
- Processing of re-usable foodstuff to feed and biofuel

#### Dongtan Eco-City:

- Integrated spatial planning
- Joint environmental management
- Services exchange
- Water relations
- Recreation

#### China:

- High quality foodproducts
- Quality standards
- Showcase products and education

#### Wetland:

- Eco connections
- Water relations
- Recreation

#### World:

- Trade relationships
- Marketing relationships
- Knowledge relationships



*Fig Greenport Shanghai Agropark in connection with the world in six steps*

should be allocated within Chongming Island to keep close connection with the trade facilities and infrastructural developments within Dongtan area.

5. At the local level, the agropark has strong interrelations with the adjacent wetlands and tidal system, with Dongtan Ecocity and the Olympic park in the Northwest. The agropark links with the wetland as source of clean filtered water, as source of high biodiversity values and in terms of recreational programming. The agropark area will develop the same underlying landscape ecological principles that underpin the wetlands, within the gradient on Dongtan East head.

6. With Ecocity Dongtan there are many (potential) linkages, as residents of the city will work in the agropark. This Master plan will develop cohesion between the city and the residential areas within the agropark through the waste flows, (city waste and production and processing of agricultural raw materials), energy flows (biomass) and water flows, that are fitting to the integral demands of ecological footprint and ecological loading capacity for the whole Dongtan area (86 km<sup>2</sup>). There are also strong connections in terms of nature developments, green infrastructures within the city and agropark and recreational facilities.

# 3. Context: International

## 3.2 International context-Delta metropolis

The world is developing into an urbanised network society. Metropolitan Areas are becoming the nodes of globalisation. Soon the share of the world's population living in cities is to surpass 50%. Most of the fast growing 'mega cities' housing this urban population are located in fertile regions, often river deltas and coastal plains, as these fertile regions could support relatively large populations from the very beginning of history and, as a consequence, have always shown high densities and a high degree of economic development, expanding trade, manufacturing and services based on their healthy agricultural starting position. For the near future, however, further urban growth with its tremendous speed is threatening this very agricultural basis. Therefore we need, for the world in general and for China specifically where urbanisation moves faster than anywhere else, a strategy to increase the productivity of agricultural land in rapidly urbanizing regions and also answer to the increasing demand for high quality food parallel to the rising incomes of urban inhabitants. Present challenges are situated in good planning of sustainable land use, tackling the urban-rural controversy under heavy urbanization pressure, dealing with good water management under threat of climate change, combining land use functions of nature, infra-structure, industry and agricultural production. These planning challenges also deal with shifting governmental and organisational issues following the transition from traditional trade towards a service oriented and knowledge economy.

The concept of 'metropolitan agriculture' can meet the agro production part of this enormous challenge. Intensive agriculture (i.e. horticulture, livestock farming) has since long been developing around urban areas. ICT, network-organisation and advanced production technology are driving new inventions to the market. Reliance on the chains that provide the main fresh products is becoming of strategic importance. The consumer is demanding high quality of food and food production methods, forcing retailers into competition on food availability and safety, quality control and ethics. Greenport Shanghai situated on the east headland of Dongtan and the Greenports in The Netherlands have the same challenge in sustainable development of agricultural production to evolve in a sophisticated innovative way, producing safe and high quality food in a strongly urbanized context.

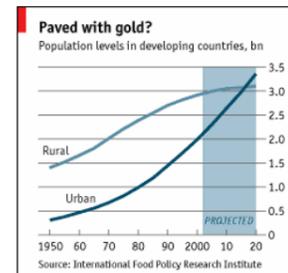


Fig Greenport Shanghai Agropark in global context one of the large delta-metropolitan areas  
Both the lower Yangtze Delta with Shanghai, as dragon head of East-China and the North West European Rhine delta are Delta Metropolitan regions with comparable developments and comparable challenges. Both these delta areas, water rich, low laying lands with fertile soils have since long had an important harbor function and are densely populated. In the mouth of the large river system, the physical conditions, the population pressure, the productivity, consumption patterns, its economic and ecological dynamics and demand for sustainable land use are very comparable.



Fig The lower Yangtze Delta with Shanghai, as dragon head of East-China



Fig. The Rhine-Meuse-Schelde Delta with Amsterdam, Rotterdam and Antwerp



### 3. Context: National and regional

#### 3.3 National context

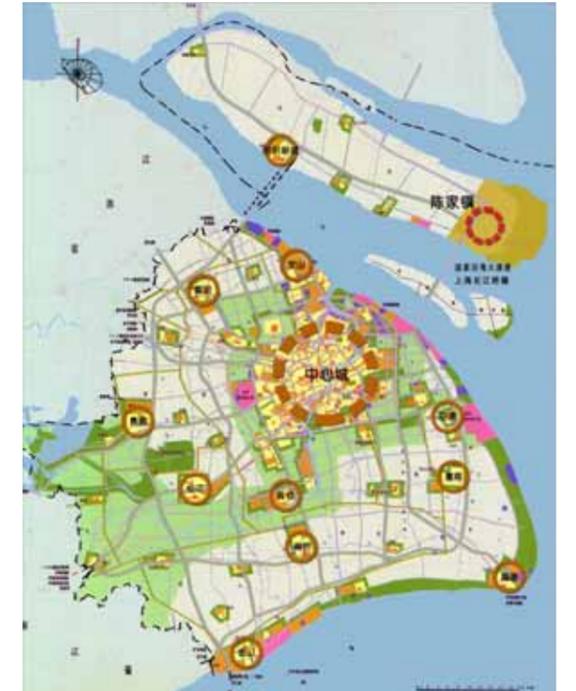
The national policy in China has brought unprecedented opportunities by the Strategy of Three Rural Issues Stipulated in the Eleventh Five Year Plan of the Government in which these refer to Agriculture, Countryside and Peasantry. These strategies are very comparable with those from the Netherlands concerning sustainable Greenport development in the delta metropolitan area of the Rhine delta. These Greenports are situated in the mixing zone of urban and rural frontlines near main ports (i.e. sea harbours and international air hubs), with concentration of activities in transport, services, primary production, trade and distribution of agricultural production. The Greenports form the basis for knowledge intensive agro business. The functions and connections between chains are tuned and interdependent, the production and processes cyclic, with use of each others rest materials and the land use planning is intensive, clustered and clever. This all applies to the Chinese situation as well, particularly in the Southern Yangtze delta.

Chongming, as the largest alluvial island in China, is part of Shanghai province and covers an area of 1,041 square kilometres. It is also the third largest island in China. Chongming Island is located in the mouth of the Yangtze River. It was, until recently, a remote place that was difficult to reach. A ferry makes the journey, but the service is vulnerable to bad weather. From central Shanghai, the trip to Chongming Island takes about three hours. However, this is soon set to change. In 2009, a tunnel-bridge combination is due for completion which will bring the island to as little as a half-hour travelling distance from Shanghai. This out-of-the-way place might then be suddenly transformed into some of the most expensive available lands in Shanghai.

[1] The 2000 census put the population of Shanghai Municipality. As of 2003, the official registered population is 13.42 million; however, more than 5 million more people work and live in Shanghai undocumented source Wikipedia Shanghai Province.  
 [2] Shanghai Province spans an area about as large as the Dutch Province of South Holland.

Fig New infrastructural links connecting Chongming Island to Southern and Northern Mainland

Once the new bridges connecting Chongming Shanghai City and Jiangsu Province are in place, the island will be very attractive for development. The City Government, however, has decided that only 'green' development will be permitted. The Dongtan Agropark is a function that fits quite well in this green character.



#### 3.4 Regional Context: Shanghai in the lower Yangtze Delta

Few cities have been growing as fast as Shanghai[1] Shanghai, also called in Chinese "Hu" or "Shen", covers an area of 6,340.5 square kilometres; It is the economic centre and the largest city in China and one of world's most important harbours. It is a city with nostalgic charm and modern convenience, with eastern essence and western flavour renowned as pearl on the west coast of the Pacific Ocean. Shanghai is leader of all Cities in the Economic Zone in the Southern Yangtze River Delta. By the mid-nineteenth century, Shanghai was hardly more than a big village, housing a few thousand inhabitants. Fifty years later, the population was over a million already. After the war the growth continued, with a marked acceleration in the eighties and nineties, to the present 16.738 million [2]. For the next twenty years a further growth to over 20 million is expected. Per capita income in Shanghai is ¥55,153 (ca. US\$ 7,116) in 2006, almost four times higher than the average for China. At present growth rates, these incomes will double every five or six years.



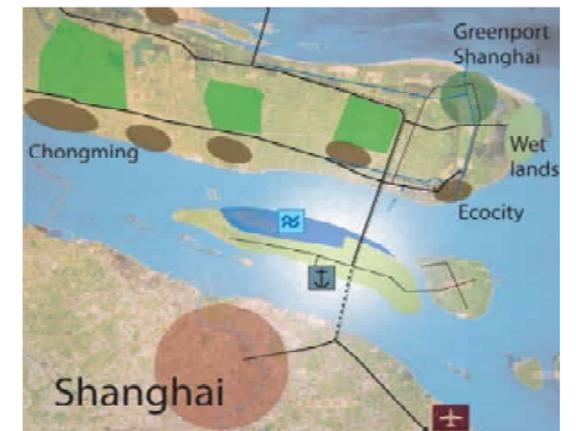
Fig The master panning for Chongming Island as a whole according to the federal Government (the Shanghai and Chongming Planning Commissions)



Fig The agropark consists of 27 Km2 virginal arable lands

Fig Chongming and Changxing Islands overall planning

In contrast to the green character of Chongming, Changxing Island will be developed for industrial purposes (mainly ship building and port equipment).



1. projected urban areas
2. New deep sea harbours
3. Projected forested areas for recreation and tourism
4. future major infrastructures (highways, light rail, railway)

## 3. Context: Chongming and Dongtan

### 3.5 Local context Chongming Island

The Shanghai City government has decided to link the Chongming Island to both the city on the Southern mainland and the Jiangshu province on the Northern mainland. These links (Grand Coast Freeway) will create vast development opportunities in which Dongtan will be situated 45km from downtown Shanghai, with convenient transportation as planned to be ready in 2009 and only 50km away from Pudong airport. The Shanghai planning institutions and national government however do not want the development to take the same form as for the present growth area of Pudong, but reserve the Chongming Island for 'ecological urbanisation'. Green functions will dominate the island, with only a moderate growth in population of about 800.000, concentrated in a number of modest size (on average 100.000 inhabitants each) towns of relatively low density, located along the Southern edge. Employment will follow these general green/ecological characteristics, with emphasis on sustainable agriculture and tourism and leisure. Heavier economic activities (such as ship building and crane manufacturing) will concentrate on the smaller island of Changxing that will also be served by the fixed link to the Southern mainland. Accordingly population density will become much higher here, with a generally more urban character. Altogether according to the current plans there should be a distinct density gradient from South to North: first the relatively high density and degree of urbanisation and industrialization of Changxing Island, then a density already much lower in the belt of 'green cities' along the southern edge of Chongming Island, next the core area of the island, partly with traditional agriculture and partly forested, and finally the open, sparsely populated Northern edge of the island with its adjacent offshore wetlands.

### 3.6 Local Context Dongtan area

The east head of Chongming Island, Dongtan (86 km<sup>2</sup>) is called the Fortress of the Island and has the advantages of its natural resources. Chongming Island is silting-on, every year the Yangtze deposits some 150 m of silt to the front side of the island and every ten years the new area has been diked. Dongtan is the most recent of these reclaimed areas. It is rich in both terrestrial and aquatic (freshwater and seawater)

resources with great biological diversification and attractive because of abundant sunshine all year round, cold weather and little rainfall in winter, high temperature and sufficient rain in summer. The quality of air, deep (underground) water and soil in Dongtan is high, although the basic conditions of the soil are still unripe (very young soils) and often highly saline. The soil is however clean with no pollutants of former agricultural or other use and with continuous efforts; its agricultural fertility can be expected to improve significantly, according to Chinese partners.

- A 24 km<sup>2</sup> area is planned for nature and recreation development (eco tourism) in the form of freshwater wetlands within the diked area. The wetlands outside the dikes are on the United Nations' habitat list as a very important area for migrating birds, stepping stone between Siberia and Australia, in peak periods providing a resting place for some 400 species of birds
- Dongtan area will be developed partly as the eco-city of Shanghai, set to be inhabited by a couple of hundred thousand residents [3]. In 2010, when Shanghai will host the World Expo, its eco-city must be operating and visible, as an integral part of the international exposition.
- Within the area 27 km<sup>2</sup> has been set aside for high technological and sustainable agricultural development. If the development of land dependant agriculture with the agropark area of 27 km<sup>2</sup>. will need more space on Chongming Island, reserved areas should be mainly located in Dong Wang Sha area.

[3] Ecocity\* is a key concept in China. One of the strategies that the federal government is implementing to bring about a great leap forward in its environmental policy is that every large city in China must develop an eco-city. These eco-cities are to serve as examples of sustainable development.

These approved development plans for the Dongtan area lead to a second density gradient, from West to East, with the rather higher intensity of land use in the core of the island, gradually declining in intensity of land use in the wetlands reclaimed earlier and now in use for extensive agriculture, with a few residential developments more to the East. The intensity of land use reduces more and more towards the freshwater wetlands inside the most recent dike and the salt water wetlands outside the dike with their Ramsar status

(international wetland convention for migratory bird habitat). Along this West-East gradient as well as along the South-North gradient the development moves from intensive to extensive, from cultural to natural, from formal urban green areas to natural ecosystems, and especially in the West-East direction from fresh to more saline water.



Fig present Master planning for a multi-functional Dongtan by SIIC: 9 Ecological Functional Districts

- 1. Swamp Tour**  
Sightseeing area of aquatic breeding. The land use is established for fish pond production in the area.
- 2. Model of Ecological Agriculture**  
The area sits in the north of the planned extension section of Beiyuan Highway where high-tech and industrialization research shall be conducted for non-pollution ecological agriculture using the good climate and particular soil environment in the area.
- 3. District for Education, R&D**  
The research and development base sits in the south of the scientific education garden area comprising such functions as information technology research, software development and biological technology research and development, etc.
- 4. Business District in Woods**
- 5. District for Outdoor Recreational Sports**  
The area sits in the far southeast of the planning area providing such high-grade outdoor leisure facilities as horse-taking center, man-made beach, indoor golf course and forest villa, etc. for the planning area or even for the whole city dominated by natural environment and supplemented by high quality man-made environment.
- 6. Experimental Ecological Community**
- 7. District for Green Industry**
- 8. District for Theme Park**
- 9. New Rural Community**

### 3. Context: Chongming and Dongtan: its conditions for land use

*Within this paragraph land form and land use conditions are shortly described; in chapter 5 the essential assets for the design on aspects of the water system (5.5), landscape ecology (5.6) and infrastructure (5.7) are further elaborated.*

#### 3.7 Land use conditions

Chongming Island is mainly flat, with no hills or mountains, but the terrain is higher in the northwest and central parts and slightly lower in the southwest and east. The Dongtan area is one of the island's main deposit zones for silt runoff. After enclosure for cultivation, most of the original natural wetlands were gradually transformed into artificial wetlands and fishponds, but a considerable amount of reed lands were preserved.

The Dongtan project area is flat with an altitude of about 3.6 to 3.9 meters above sea level. The land mainly consists of alluvium from the Yangtze River, with some loam and clay deposits. Due to the fact that the land was formed relatively recently, its geological structure is quite porous. The pH of the soil varies between about 8.0 and 9.0 which can be considered as alkaline. The salinity of the soil varies from normal salinity to strongly saline soil which occurs in a small part of the area.



The Dongtan area is surrounded on three sides by water: the north side faces the terminus of the northern branch of the Chongming River; the southern side opens to the Beijing (north port) water Channel and the eastern side to the Yangtze River seafront.

#### 3.7.1 Climate

Dongtan is located along the seashore of the southern fringes of the northern subtropics and has a marine climate. The temperature is warm and humid and the four seasons are clearly defined. In winter it is cold, there is less rainfall and northwest winds prevail. In summer, it is hot, there is a great quantity of rainfall and southeast winds prevail. In spring and autumn, warm and cold alternate frequently, as do dry and wet days. The annual rainfall is 1117 mm and the annual evaporation is 600-800 mm. During summer there is hardly a deficit because of high rainfall in this period. The summer and autumn seasons often experience typhoons, with an average of 1.5 times per year. Influenced by the monsoon seasons in winter and summer, the primary wind directions change in sequence, from southeast, to northwest to northeast. Due to the alternation of winter and summer monsoons every year, the seasonal variations in wind direction patterns are very distinct. In spring, cold and warm air fronts supersede each other frequently, producing much cyclonic activity causing high wind speeds. In autumn the average wind speed is about 3.5 m/s. The frost season generally runs from the beginning of November till the end of March.

#### 3.7.2 Hydrology

Influenced by the runoff of the Yangtze River and the tides, the hydrological conditions near Dongtan change distinctively in conjunction with seasonal shifts. The tide changes as an informal shallow-sea-half-day tide. In general, the smallest and largest tidal change takes place in August and December, influenced by runoff. The rich water season is from April to October and the total flow of the runoff during the summer is about 60% of the annual runoff. The flood peak frequently takes place during this period and the dry season is from November to the following March.

Drainage of the island takes place from the western to the

eastern part of the island by the North Horizontal Canal and the Southern Horizontal Canal which are connected to each other at several places. Several times the system is flushed with water from the Yangtze River by opening gates of the main canal system.

#### 3.7.3 Water Quality

The quality of Yangtze water at the intake points in the western part of the island is rather good due to the high influence of rainfall. According to Chinese Environmental Quality standards for surface water the water quality in the drainage system can be considered as Class I/II in the western part of the island to II/III in the eastern part. There are rich freshwater and saltwater resources in the Dongtan area. The water flow is slow, stable, warm and highly fertile. As the water is relatively low in pollution, there are large amounts of fresh water fish, waterfowl, and aquatic plants. The temperate zone to subtropical zone provides a suitable habitat for many saltwater and upstream fish, shrimp and crabs.

#### 3.7.4 Agriculture

Due to the fact that Dongtan is relatively new land, having been cultivated for just a few years, and its situation far from municipal pollution with little wastes, it is an exceptionally clean area according to Chinese standards, with unpolluted land, water and air. Based on the results provided by the Shanghai Environmental Academy from their recent study "research of Dongtan green Produce Park and its surrounding area", data shows that pollutant content of all types are lower than average levels. This opens up possibilities for ecologically friendly (green) marine production. The environment for ecological agricultural provides excellent conditions for the production of organic foods. Salinity of the unripe soils and of surface- and groundwater however determines the possibilities for crop production. This is an important reason to focus agricultural activities towards land independent activities.

## 4 Orgware: The planning method

*The previous chapters showed that the development of the Agropark represents a new type of assignment: integrated urban-rural development through 'metropolitan agriculture, meeting the requirements of sustainable development with regard to 'planet', 'people' and 'profit. Such a new assignment needs a new planning approach, not only for this Master Plan, but also in the parallel development and preparation of the Strategic Plan and the Industrial Plan for the Dongtan area. In order to proceed to the concrete spatial design of the Master Plan, there is need for a thorough explanation of this new planning approach, which results from an intensive dialogue between current Chinese and Dutch practices, and is based on principles of the Wageningen approach towards planning. This dialogue produced a 'paradigm' shift in the way spatial planning of rapidly urbanizing delta areas should be undertaken. As such this Master plan forms a pilot for learning from Chinese as well as Dutch perspective.*

### 4.1 General approach: from control planning to development policy

The new planning paradigm is needed in the first place to ensure successful implementation of the plans for the Dongtan Agropark. The type of planning needed is *development oriented*, not control oriented, because implementation depends in the first place on entrepreneurs willing to invest in productive activities. They will assess the possibilities to maximize returns, minimize risks, and guarantee continuity and growth. For the entrepreneurs freedom is crucial to organize production processes as efficient as possible, to decide on where to purchase their inputs, which types of products to select.

Traditional 'blue print' land use planning seldom offers sufficient freedom for entrepreneurs to make investments attractive. This type of planning is discouraging rather than stimulating to (international) investors. Instead, within a limited set of simple and transparent constraints that are indispensable to attain the fundamental objectives of the Agropark, actual development should be highly flexible, offering as much freedom to investors as possible. There is no preconceived detailed plan to which entrepreneurs have to adjust their plans, but an open, inviting and welcoming

reception of all initiatives that agree with the *basic philosophy and structural elements* of the Agropark.

### 4.2 Evaluation framework

The necessary constraints to safeguard the basic objectives of the Agropark constitute an evaluation framework in which the optimum freedom to act for entrepreneurs is embedded. The evaluation framework directly reflects the strategic qualities of the Agropark, such as its balance and harmony between urban and rural characteristics, its ambitions in terms of sustainable development, and the high quality of its products and provisions.

The evaluation framework consists of three parts:

- (1) *Criteria and indicators to assess sustainability of development proposals*, for each of the basic aspects of people, planet and profit
  - (2) *Design principles* for the water system, landscape ecology, and the CPU with its related mix of interrelated production and processing activities
  - (3) *structural elements of the spatial layout*: the overall density zoning, the alignment of the central development axis, and the 'backbones' of the networks for water, ecology, transportation, tourism, and the CPU
- Criteria and indicators for the sustainable development of agriculture are to be found in section 4.6 of this chapter. Design principles for water and landscape ecology are given in the next chapter, sections 5.5 and 5.6. Design principles for the CPU and the agro-industrial mix are elaborated in chapter 6. The structural elements of the spatial layout are again in chapter 5, section 5.4 (density zoning and main development axis), 5.5 and 5.6 (water and ecology networks) and 5.7 (networks for transportation, tourism and CPU).

For a better understanding of the function of the various parts of the evaluation framework, both in chapter 5 and chapter 6 illustrative examples are given of further design elaborations (e.g. 3D visualisations of the development axis and tourist 'hotspots', land use schemes, ecotopes and target species, etc.). It should be kept in mind, however, that these are illustrations only and are certainly not meant to control the exact allocation of functions to the land, or of land to producers.



To ensure the sustainable development of the Agropark and the whole Dongtan district of 86km<sup>2</sup> under SII management a performance evaluation index system should be established and managed by an independent body. It applies to the planning phase, to development, preparation and building of infrastructures and structural elements as well as to implementation and operation. This Performance Evaluation Index System needs to answer to the criteria and indicators of people, planet and profit, the design principles for the water system, landscape ecology and CPU and to the structural elements. The index system answers to the multi-objectives, it relates to the different phases of development and its modular approach and answers to dynamic process control and iterative monitoring of decisions.

## 4 Orgware: Process oriented planning

### 4.3 Process oriented planning

To make the development orientation operational, what needs to be adopted is a *process oriented planning* methodology. This is for two reasons: not only because of the unpredictability of actual implementation that makes it necessary to offer maximum flexibility while at the same time safeguarding essential qualities, but also because the concept of urban-rural integrated planning and planning for metropolitan agriculture is new, doesn't fit in existing legal frameworks, and asks for a 'learning-by-doing' approach.

With regard to this new concept of urban-rural integrated planning, it cannot be expected that the Chinese legal context is to be changed just to accommodate a single project that falls outside normal practices. Needed is recognition as an experiment, which offers opportunities to learn lessons from practical action. When successful, the experience from this project as a pilot, may well lead to a future review of present formal regulations on peri-urban planning procedures and protocols, as a learning case; though this is a matter to be decided within the Chinese policy making context.

In the process oriented planning, after this Master Plan is available, the next step is to use it as a 'bid book' to invite investors to participate in the actual development of the Agropark. Once concrete investment initiatives come forward, these have to be evaluated for their contribution to the objectives of the Agropark development (see evaluation index). When found positive, the following step in the planning process can be made, adjusting the overall business mix, the necessary infrastructure, the spatial lay out, the relation between private investment and public investment, etc. This offers a scenario that remains always fluid and will never solidify as ever new investment, disinvestment and reinvestment initiatives will present themselves, that will require a highly flexible environment to attain optimum returns.

These steps of bidding for investment initiatives, evaluating them and then adjusting detailed plans, need to be repeated all the time as long as the Agropark keeps developing (see also chapter 7).

### 4.4 Relations between Strategic Plan, Master Plan and Industrial Plan

From the 'development policy' and 'process oriented planning', in the preparation process of this Master Plan the relations within and between the Strategic Plan and Industrial Plan have been explored (see chapter 2). As a result of a coordinated effort of the three planning teams involved there is dealt with strategic, practical and innovative-creative aspects and together the three plans meet the following necessary preconditions:

- They express the three basic concepts that are crucial to the success of Greenport Shanghai Agropark Dongtan: (1) a shift from separated urban and rural development to urban-rural integration (in the form of 'metropolitan agriculture'), (2) a shift from control planning to development policy, and (3) a shift from focus on economic development only towards focus on sustainable development, including aspects of profit and also of planet and people
- They make a clear distinction between the framework of 'hard' structural elements on the one hand and flexible implementation options on the other
- Between them they cover all important content matter, background information and basic knowledge studies
- Relations between plans work always in two directions, making them interactive and fit for a process planning approach

The following characterization defines the central focus of each plan:

The *Strategic Plan* contains the design for the development of the Dongtan area at a conceptual level. It brings up the whole framework and general ideas guiding the Master Plan and the Industrial Plan. Its main contents are strategic conception and orientation, strategies for industrial development, management, spatial layout, landscape ecology and community building, as well as safeguarding technical quality and performance level.

The *Master Plan* deals mainly with 'hardware', 'software' and 'Orgware'. The innovative hardware covers density zoning and network design for water management, landscape ecology, transportation and tourism infrastructure, and the central processing unit (CPU). Added to these are indicative land use options that serve as illustrations of how the Agropark may function and how it might be experienced. Software and Orgware cover various management aspects (involvement of SIIC, technology management, HRM, quality management, etc) as well as financial constructions, public relations, branding, marketing, (see chapter 2).

The *Industrial Plan* concentrates on the actual development of production and processing activities, including the CPU, based on a SWOT-analysis. Its main contents are the general targets of industrial development, industrial scale and structure, detailed spatial lay out, investment pre-calculations, fund raising, etc.

The Master Plan as *framework for development*, is in accordance with the concepts of the Strategic Plan, dealing with (a) relations with the outside world, (b) overall zoning according to higher-order spatial plans, (c) basic structure and features of internal networks (transportation and tourism, material and energy flows, ecological relations), (d) the overall landscape pattern, (e) criteria for the evaluation of implementation schemes (especially the balance/mix of activities), including (f) principles for the location of specific activities, and (g) principles for the phasing of the implementation. For the evaluation of investment initiatives, generally speaking, in the Strategic Plan the aspects are selected, related to these the Master Plan has formulated criteria, and the Industrial Plan derives indicators and threshold values as planned within the Performance Evaluation Index System.

## 4 Orgware: Process oriented planning

### 4.5 Ecological footprint and ecological loading capacity

An important evaluation tool, especially to decide on numbers of inhabitants that may be accommodated by the Agropark, is to assess the 'ecological footprint' of various residential community sizes, according to the various CPU-scenarios (see chapter 6) and relate this to the ecological loading capacity, both of the 86 km<sup>2</sup> Dongtan area as a whole and the 27 km<sup>2</sup> Agropark area specifically.

The concept of ecological footprint and loading capacity is set forth by the Strategic Plan, while specific calculations belong to the Industrial Plan, based on the CPU-scenarios of the Master Plan. The overall objective is a balance between footprint and loading capacity on the level of the whole 86 km<sup>2</sup> Dongtan area, which means that an eventual ecological deficit of the Dongtan Eco-city has to be compensated by a surplus generated by the Agropark.

To attain this balance between footprint and loading capacity, it is important to reduce the per capita footprint as much as possible, for instance by minimising the use of fossil energy (e.g. by better isolation of buildings, or improved natural ventilation in stead of air-conditioning), or by using more efficient ways to produce the food consumed by local residents. It is important to look at static quantities such as the number of inhabitants, but also to adopt the more dynamic approach of flow management. The CPU concept of the Agropark leads to closed cycles of waste and materials, with zero environmental impact, and generates surplus electricity from biomass processing. Other options for non-fossil energy are aquifer storage, solar boilers, solar cells and windmills. All these may be essential in the counterbalance the pressure of occupation on the whole of Dongtan East head, as for instance in the urban area of Chen Jia Town or Yu An Farm.

Following these considerations a first estimate has been made of the maximum residential capacity of the Agropark that still meets the requirement of compensating ecological deficits that may arise elsewhere in the wider Dongtan area. This maximum lies around 30,000 thousand inhabitants which is enough to cover the needs of workers, experts and managers as well as supporting personnel of the Agropark, while also leaving some space for the settlement of

'suburbanites' in general (maximum 10%) (See calculations on land use for housing in chapter 6).

More detailed footprint and flow management calculations will be assigned to the Industrial Plan, as part of the further process of decision making and implementation. The first step could be a further elaboration of the calculations already available for the whole region, adjusted to additional information on household waste processing and energy use, in relation to the capacity of the CPU to produce surplus heat and electricity. This should be followed by additional calculations, which may be based on specific flow figures as follow from the mix of agro-production and processing activities in each of the four illustrative scenarios given in chapter 6 below. These two steps are still 'ex ante'. Definitive calculations can only be made once more is known of the business mix that results from actual investment initiatives. These calculations have to play a crucial role in the evaluation of such initiatives and need to be followed by constant monitoring after the investments have been implemented as part of the sustainability evaluation system.



Fig Sustainable development = Planet, People and Profit in Balance

### 4.6 Evaluation aspects, criteria and indicators for sustainable development of agriculture

Concluding this chapter on the planning method for the sustainable development of agriculture, it will be demonstrated how the relation between aspects, criteria and indicators works in practice. In general the concept of sustainable development has been defined by the Brundtland Commission as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs".

In order to develop criteria for the evaluation of sustainable development it is present good use and generally accepted to focus on three integrated aspects: people, planet and profit, referring to the social, environmental and economic spheres.

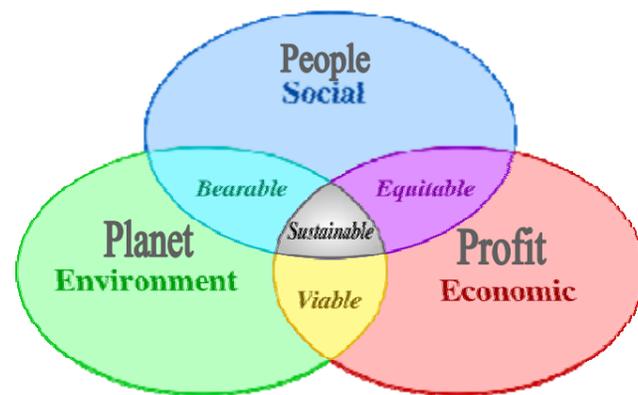
For each aspect different criteria can be distinguished that are relevant to the evaluation of the performance of an Agropark, as is represented by the table below. Also in the table are suggestions of possible indicators linked to the criteria. The indicators help to measure performance and establish thresholds and critical values. Within the Industrial Plan these will be further elaborated within the Performance Evaluation Index System.



# 4 Orgware: Evaluation criteria for sustainable development of Agriculture

## Aspect people

Criteria for People	Indicator	Value/Scale/ Improvement level	Remarks
Employment	Number of employees per ha	Higher than rural mean, up to industrial level	The Agropark should contribute in creation of urban jobs for rural people
Wage and Benefits	Minimum wage earned and Shanghai government standard set for employee benefits	Higher than rural mean (to those still holding rural residency status)	Agropark must improve living conditions
Transferred people	Number of local residents unwilling to leave and not working at the agropark	Zero	No people should be re-allocated against their will
Working conditions	Quality of working environment	All working environment should meet international standards of International Labour Organisation	
Residential quality	Quality of housing and dormitories Quality of public space Quality public services	Values defined by the Dongtan Ecocity concept	Dongtan Ecocity standards exceed normal Shanghai standards
Residential safety	Safety measures against typhoons & flooding	Equal to Shanghai standard	

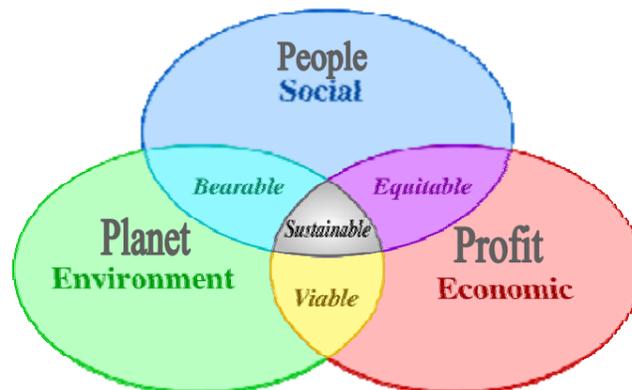


## Aspect profit

Criteria for Profit	Indicator	Value/Scale/ Improvement level	Comment
Profitability	Return on investment	Production > 5% Processing > 10% Tourism > 5% Services > 5% Knowledge generation > 3%	A startup period of 3 – 5 years is needed before these levels can be reached. Labour wages included. Investments costs included.
	Productivity	Amount of value added in relation to capital, labour and land and knowledge	
	Business size:	number of employees	
	Ownership	balance between state owned enterprises, local government owned or private enterprises	
	Continuity of the business:	degree of flexibility and resilience to shifts in market	
Public earning	Taxes	Normal standards on economic development zones	
	Amount of value added tax and corporate tax	Normal standards on economic development zones	
Subsidies	Subsidies on agricultural products	According to Chinese and Shanghai standards	
	Subsidies on innovative investments	According to Chinese and Dutch standards	
Knowledge valorisation	Consultant fee	According to national standards of participants	
	Success fee	5% of implementation investment	Structural investment: after decision to implement the park. Flexible investments: after implementation of specific parts
	Share	5% of shareholder value of agropark	Used for funding of applied research on agropark research question
Sustainability status	Sustainability status per enterprise:	improvement in most critical social aspect improvement in most critical environmental aspect decline in energy use and CO2 production availability of environmental management system	
	Certification:	Iso certification realised High corporate governance rate	

## 4 Orgware: Evaluation criteria for sustainable development of Agriculture

Aspect planet



Criteria for Planet	Indicator	Value/Scale/Improvement level	Comment
Biodiversity	Shannon index Connectivity of robust connections macro, meso and micro level "Nature friendliness" of verges and embankments	Must increase	
Landscape	Typical parcelation . Degree of openness Surface area of landscape plantations (lines & mass structures		
Energy efficiency	Direct fossil energy use	Must develop to 0	
	Indirect fossil energy use	Minimise according to international standards	energy used for production of raw materials and production means
	Direct and indirect solar, tidal and geothermal energy	Must increase with every enterprise established or growing	
	Agropark as energy source	Must increase with every enterprise established or growing	Sources: electricity, heat, cold, energy carriers
Net gain of organic material produced	Quantity of organic material	As high as possible.	
Waste treatment	Re-use, recycle or treat.	According to highest standard	
Mineral cycling	Nitrogen output as waste,	Must develop to 0	
	Phosphate output as waste	Must develop to 0	
	Other minerals	Must develop to 0	
Hazardous materials	Restricted use	According to highest standard	
Biocides and growth agents	Substance use	Exceptional use only to cure diseases	Pesticides, herbicides, animal medicines, growth enhancing means.
Biological Control	Number of ecological feedback mechanisms to prevent diseases	Increase to high level of complexity	
Transport	Transport distance	Shift from low to high efficiency. Minimize.	
Animal comfort	Stress indicators for specific animals.	Reduce stress wherever possible	
	Area use per animal	Optimise according to specific animal needs	
Water quantity Groundwater and surface water	Amount of fresh water	According to Chongming Standards	
Water quality	Salinity and pollution	According to Chongming Standards	
Soil quality	Soil pollution	Must remain/ be brought on lowest possible level.	

# 5 Spatial design: The reasoning

## 5.1 Introduction

In this chapter the spatial design of the Master plan design is explained, with a distinction between design principles and structural elements on the one hand, that are part of the evaluation framework as set forth in chapter 4, and illustrations on the other hand that visualise the framework and clarify its meaning.

This chapter starts with the general reasoning behind the plan (sections 5.1 to 5.3) and the overall density zoning and alignment of the central development axis (section 5.4). Then it deals with the various functions of the park and their supporting networks: water (section 5.5), landscape ecology (5.6), infrastructures for transportation, tourism and the Central Processing Unit (5.7). In the last section (5.8) the integration of density zones, central development axis and networks is set out.

As stated in chapter 2 the Master plan should offer an integrated design for modern metropolitan agriculture, based on sustainable development principles, supported by high-tech infrastructure, and guaranteeing a profitable operation. According to chapter 3 it should fit in a multi-layered context: the development of China in a global setting, the development of Shanghai and the Yangtze River delta as one of the major economic regions of China, and the Chongming Island as an eco-development zone within the overall urban development of the city of Shanghai and the neighbouring province of Jiangsu. According to chapter 4, the Master plan needs a new approach, moving from the traditional control planning to modern development policy. An important aspect of this move is to make the sharp distinction between *structural elements\** and *basic design principles\** on the one hand, and *flexible implementation options\** on the other.

•To make a clear delineation of the structural element and basic design principles, these are indicated in the following texts of this chapter with the blue colour, the optional elements are indicated with green.

Another important aspect is to adopt the concept of process planning as an iterative activity that goes on continuously as long as the Agropark is absorbing new activities and transforming existing ones.

This leads to the mission statement:

**“Greenport Shanghai is the innovative and ambitious exploration of how Chinese metropolitan agriculture will jump into the 21st century: Circular, Sustainable, and Profitable”**

## 5.2 Metropolitan agriculture

In traditional spatial planning an area is designated as either urban or rural. Cities have to be allowed to grow, especially when they attract vast numbers of immigrants as is the case in Shanghai, while – still according to the traditional model – this should take the form of well ordered new residential or industrial areas that replace entirely the existing rural functions. A number of serious problems result from this traditional urban-rural 'paradigm':

- fast growing cities occupy much land, often the most fertile soils, where historically cities often developed, for that food production is seriously endangered
- farmers lose their livelihood; even if they are compensated properly they cannot always reinvest in activities that yield sufficient income in the long run; industrial employment as an alternative is not always available, nor is it their first choice– thus many farmers having lost their land, lead a marginal existence in the cities
- green and open areas within the city have to be planned specifically, for no other purpose than recreation and leisure – Green and open spaces within cities are costly to implement and maintain, when development pressure and land prices are high and always at risk of being marginalized.

An alternative to the traditional approach is not to separate but mix urban and rural functions in urban expansion areas. Agriculture need not be terminated, but may be continued, also with a transition to more intensive, high tech production; total output and income may remain at the same level or even reach higher values. In that way the city can still grow while agriculture is maintained and farmers do not lose their livelihood. And at the same time the resulting mosaic of urban and rural functions results in an attractive green character for the city, at much lower costs. The green character will be further enhanced when combined with water management (e.g. retention ponds, wetland water filtering, etcetera). Green and water together can provide strong ecological networks that add natural functions that further enrich the urban-rural

mixed land use. In this way a new type of agriculture is introduced: metropolitan agriculture. This type of agriculture is characterised by international state-of-the art technology, high yield of high quality products that fetch high prices in urban markets. It adds significantly to sustainable development (zero impact) and nature friendliness and it offers excellent opportunities for modern entrepreneurs and it has the capability to absorb a considerable number of workers and offer these healthy working conditions and good wages. Metropolitan agriculture helps to balance and harmonise urban and rural development and closes the economic and social gap between city and countryside as well as lessen tensions over agricultural land appropriation for urban expansion purposes. Next to attracting entrepreneurs both from the region and from abroad, SIIC/SAC may support traditional farmers to make this transition through research, identification of best practices, training, knowledge transfer and marketing assistance.

## 5.3 Urban – Rural integration

To make the new concept of urban-rural integration really work, other planning rules are necessary, not those that support the separation of urban and rural spheres, but rules that help to maintain balance and harmony in a mixed development. In various parts of the world methods have been devised to find this balance, such as transferable development rights, compensation requirements, differentiated land sales prices or lease tariffs, differentiated subsidies or levies. For the situation of Dongtan Greenport, where all the land is owned by SIIC, land lease seems the most appropriate way to make land available to commercial enterprises. In that case, as an example, land lease fees may be lower for users who manage to reduce the percentage of their plots covered by buildings (by more efficiently organising the internal layout, or by building two or more storey's, etc). Another way to use differentiated fees is to stimulate the right mix of production activities to ensure maximum efficiency of the CPU, resulting in effective zero environmental impact. This will also help to ensure the availability of outputs of one activity that form crucial inputs for another. This type of land lease rules need elaboration in the Industrial Plan. It is not only the concept of urban-rural integration that calls for new planning rules. The same holds for the move from control planning towards development policy and from a development that is primarily economically oriented towards really sustainable development, balancing 'people, planet, profit'.

# 5 Spatial design: The zoning structure

In the following parts of this chapter the process of integrated design of the structural elements of the Master plan will be explained and presented step by step. First the density zoning and main development axis will be explained. In the sections that follow each of the structural elements will be dealt with separately: water and ecological networks, transportation network, tourist routing and the CPU-network. For all of these the internal structure will be defined as well as the 'interfaces' with the outside world. The crucial step of integrating the structural elements, results in what is actually the core of the spatial design of the Master plan.

## 5.4 Spatial gradients - Density zoning and main development axis

According to the higher order plans for the Chongming Island and Dongtan area as a whole, there are the two South-North and West-East density gradients that together determine the distribution of land use intensity of the Agropark.

The park is located between two new urban projects to its South and the open area at the North coast, and also between the bridge head to the West and the natural reserves of the Eastern wetlands and 'Ramsar' foreshore zone. For the design of the Agropark itself the combination of these two gradients is paralleled into a general zoning with relatively high density and intensity in the South-western corner via an intermediate zone to a low density/intensity zone in the North, Northeast and East.

This three-fold density zoning, parallel to the coastline establishes the first and foremost context derived governing principle for the Master Plan.

The second feature following from this context are the entrance points where the Agro park connects logically to the external transportation system: one in the South, which will be the gate towards the outside world, the first to be developed and which will remain the most important one throughout the whole development. The other gate will be situated in the West, developing in a later phase and remaining of a more or less secondary character. From the location of the two entrances to the Agro park follows the alignment of the main access axis that is also the main axis for the spatial developments in time: starting from the South, this central axis makes a left turn near the centre of the park towards the Western access.

	POLDER	WETLAND	TIDAL AREA	ESTUARINE AREA
ECOSYSTEM	AGRICULTURE	FRESH WATER LAKES, POOLS AND REEDLANDS	TIDAL SYSTEM WITH SALT MARCH AND CREEKS	ESTUARINE SYSTEM
GROUNDWATER	FRESHWATER	FRESHWATER	BRACKISH SEEPAGE	SALT WATER
SURFACE WATER	FRESHWATER	FRESHWATER AND BRACKISH SEEPAGE	BRACKISH	SALT
WATER QUALITY	EUTROPHIC	EUTROPHIC TO MESOTROPHIC	EUTROPHIC	EUTROPHIC
SOILTYPE	CLAYS	CLAYS-PEATY CLAYS-ORGANIC DEPOSITS	SANDY CLAYS-CLAYS	SAND-SANDY CLAYS-CLAYS

Fig Density gradients paralleled within the agropark

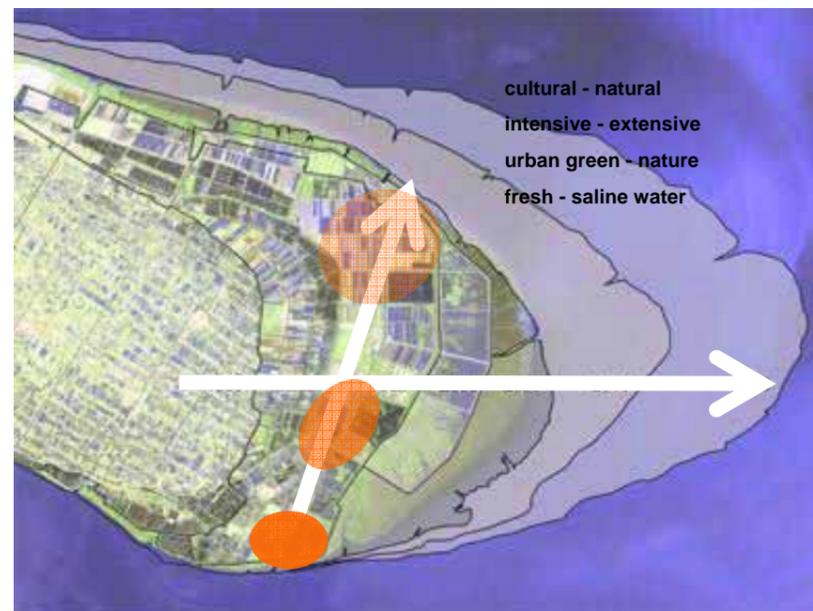


Fig South-North and West-East density gradients

From South to North and from West to East the projected land use densities on Chongming Island are decreasing. Dongtan Agropark borders on the Eastern wetlands and off shore tidal zones with their completely natural character and high ecological value.

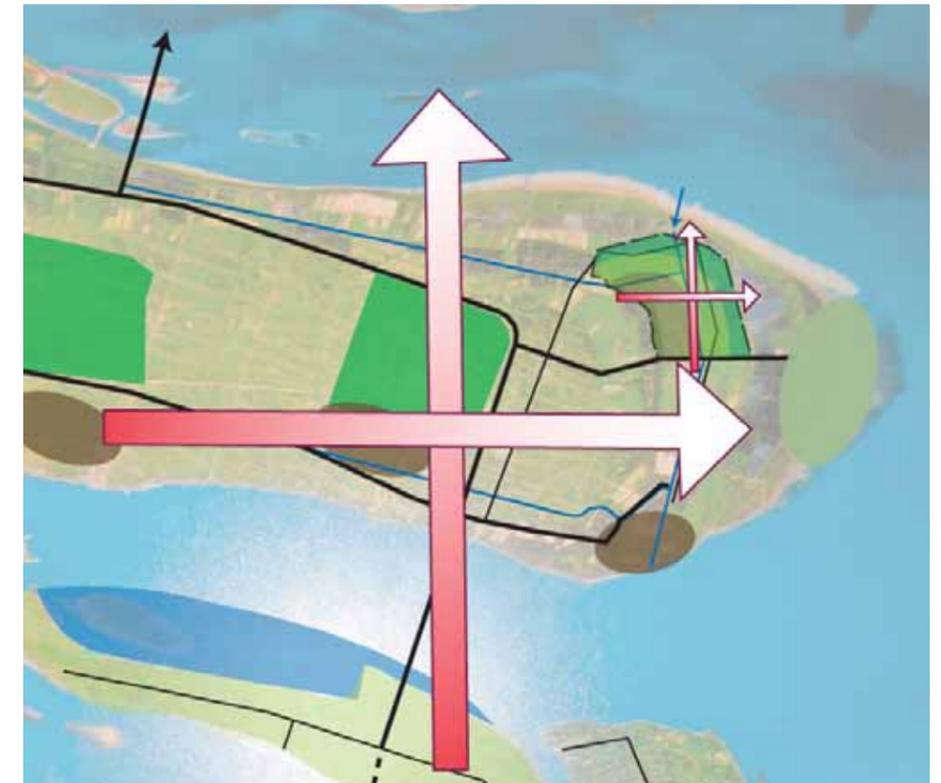


Fig The overall density zoning of Chongming Island is paralleled by the internal zoning and gradients of the Agropark itself.



Fig Density zoning: The zoning consists of high density land use in the SW corner, fading to medium land use and building in the middle zone to openness in NE zone.

# 5 Spatial design: The water system 1

*The Agropark is connected to the outside world through external network relations for water, ecology and transportation infrastructure. The first of the major internal networks is the water system. For water the most important relations are to the Northwest, from where the fresh water supply is taken from an inlet at the North-western tip of the island, and to the South where it connects to another fresh water supply from the West. In order to have a sustainable Agropark development it is basic that the conditions of the underlying water system are both robust and flexible, easily adjusted to change in land use decisions, but designed as such that whatever land use, the basic water conditions will be sound.*

## 5.5 The Water Infrastructure

Water management is essential for a good functioning of the water system. In the design of the Agropark, principles of sustainable water management are adopted. This means that the overall design takes into account both water quantity and water quality for surface water and ground water. The design of the water system will also have an educational goal. Examples of the principles of sustainable water management as it has been practiced and developed in the Netherlands will be introduced in the system.

### 5.5.1 Main characteristics of the Dongtan area water system

The main drainage system of the Dongtan area plays an important role in the total drainage capacity of Chongming Island. This leads to the principle that if any changes take place in the surface water system the loss of surface water has to be compensated elsewhere.

The water quality and land use potentials for land dependent agriculture in the Dongtan area is strongly influenced by the salinity of the soil, which will determine the salinity of the ground water and surface water system. The external circumstances of changes in water discharge and sediment flows of the Yangtze river due to the building of the Three gorges dam upstream and climate change will certainly influence the water quality, degree of salinity from invading sea waters and the present Yangtze water quality. These influences are however very uncertain and need more

thorough investigation. Based on present circumstances of Yangtze water, all possibilities of flushing the internal water system of Chongming and Dongtan area with Yangtze water, as presently in use, are to be included in the design to control the salinity. The present water quality of the Dongtan area can be considered as meso-trophic. The water quality of areas of ecological value should be improved in nitrates and phosphorus load. If water will be used as process water the quality should be even higher.

On the eastern side of Dongtan a wetland with helophyte beds has been projected. The objective of this wetland is to function as a natural purification system for the waste water from the Dongtan area. This purification system will be included in the overall design.

### 5.5.2 Water Treatment

In modern high tech agriculture there is hardly any waste water flow because of the use of closed systems. Clean rainwater is used as process water and in time of shortage, suppletion takes place from surface or ground water of good quality that is kept in store in retention areas. Also additional techniques are used to disinfect the water flow, within each hydrological compartment. The wetland with helophytes beds that is being developed adjacent to the Dongtan area can be used for additional water treatment. The capacity of this wetland for natural water cleaning, is designed in such a way that it should be able to serve the whole Dongtan area, as soon as it is realised completely as wetland (24 Km<sup>2</sup>). Helophyte beds have proven to be a good method for natural purification and the present water quality from the pilot area wetland is very satisfactory. At this moment monitoring of the water quality in the wetland takes place to evaluate the functioning of the wetland as a helophyte filter. The inflow of water to the wetland takes place in the northern part of the wetland and the water flows through the helophytes beds to the southern part of the wetland. After purification water can be used for suppletion in the total Dongtan area, including the Eco-City or in times of excess, discharged to the sea.

### 5.5.3 Water Quality and Salinity

The water quality in the Agropark can improve in time. Besides using modern technology to prevent the water from pollution, it is very important to change the attitude towards the use of herbicides, pesticides and fertilizers (N, P and K) in land dependant and water dependant agricultural practices (aqua cultures). This change in attitude by all agricultural workers is a precondition, supported by legislation, to have water quality improved. By flushing the drainage system (see also 5.5.1), salinity can be kept at an acceptable level for some crops already. Although the agropark has strong focus on land independent agriculture, for land dependant agriculture focus on saline agricultural systems with (new) salt tolerant crops is feasible (see 6.5). During time salinity will decrease because of leaching by precipitation and the water quality will improve. This means that in the future also crops can be produced that are more sensitive for salty water.

### 5.5.4 Water Management

The drainage system of Dongtan Area is part of the total drainage system of Chongming Island. Several times a year the whole system is flushed with Yangtze River water to improve the water quality. At certain times it occurs that the water depth of the drainage system drops close to zero. This makes the system very unstable and could damage the ecosystems connected to it. This instability is a strong drawback for the development of more natural aquatic ecosystems. With in the agropark the canals and ditches also will have a function as transport zone to the harbours and smaller overloading points. This should be not stressed by irregular water depths. It is recommended to control the water level between certain ranges depending on the function of the water system and the land use and to induce a more regular flow of the main canal system with fresh water.

# 5 Spatial design: The water system 1

## 5.5.5 Design Principles for the water system

- the existing lay out of the water infrastructure is the basis for design
- Each defined unit block has its own separate water system.
- flexible implementation for each unit block depending on the wished for land use
- collection and retention of rain water for each unit block
- water quality depending on the function
- natural water purification by helophytes/wetland
- flushing of water system to control salinity; needed for land use as land dependent agriculture that is sensitive for unripe soils and saline conditions.

These principles have led to a schematic design of the basic unit of the water network that can be used for each unit block, depending on the land use and the characteristics of the different unit blocks in relation to their surroundings. This makes the implementation of the water system per unit block very flexible. The scheme is presented in the figure schematic design. Each unit block has its own closed water system, in which water class A, B or C is realised, respectively high, medium and low water quality. These 3 water classes follow the Chinese system of water classifications, as indicated in the table of Chinese Environmental Quality Standard for Surface Water.



Fig overall water network

- A: High water quality
- B: Medium water quality
- C: Low water quality

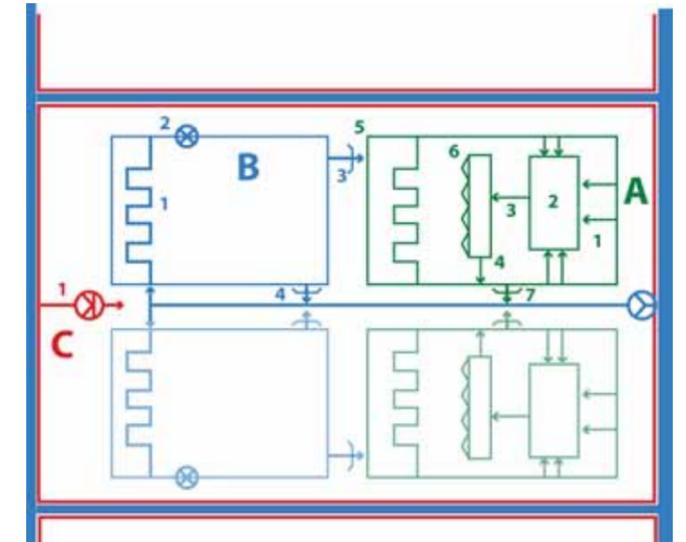


Fig Schematic design of one basic unit of the water network

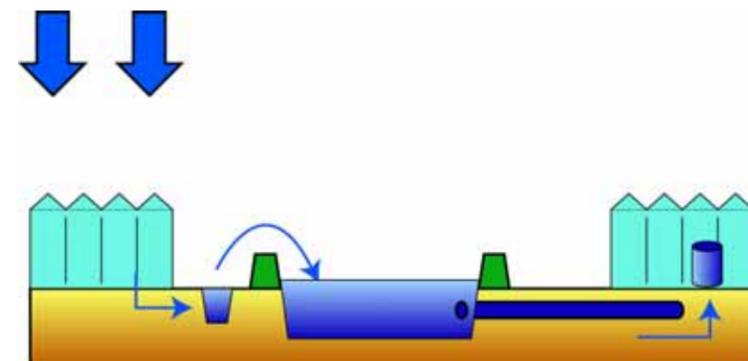


Fig Collection of clean rain water

Class	Description of use
I	Water that flows through national nature reserves
II	Source of municipal drinking water supply (first grade conservation area); conservation areas for rare aquatic species; and areas for fish spawning
III	Source of municipal drinking water supply with treatment required (second grade conservation area); conservation areas for common aquatic species; and areas for swimming
IV	source of industrial water supply and recreational use other than swimming (e.g., boating and fishing)
V	source of industrial cooling water, irrigation water, and ordinary landscape

Table Chinese Environmental Quality Standard for Surface Water

Type A: CLASS I WATERSYSTEM	
1	Collection of clean rain water
2	Retention of rain water
3	Use for agro production with clean water demand
4	Return flow to water system
5	Suppletion from type B water system
6	Natural purification
7	Regulated overflow in case of surplus to type B water system
Type B: CLASS II/III WATERSYSTEM	
1	Natural purification of water by helophyte filter system
2	Flow through the water system
3	Regulated supplement to type A water system
4	Regulated overflow in case of surplus to type C water system
Type C: CLASS III WATERSYSTEM	
1	In open connection with regional water system
Regulated suppletion to type B water system if needed	

Table The three classes of water within the Greenport Shanghai Agropark

## 5 Spatial design: The water system 3

### 5.5.6 Indicative description of characteristic water systems per unit block

The design principles and schematic design per basic unit as mentioned above have resulted in an optional design for specific water infrastructure per unit block, dependent on its different land use practice, in which each unit block has its own closed water system. As example of how the micro water system in each unit block may be related to the intensity of land use, the character of agro production functions, and the degree of naturalness, the following seven references are made, referring to characteristic water systems in the Netherlands as well as to the existing typical Chinese water system that is present in the Dongtan area. These references fit well with the intended land uses in the design of the agropark as indicated in the scenarios (see chapter 6). Application however of these options is dependent of the chosen land uses during the implementation phase of the Agro Park

### Water system for intensive dry land culture (*The Wieringermeer' water system*)

This water system is designed for intensive dry land culture:

- Agricultural practice is leading; water management has to facilitate agriculture
- For optimal agricultural use the distance between ditches and drains to control the water level has to be optimised within a narrow range
- Due to leaching of nutrients in this type of land use water quality will be negatively influenced, water quality is less important within certain limits for salinity
- To avoid high salinity, water suppletion and flushing is needed through inlet structures

Water quality type B/C

### Meadow water system (*The 'Veenweide' water system*)

This water system is designed for dairy farming:

- Difference between water level and soil level (freeboard) near 50 cm.

- high density of drainage system and high groundwater level
- leaching of nutrients is relatively low, allowing high potent ions for water quality and ecology
- water quality type A/B
- this is a good reference for the water system of the low density, open North-eastern zone of the Agropark

### Greenhouse water system (*The Bergerden' water system*)

This water system is designed for greenhouses:

- collection of rainfall in shared basins to use as process water for greenhouses
- water supply from basin to each greenhouse by special infrastructure
- high demands for water quality as process water does not allow a well developed ecosystem; separation of open water and process water by a filter system
- water quality type A
- this might be suitable for greenhouse areas belonging to the ecological link Yangtze-Agropark-North-western wetland

#### Water systems

1. Wieringermeer Water System
2. Veenweide Water System
3. Horst Peel Water System
4. Bergerden Water System
5. Haarlemmermeer Water System
6. Meije Water System
7. Present Dongtan Water System
8. Wetland Area



## 5 Spatial design: The water system 4

### Facility agriculture water system (*The 'Horst Peel' water system*)

This water system is designed for modern mixed dry land culture and life stock farming:

- closed nutrient cycle; dry land culture crops are used as life stock food, life stock manure is used as fertilizer.
- Intensive land use leaving less room for nature
- Low nutrient leaching; clear surface water
- Low density of drainage system
- Collection of rainwater to use as process water / closed water cycle
- water quality type A/B

### Floating greenhouse water system (*The Haarlemmermeer' water system*)

This water system is designed for floating greenhouses:

- large areas of surface water
- multiple land use, e.g. combination with recreation or aquaculture
- high ecology in ponds (plants in open areas and fish under floating greenhouses)



- low leaching of nutrients
- high storage capacity of water excess
- water quality type A/B
- this water system might be appropriate for those areas that are part of the ecological link Olympic Park-Agropark-Eco City, and also for fish pond area belonging to the link Yangtze-Agropark-North-western wetland

### Marshland water system (*The 'Meije' water system*)

This water system is designed for natural areas in combination with agriculture:

- High density of drainage system in combination with "old creek" water system
- High quality ecology in "natural" water extending into small ditches
- Low leaching of nutrients
- Water quality type A/B
- this water system coincides with the ecological connection between Agropark-fresh water wetland-salt marshes and the connection between Agropark-Creek Park-Eco City



### Present Dongtan water system (*The Dongtan water system*)

This is the existing water system in Dongtan area:

- High density of small drainage systems
- High leaching of nutrients and excess use of fertilizer
- Low ecological quality
- Water quality type B/C



# 5 Spatial design: Principles of the landscape ecological system

## 5.6. Ecological network and landscape structure

In this section on landscape ecology the Agropark can fulfill its ecological objectives optimally when it would form part of an, at present not yet well functioning landscape-ecological context. The design of the Agropark offers a good opportunity to develop the initials for a better ecological contact for Chongming as a whole. So in this case it is not the context that determines the Agropark, but the Agropark is setting conditions for the context in order to maintain and improve its resilience and biodiversity. The assumption is that the Agropark should form part of continuous networks of high quality ecological relations within Chongming as a whole, respectively for the East head of the Island. The first part of this paragraph deals with these context level networks first (macro and meso level) before coming down to design principles and internal network structures for the Agropark itself (meso and micro level).

For the external connections of the Agropark in landscape ecological sense, the most important relations are with the wetlands surrounding Chongming in the coastal zones in the East and North and South. This is called the macro level. Within the east head of the Island, the Dongtan area, the relationships are between the city, parks, wetlands and tidal areas of the Yangtze, the so called meso level. Relations within the Agropark form the micro level

### 5.6.1 Principles for ecological networks

The basic principles of ecological networks aim at increased cohesion between the parts of the network. This can be established by various means: (a) improvement of the network quality, (b) enlargement of the total network area, (c) increased network density and permeability of the surroundings for ecosystems or species and (d) good management of existing nature.

To improve the permeability of a landscape for target species and improve the connectivity of populations or ecotopes the spatial structure of this landscape should be modified into an ecological network in which the core areas with high quality ecotopes are connected through patches

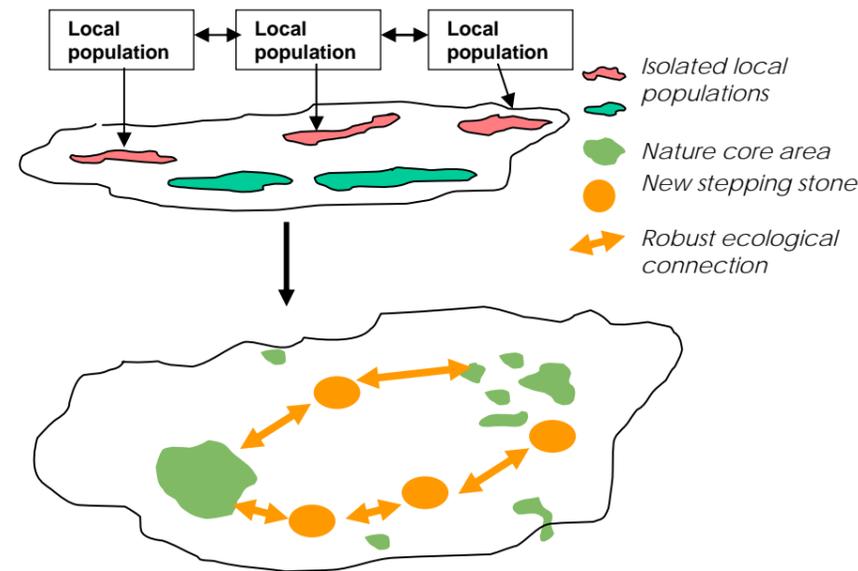


Fig Principals of ecological connections: dispersed local populations (plants or animals) connected via robust corridors or stepping stones.

(steppingstones) and the quality of the surrounding landscape should be improved as for instance by improved water management and diminished flow of excess of nutrients. To connect core areas by robust corridors is the option that strengthens cohesion between local populations resulting in so called meta populations. These connections need to be wide enough to create hiding places for species in case of calamities. For the wetlands in the Dongtan area this means that the unpredictable environment of the water system needs to be buffered as good as possible against high water discharges or sudden drying out.

For Chongming Island as the contextual framework of Dongtan Agropark and for the agropark itself, this principle of connecting means:

- Increase biodiversity by connecting on macro-, meso- and micro level
- Create connections between core areas and patches of ecological value (meta-population approach)
- Extend existing networks and create new habitat patches and enlarge core areas

- Create steppingstones and develop habitat patches
- Develop robust connections via line and patch elements and create stepping stones and increase the density of corridors
- Make abiotic conditions adequate for wanted specific habitats and target species (e.g. nature friendly canal/ditch banks or high water quality)
- Use robust corridors for reintroduction programs for sturgeon, alligator, deer and indigenous fish species

The over all strategy can, as a metaphor, be denoted as high quality "blue green veining" through landscaping with high water and nature quality in which eco functions with regional water retention are combined in the aquatic core areas, stepping stones as well as the connections (canals and ditches). The multifunctionality of this blue-green veining can be further enhanced by combining biodiversity and water safety functions wherever possible with agriculture, recreation, and climate proofing and pest control.

Blue green veining should result in robust connections in and around Greenport Shanghai Agropark, that consist of wet and dry ecosystems, connecting the existing wetlands, coastal zones, fishponds and canals and rice fields, but also dry ecosystems such as the park and woodland areas in the new Eco-polis and the adjacent areas with small forests, patches of trees and bushes, lanes, meadows and road verges. Robust connections are distinguished at three levels: macro, meso and micro.

# 5 Spatial design: Principles of the landscape ecological system

## 5.6.2 Macro-level (Chongming Island as a whole)

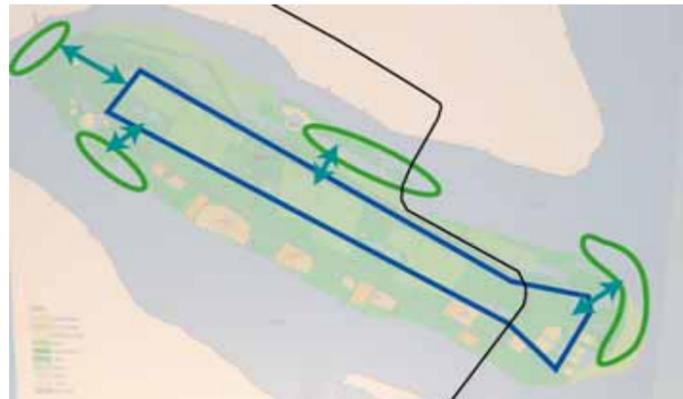


Fig Landscape ecological relationships Chongming island macro level  
Connection of the major wetlands and tidal zones within Chongming island via the main canal.

On the macro-level there the Grand Canal should be further developed as the robust wet eco-connection between the east-south, west and north wetlands of Chongming Island, via the Grand Canal. This ecological connection is also the heart line of the Agropark area.

The water quality of this water connection of 60-80 meter of open water, with its present instable water regime is low: C (class II-III). Therefore this connecting water ecosystem with shores, marshland, open water and dry edges with lanes and moist grasslands adjacent to the water edge, has a low stability and relative low biodiversity perspective. However, it can function very well as a corridor for the target species of avifauna and small mammals along the shorelines (see ecotype description).

## 5.6.3 Meso-level (Dongtan and Agropark area)

On meso-level five robust eco-connections should be developed between natural and semi-natural core areas in the Dongtan area, such as the freshwater wetland in development, the Dongtan Nature reserve, the tidal fringes of the island outside the dikes, with the brackish and saltwater sands and tidal mudflats and the parks and woodlands in development west and south of the Agropark area.

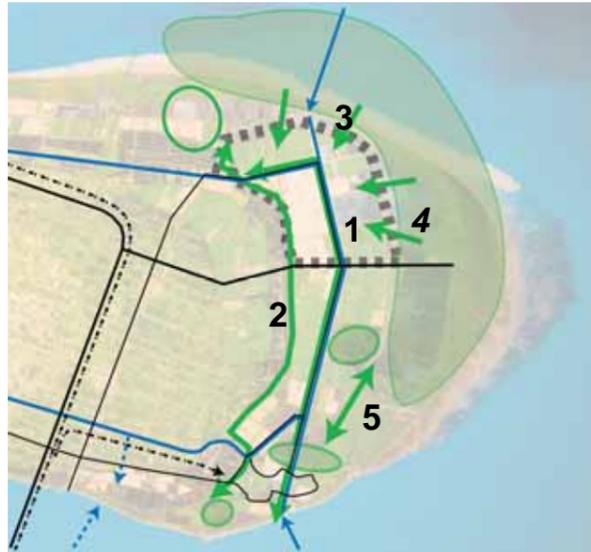


Fig Landscape ecological relationships on meso level for Dongtan area

These are five main road eco-connections, connecting core areas of nature. Five robust eco-connections between natural and semi natural core areas in Dongtan: Green blue veining, micro pattern with ditches lanes & verges with high biodiversity / landscaping

1. Main axis-Greenport Shanghai Agropark (GPS) connection from Creek park to Olympic park; this can be elaborated as a dry/wet ecosystem with lanes, woodland, groves and flower-rich verges in combination with the canal and its shore line. Once established, this eco-connection will form a dry/wet corridor consisting of the partly wooded 30% compensation zone of the infrastructural main axis of the area of 2 times 60 meter in combination with about 40 meter water of the main canal (see below 5.7.3). On the west side of this eco-connection the main routing systems and pipeline construction will be situated which will offer visitors a pleasant semi natural green entrance to the agropark. The eco-connection will be built up as a gradient that goes gradually from open water, via the shorelines with nature friendly shores to the wooded zone. This zone fades via a half open grove zone with lower bushes into flower rich grasslands. The water quality of the canal and shore lines will be class C and coincides with the present local water system, unstable and unpredictable. The

choice of woody species and grasslands must be made consistent with the species composition of autochthonous ecosystems that are used in the wetland area. It should not be a gardened system with allochthonic species as is common along infrastructural axes in China, but developed and managed as a semi natural system with its own dynamics.

2. Olympic Park-Agropark-Eco city zone should be developed as a wet/dry connection, with retention function for excess water during much rainfall. The zone would consist of deep and shallow water with a high water quality, class A/B; small forests, bush lands, groves and lanes. The about 130 meter wide zone will have 30 meter of open shallow and deep water class B/C and 100 meter of helophyte zone with shallow water, that forms a water retention zone during calamities of high rainfall, but would be mostly in use as helophyte zone, semi isolated from open water, producing the excess naturally cleaned water class A/B to be used as process water in the facility agriculture or as clean surface water around the building complexes. From west to east there will be a continuous slow flow instigated by a pumping system in which retention time in the helophytes is about three weeks before it will be used as process or surface water.

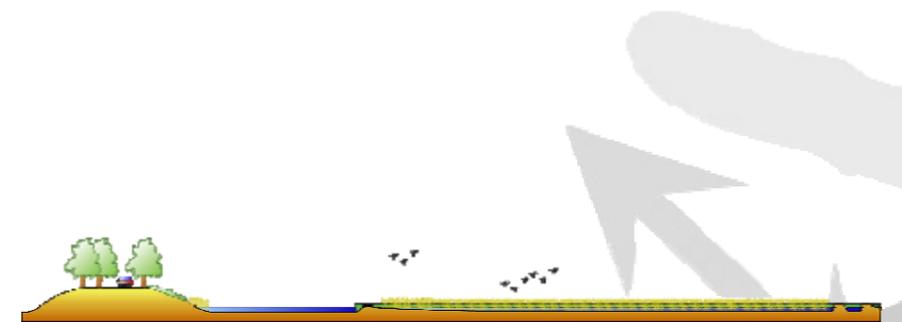


Fig profile D: Eco connection Helophyte filter  
West canal, with the westerly wet eco connection on meso level: helophyte zone, semi isolated

# 5 Spatial design: Principles of the landscape ecological system

3. The connection between the Yangtze, the Agropark and the North-western wetland would form a wet steppingstone between the salt marsh wetland outside the dikes and the fishponds. This connection would be the base for the reintroduction program for sturgeon and alligator-eel-fish and would thus be of high importance for the crucial avifauna of the Dongtan area. The micro pattern of interconnected fishponds should have water quality B. If greenhouse systems are projected in this area, the fishponds adjacent to these can make use of the rainwater usage cycle (water system class A). The fishponds in semi-connection with the main canal system and with more hypertrophic conditions will be situated more to the fringe of the outer borders of the agropark. (see 5.6.6 ecotope system)

4. The connection between the Agropark, the freshwater wetland and the salt marshes of Dongtan should be elaborated as the direct connection to the large high quality core areas of freshwater wetland and tidal ecosystem for which the Dongtan area is famous. This connection in which the water flow from the Agropark goes to and from the huge helophyte function of the wetland area consists of a mosaic of wet (fishponds and ditches) and dry ecosystems (bushes, groves and wet meadows) that offer the opportunity for wetland species to migrate from wetland to Agropark. In the southern part of the Agropark the Landscape Park will be situated with the old creek water system for natural areas in combination with agriculture. Here water quality A/B will be the reference. The naturally purified water from the wetland will enter the Agropark area here via the old creek structures and will flow in the fine mazed ditches structure of this water system. These wet ecosystems and ecotopes of reed lands, marshland, shallow and deep water will have high quality, fitting into the landscape park which will need high surface water quality.

5. The last eco-connection Agropark-Creek park-Eco city should be situated outside the Agropark but forms the link between the projected parks of Dongtan eco-city, the southern part of the Agropark (the south-east landscape park compartment) and the large wetland. Its target ecotopes will be dry and wet ecosystems, with substantial surface of open water (class A/B) and gradients towards bush and wood-land which are in use as multi-functional parks for inhabitants of the eco-city.

## 5.6.4. Micro level (Agropark area)

The north-east zone of the Agropark is designated as the low density zone, where openness and less intense functions are allocated. In this zones so called "blue green micro veining" of the landscape is elaborated as a fine mazed micro-pattern of water infrastructure, ditches with high quality water system (Class A) and an intricate dense network of lanes, small patches of woodlands bushes, groves and flower rich grasslands. This band of minimal 500 meter width, with lanes and flower rich verges would have a high biodiversity/landscape quality and should give the feeling of accessibility and openness. The attractive small scaled landscape pattern will have high access possibilities for visitors. The water system should allow for open grazing land suitable for dairy production or horse keeping. The profiles of the fine maze of ditches will be adjusted to nature friendly profiles, with wide wet-dry gradients that also have a water retention function during high rainfall periods. The hotspot for the rural exhibition area is situated within this zone as well as the mosaic of fish ponds from eco-connection 4.

## 5.6.5 Landscape structure

The landscape structure of the total Agropark follows the Southwest-Northeast gradient moving from high densities in land use, buildings and occupation to lower densities in land use, and more openness. This is reflected in the positioning of functions respectively of the intensity of their land use and in a growing degree of naturalness.

In low density, open parts of the Agropark the parcelation of the unit blocks should be based on the present parcelation and water infrastructure. In section 5.5 these have been



Fig The bird's eye view of the park gives a very green impression, because of the green roofing system of the functional buildings

- Wide green lanes
- Water retention
- Water retention under buildings
- Green roofs
- Wet ecological zone
- Dry ecological zone
- Blue-green veining of the landscape
- Green patch/ forests/ groves
- Canals and ditches
- Lanes and verges

related to the water system with references to comparable Dutch landscape types.

The lines and mass structures of lanes, widened banks of canals and ditches will mark and structure the important land use functions (infrastructure axis, canals, hot spots) etc) and make these clearly visible and recognisable within the landscape when visiting the park. Mass structures as forest patches, groves, and flower rich meadows are indicators for leisure and recreation functions.

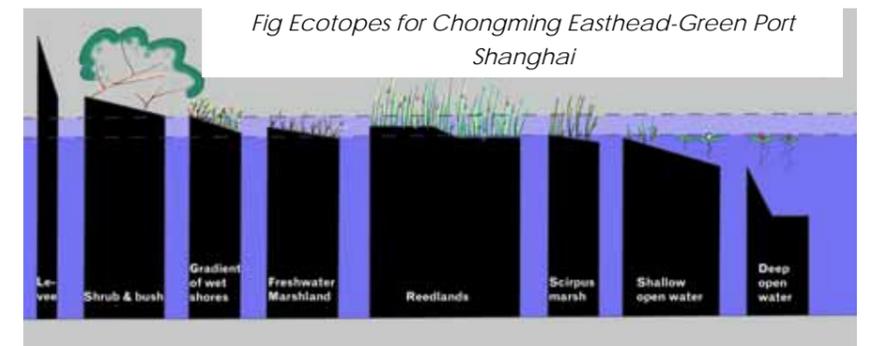


Fig Ecotopes for Chongming Easthead-Green Port Shanghai



Fig Coherence between the water network and ecological network

# 5 Spatial design: The ecotopes for the landscape ecological system

## 5.6.6 The Ecotopes for eco-connection

The ecotypes for the dry and wet ecosystems in Greenport Shanghai Agropark will consist of wet ecotopes for the small existing and also new wetlands, for the main canals, fishponds, ditches, swamps, helophyte filters and rice fields. The dry ecotopes will occur in patches of trees and bushes, small woodlands, lanes, meadows, road verges and parks. The selection of key species for vegetation and fauna have been made in concordance with key species that are defined for Dongtan International Wetland Park, with focus on species that are relevant as feeding habitat for crucial birds and little mammals. The ecotopes of the tidal systems have been excluded as specific ecotope for connection, because the specific brackish to salt condition will not be realised in a stable way within the agropark.

The target species consist of the typical (avi-fauna for the wetlands and softwood woodlands of Dongtan East Headland within the groups of:

- waterfowl with ducks, geese, and swans
- upland game birds include dove and quail
- songbirds include sparrows, woodpeckers, flycatchers, swallows, jays, chickadees, wrens, thrashers, thrushes, vireos, warblers, blackbirds, finches, and sparrows
- marsh birds and shorebirds include cranes, herons, egrets, rails, plovers, and sandpipers
- small mammals include moles, shrews, bats, squirrels, mice, rats, and voles
- the specific fish species for lower Yangtze Delta
- "reintroduction species" for the lower Yangtze Delta as the sturgeon, eel, deer and Yangtze alligator



Fig ground plan with cross sections

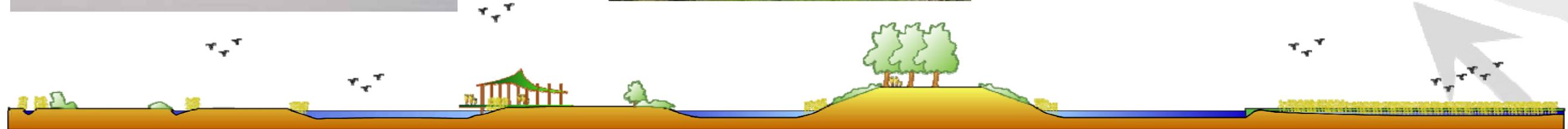


Fig profile E: Landscape park

The dike and connecting gradient from wetland to landscape park., from levee and the eastern canal to the landscape park with natural water systems in which demonstration area, research building (hotspot 2) and semi permanent exhibitions are situated. The visitors centers and observatories are situated in the semi natural wetlands in the south eastern corner of the landscape park

## 5 Spatial design: The ecotope system of the Dongtan landscape

The ecotope table indicates per habitat the required abiotic conditions and the target species (groups)

ECOTOPE	Polder and meadows	Dike (levee) Lanes and road verges	Dry areas bush and woodlands and parks	Sloping wet shores form canals and ditches, (instable gradient)	Freshwater marsh and helophytes filter-areas	Reedland	Shallow open water	Deep open water
Design height in meter above sea level	>0	+4	+0.75 to +1.50	0 to + 0.75	-0.15 to +0.25	-0.25 to +0.25	-0.25 to -1.50	-1,50 to -.3.50
Mean water level	Below surface				Mean high water level: +0,65 m Mean low water level : -0.10 m			
Water regime	Dry	Dry	Dry	Moist: unstable water regime	Wet-very wet unstable water regime	Dry-very wet unstable water regime	Very wet	Very wet
Salinity	Fresh <0.3g Cl/l		Fresh <0.3g Cl/l	Fresh-brackish <0.3gCl/l	Fresh to slightly brackish <0.3g Cl/l	Fresh <0.3g Cl/l	Fresh to brackish 0.3-10 g Cl/l	Fresh to Brackish 0.3-10 g Cl/l
Water quality Nutrient status in mg P/l	Eutrophic –mesotrophic 0.15<P>0.30	Mesotrophic 0.08<P>0.15	Eutrophic-mesotrophic 0,15<P>0.30	Mesotrophic 0.08<P>0.15	Eutrophic 0.30<P>0.50	Eutrophic-supertrophic P>0.50	Eutrophic-supertrophic P>0.50	Eutrophic-supertrophic P>0.50
Water quality Nutrient status in mg NH3-N	Eutrophic –mesotrophic 1.5-3.0 NH3-N	Mesotrophic 0.5-1.5 NH3-N	Eutrophic-mesotrophic 1.5-3.0 NH3-N	Mesotrophic 0.5-1.5 NH3-N	Eutrophic 3.0-6.0 NH3-N	Eutrophic-supertrophic NH3-N>6.0	Eutrophic-supertrophic NH3-N>6.0	Eutrophic-supertrophic NH3-N>6.0
Vegetation and key species	Food crops and grassland	Flower and herb rich moist and dry grassland	Softwoods with large herbs	Low sedge-rich vegetation and moist and wet grasslands Pioneer vegetations	Species rich marshland and wet grasslands	Dominant Phragmites beds	Floating open water vegetation and marshland	Open water and floating vegetation
Key plant species in concordance with key species in Dongtan International Wetland Park, (relevant as feeding habitat for crucial birds and little mammals).	Chenopodium spp Setaria sp Amaranthus retroflexus Ambrosia artemisifolia	Poa pratensis Alopecurus littoralis Avena fatua Poa Annua Chenopodium spp Setaria sp		Salix sp Salix babylonica Acer palmatum Celtis sp Diospyros spp Morus alba Pinus ellioti Populus tomentosa Prunus spp. Quercus variabilis Rhus chinensis Rubus parifolias	Typhus sop Care scabrifolia Carex spp Alisma spp Echinochloa crugalli Eleocharis tuberosa Polygonum spp Sagittaria spp Scirpus spp Zizania spp	Phragmites australis Typha spp Carex scabrifolia Carex spp Alisma spp Echinochloa crugalli Eleocharis tuberosa Polygonum spp Sagittaria spp Scirpus sop Suzanna sop	Carex sp Juncus sp Cyperus sp Nymphaea sp Lotus Lemna minor spp Najas spp Polygonum amphibium Potamogeton spp Sagittaria spp Suzanna sop	Potamogeton sp Nymphaea spp Lotus sp Lemna minor spp Najas spp Polygonum amphibium Potamogeton spp Sagittaria spp Suzanna sop
Key species avifauna Small mammals	Game birds as dove and quail Songbirds as sparrows, woodpeckers, flycatchers, swallows, jays, chickadees, wrens, thrashers, thrushes, vireos, warblers, blackbirds, finches, and sparrows Small mammals as moles, shrews, bats, squirrels, mice, rats, and voles			Waterfowl include ducks, geese, and swans marsh birds and shorebirds as cranes, herons, egrets, waders, rails, plovers, and sandpipers, Specific: Oriental white stork Wistling swan Black faced spoonbill Armstrongs sandpiper Hooded Crane Small mammals as moles, shrews, bats, squirrels, mice, rats, and voles		Ducks Gulls Terns Diving ducks		Diving ducks, geese, and swans, gulls terns

# 5 Spatial design: The infrastructures

## 5.7 The infrastructural networks

The network of infrastructures is aimed at all target groups: for business, production and recreation. The functional internal network of infrastructure links up with the external highway and light rail connections and connects with the wetland, eco-city and adjacent recreation zones. It comprises the transportation network, tourist routing and the CPU-network.

### 5.7.1 The external linkages

The road transportation relations to the West and South are the most important, linking with the mainland bridge and the two neighbouring concentrations of urban development. There is a secondary relation, to the future Olympic Park in the Northwest. For linking up to the urban public transport system there may arise an opportunity once a light rail line has been built via the new bridge to Dongtan Ecocity; this may later be extended to the Greenport. And for transportation over water the existing North-South main water course may be used, with inland (barge) shipping/short sea (coaster) ports at both its Northern and Southern ends.

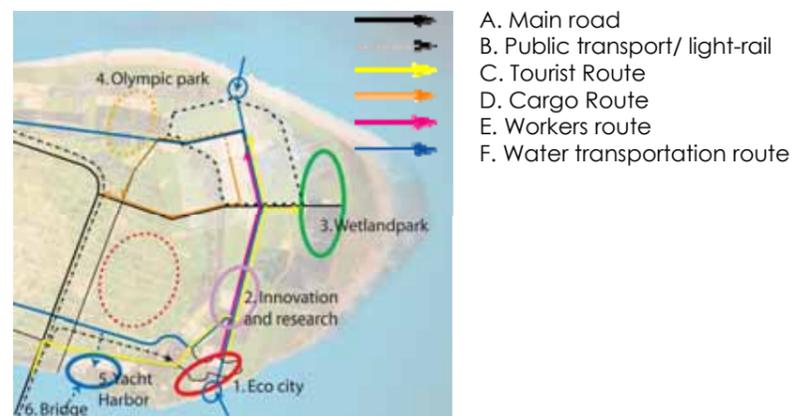


Fig 5 Transportation networks Eastern Chongming Island  
The main infrastructure and road system of the Dongtan area provides existing links with the other parts of the island. New links will be established to the two bridges, connecting the mainland to the South and the North. In the future the light-rail line will be built.

### 5.7.2 The internal transportation network

The main internal access road coincides with the main development axis as follows from the general density zoning in combination with the location of the main entrance points. To provide a more efficient basis for parcelling, however, the smooth turn to the west is replaced by a right angle, with secondary extensions to the North and East. This leads to a natural focal point for the whole Greenport area, to be modelled as a central square and emphasized by some kind of landmark. Both the Southern and Western legs of the main road closely follow the major water courses, with a sixty meter wide green zone in between. In this zone a central walking promenade for visiting tourists is created, shaded by a closed tree cover. From the main road secondary roads and footpaths branch out to give access to the various functions located along the main axis of the Greenport and to the open areas behind these functions. Footpaths should form part of wider green zones and be accompanied by smaller water-courses. In this way, walking will not only become more agreeable but also additional ecological link-ages will be provided. Along the main road at regular distances parking space is located in order to keep cars from penetrating too deeply into the area, especially in Eastern and Northern direction.

Functions that generate considerable amounts of heavy cargo traffic should be located to the West and South of the main road where they can get independent access by a dedicated truck road. In that way they will not affect the 'softer' functions located directly along the main axis and in the area to the North and east of the axis.



- A. Main road
- B. Public transport
- C. Dongtan Tourist
- D. Cargo
- E. Workers
- F. Water transportation
- G. Light rail
- H. Water route for tourist
- I. Internal route Greenport
- K. Pedestrian park
- L. Biking route
- M Connection to metro system

Fig 6 Internal transportation network  
The internal transportation network for all target groups links up to the outside world from the main entrance in the South, where roads and pedestrian routes begin and also the light rail starts. The westerly situated axis is mainly for cargo. The main roads follow the development axis, crossing at the central square. The road from the South is extended to the Yangtze River harbour in the North.

# 5 Spatial design: The central development axis & other major elements

The central axis forms the heart line of the agropark. This part of the Master plan shows visualisations of the structural elements and offers 'artist's impressions' and explanations that may help to better understand the design principles involved and get a general picture of what the Dongtan Agropark may look like.

## 5.7.3 Central development axis

Basis for the design of the main development axis form the existing water course and road with their sixty meter wide green zone in between. As already said the green zone should be turned into a walking promenade shaded by a closed tree cover. At the same time the edges of the watercourse need to be made nature-friendly so that the green walking promenade together with the watercourse may serve as a robust ecological connection. Beyond the central square this connection is extended in Northern and Eastern direction, linking with the Wetland zone bordering on the Greenport.

While in this way on its Eastern side the main access road is accompanied by the tree covered walking promenade and nature friendly watercourse, on its Western side it will be accompanied by the overhead pipes and cables of the CPU-backbone, roofed by the solar cell panels. In designing both sides of the road as one indivisible whole there is an excellent opportunity to demonstrate how 'high tech' and 'high eco' may be balanced and harmonised, symbolising the unity of these to fundamental characteristics of the Greenport. In a later stage the road must be doubled, at its West side; then the supports of the CPU-backbone will find themselves in the separation between the lanes.

Building lines along the axis will alternately jump backwards and forward: backwards where functions are located that attract voluminous flows of visitors that ask for space in front of their entrances, and forward where production and processing units need to be close to the CPU-backbone.

Plug-in sockets to connect production and processing units are placed at regular distances along the CPU-backbone, as are secondary roads and footpaths/secondary ecological linkages that branch off from the main road and walking promenade/water course respectively. Exactly how far these connecting/branching points have to be set apart has to be established by the Industrial Plan, derived from an optimum modular dimensioning of production and processing units.

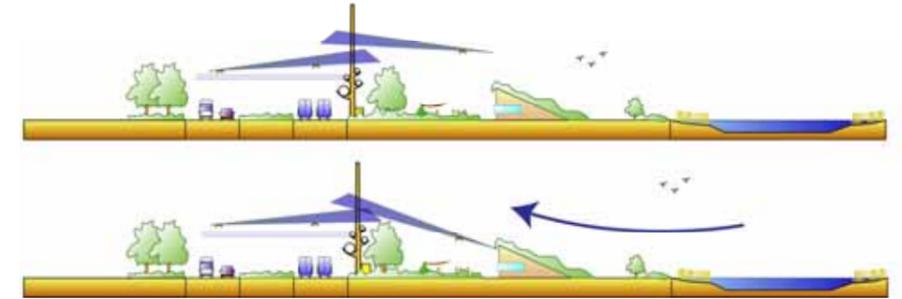


Fig Profiles and birds eye view of the prominent CPU pipeline system, as coupled with the main axis: the positioning of "the wings" is flexible, wind and weather dependant.



Fig ground plan of the main development axis with cross sections

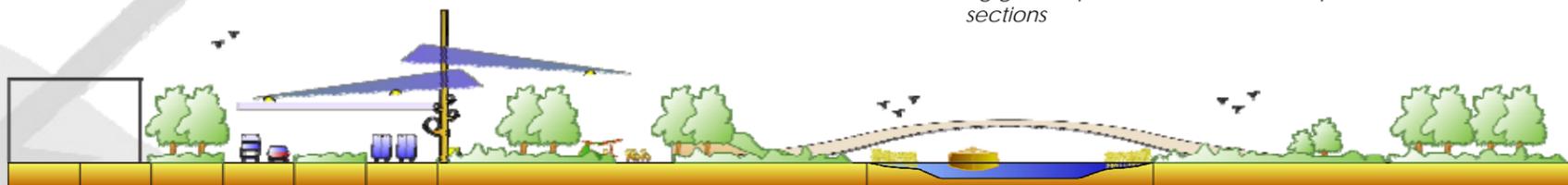
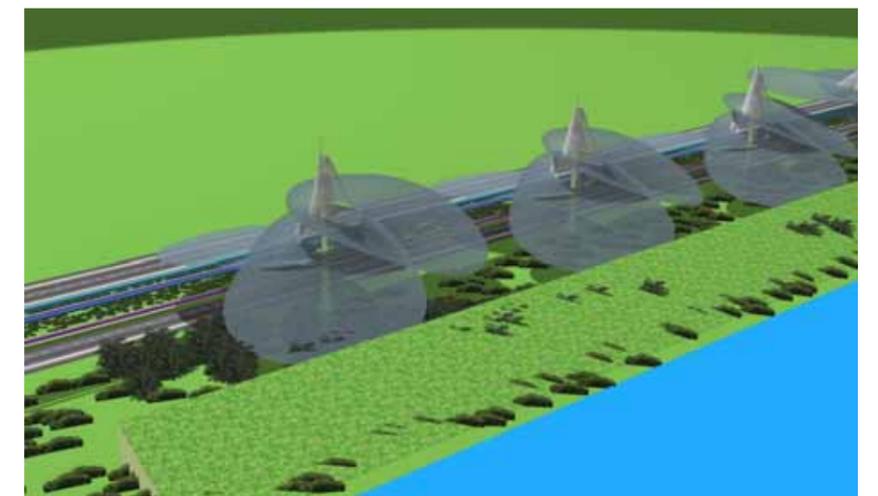
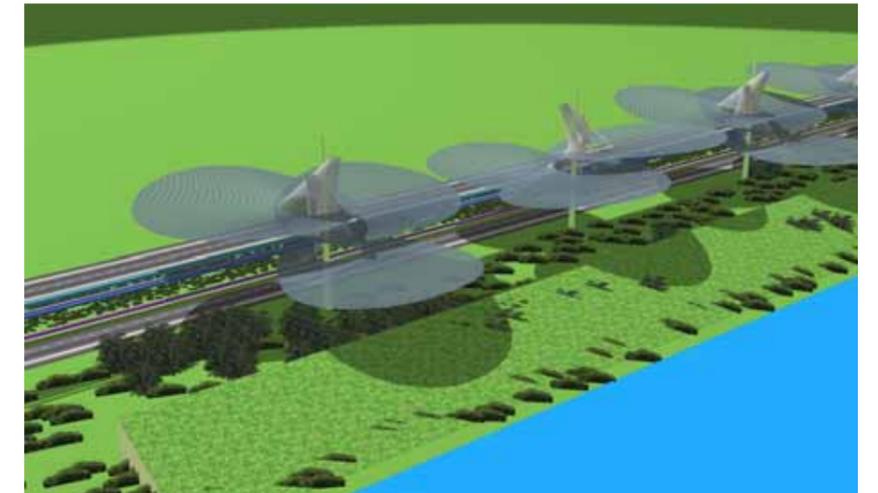


Fig profile A: main axis. Central axis of the Agropark with main canal with on its west side the infrastructural bundle, central pipeline bundle CPU with solar cell roofing and on the east side of the canal the landscape ecological zone.



# 5 Spatial design: The story lines at the hotspots 1

## 5.7.5 The story lines of Agropark Dongtan in five hotspots

### 1. This is our world

Hotspot 1 is the entrance of the park, where eventually the internal light rail may start. Here the concept of world sustainability is explained, using the keywords: "Urban, Rural and Nature". This first Hotspot, with the theme 'This is our world' can be seen as the focal point of the whole Dongtan area, where, in the rear the Urban (the Ecocity), in front the Rural (the Agropark) and to the right Nature (Wetland park) in its optimum form is displayed. The story line itself is that by planning intensive, closed industrial agriculture in the way it is done in the Greenport, there is more open space available (in Dongtan, but also globally) for nature, water, living as well as for sustainable housing.

The globe built near the entrance is mascot for a sustainable world, the sustainability index showed in changing colours and lights on the globe as a continuously changing display of world sustainability.

It is a viewing point for the total area. It is the marker for the concept of sustainable farming, food and water quality issues. Because this is the first hotspot, a large parking facility is situated here, routing systems start from here and relevant information about the routing in the rest of the park can be obtained here.



Fig Hotspot 1: This is our world



Fig ground plan with the hotspots

### 2. Greenport Dongtan

This is the demonstration park in which all aspects of the chain of agricultural production, processing, trade and service agriculture, quality management etc of Dongtan Greenport are shown. It is the location of a sub-unit of the central processing unit. This hotspot is the show window of the production and processing units, in accessible pavilions in which reality is demonstrated with the use of tele-screens and webcams. Here is explained how we are able to produce more food on less land, environmentally sound, with care for animal welfare, with closed cycles of water, CO<sub>2</sub>, energy and nutrients, with enormous care, for high certified standards in the use of water, soils and air. Also the links to other agro parks and Greenports worldwide can be found here. The water system and its quality control of the park are explained here, as well as the landscape ecological features and the connection principles between the Eco-polis, the

Agropark, the wetland area and the tidal areas. Here also the locations are situated where food products can be gathered and picked within free roaming zones.

This hotspot is situated in the landscape park, where the recreational and educational functions for guests are located. Permanent, semi permanent or transient exhibitions will be arranged in concentric circles around the hotspots, for instance a satellite of the Dutch international flower and horticultural exhibition Floriade. The landscape park has a main matrix of primary and secondary water systems with high quality water, fed by local rainfall and received from the wetland nearby, that can be used for boating and recreational purposes. Within its specific narrow parcelation of the land it forms the matrix in which public activities can take place year round.

The research buildings connected with knowledge development and education purposes for the agri-business may well be situated within or near to this hotspot.

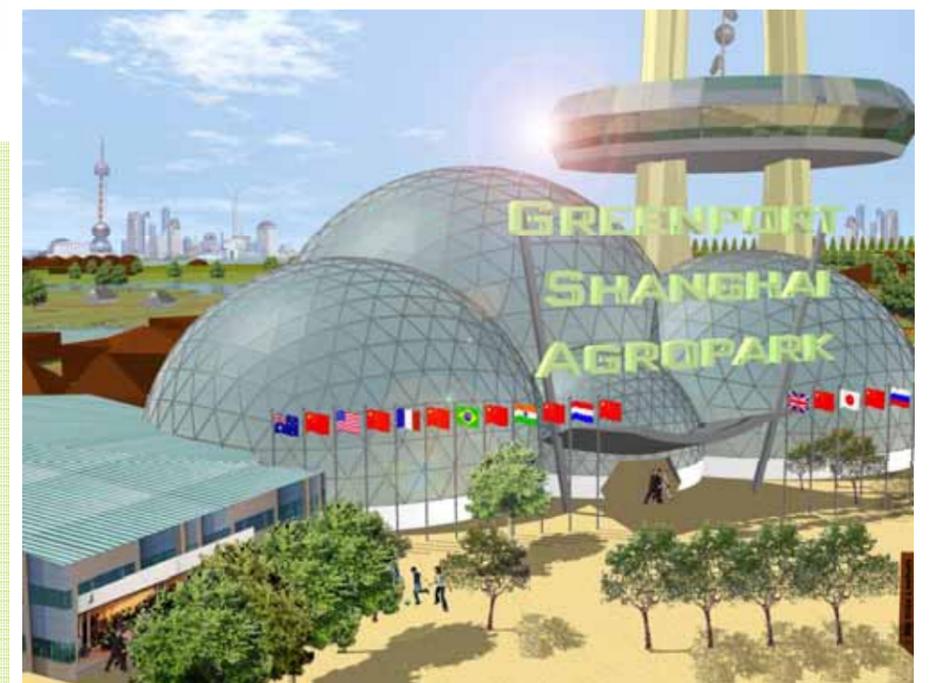


Fig Hotspot 2: Greenport Dongtan

## 5 Spatial design: The story lines at the hotspots 2

### 3. Dongtan Tradepark

In this central spot all trade of agricultural products is conducted. There is a trade harbour and a large auction place, there are trade buildings, a communication centre, a hotel and restaurant complexes. The typhoon proof architecture of the buildings must be open, transparent and inviting to stay and do business in a relaxed open way.



Fig Hotspot 3: Dongtan Tradepark

### 4. Central Square

At the cross road of the two main axes, the central square is situated. Beside this square the main functions of the Central Processing Unit are situated.

Here we find the Solar cell Pagoda, where visitors can view over the natural landscape and the green-port, and can get acquainted with Chinese and Dutch culture. The solar cell Pagoda is a marker in the landscape in connection with the overhead pipeline structure of the main axis. Here the visitors can learn about the relation between food and health and can experience the products from the Greenport in food stalls and restaurants. It is the building in which the urban dwellers of the Agropark communities will have their communal functions. Leisure and residential functions are also situated here, as well as the place for special, temporarily exhibitions and (music or agro) festivals.

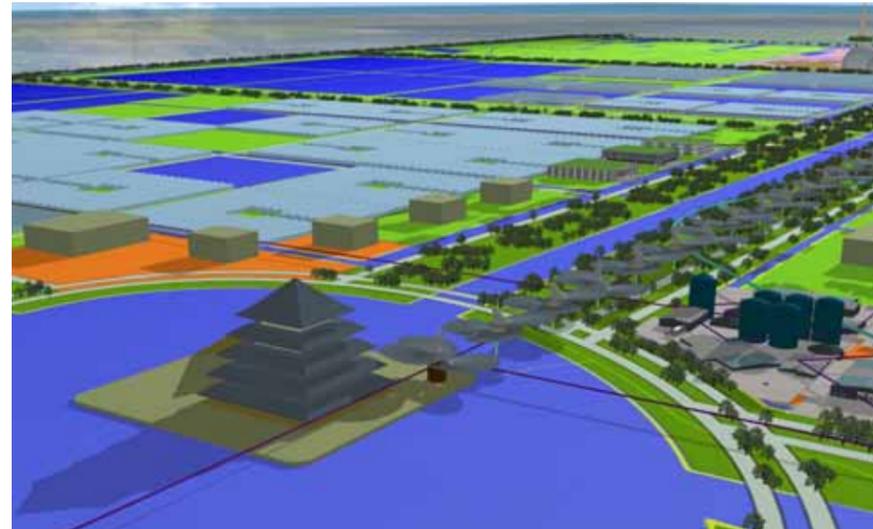


Fig Hotspot 4: Central Square

### 5. International Rural Exhibition

The last hotspot forms also the exit or second entrance of the Agropark, dependant on the development of the park. Here

is situated in long linear configurations the international rural exhibition, where farms from all over the world can be brought in and visited. The rural and reclamation history of Chongming Island can also be explained.

Also production and processing of 'forgotten' foods, new agricultural products and explanation of endangered species can be found here. It will form a world decor of past agriculture against which to show and try out what new movements, fashions and trends of food and agriculture are developing in the 21st century. This is the place where target groups of trend watchers of food innovations have their try-out place, where the trendy new food products will be shown, probed and discussed.

Because Dongtan itself has a very short history at this moment, being only recently reclaimed it lacks a cultural story of its own. By developing the new story lines of agriculture (past, present and future) combined with the stories of the businesses situated in the park, a unique new cultural story of agri-business can be told here.

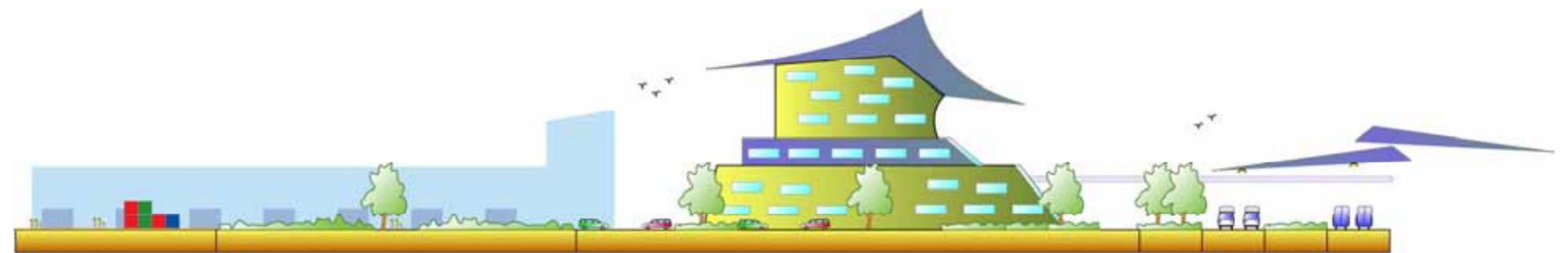


Fig profile B: Trade zone

West side of the central axis, Trade Park zone; hotspot nr 3 with Trade center, Auction area, logistical centers, Hotels, Restaurant and communities of local employees. Westward the product and processing areas and secondary road systems, with focus on cargo traffic.

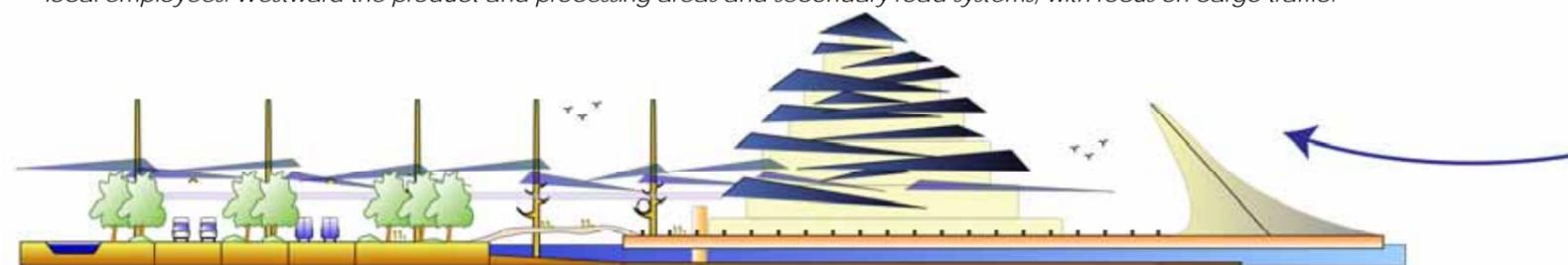


Fig profile C Central Square

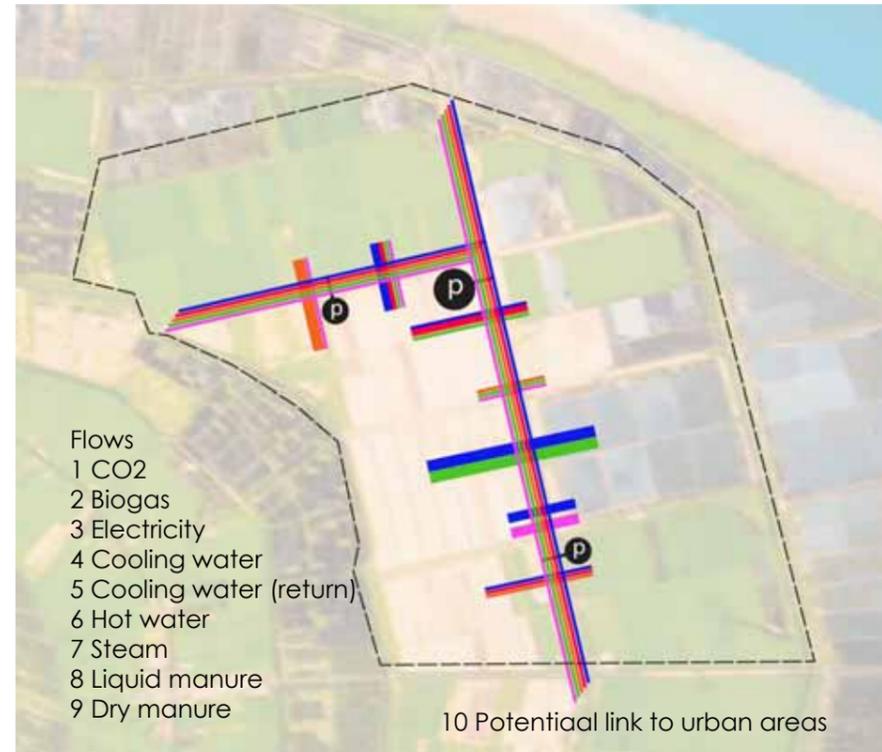
Profile Central axis, hotspot 4, Central Square with Floating Pagoda, Wind catch screening and CPU pipeline system with solar cell roofing.

# 5 Spatial design: The CPU Infrastructure

## 5.7.6 The CPU network

The third major internal network consists of the infrastructure (pipes, cables, and conveyor belts, etcetera) accommodating the various inputs and output flows that interconnect the different production and processing functions of the Greenport. For several reasons this network should be constructed overhead rather than underground. The first are practical: maintenance will be much easier, with problems coming to light directly so that interventions may follow immediately, and connecting new production or processing units will be much easier as well, without digging and thus disrupting traffic flows and doing damage to road surfaces. Of course overhead construction should meet higher standards and will hence be more costly. This will be compensated, however, by lower maintenance costs and lower costs of connecting new units, especially when main conduits are prepared by placing 'plug-in sockets' at regular distances.

The second reason is more psychological and should therefore be considered even more important: the general message the Greenport sends is its closed circuit principle. No waste or other harmful emissions are allowed to escape from the system: everything is recycled or reused. Whatever leaves the area is truly beneficial: healthy food produced in a sustainable way, surplus energy, and clean water. This central message is embodied and symbolised in the infrastructure that carries all input, output and intermediate flows, with the processing units attached to it. Therefore this infrastructure should be highly visible, following the central development axis as a kind of 'backbone' and should be beautifully designed. The effect may be further strengthened by covering the overhead pipes and cables with a roof of solar cells. This will stress the sustainable character of the Greenport even more and will also provide extra clean energy, even in such amounts that neighbouring areas may be supplied as well. A further elaboration of the technical features of the CPU is given in chapter 6.



*Fig The network of central processing units (CPU's) and connecting pipe systems*

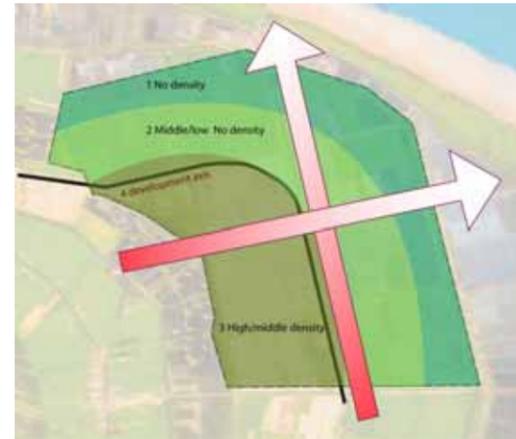
*The central processing unit is the heart of the agropark. It consists of a bundle of pipes, cables, conveyors, etc linking all production and processing activities to each other. It is the central installations, where waste is treated, energy generated, compost produced etc. The network has 'plug-in' sockets in which easy linking up is possible for new activities. With its high visibility and superb high-tech design the CPU-network stresses the core message of the Agropark. This is modern urban ecological agriculture and service agriculture, producing top-quality food in an entirely sustainable way: closed cycles of material flows and zero emissions*



# 5 Spatial design: Integration

## 5.8 Integration of zones and networks: the core of the Master plan

Combining the three networks, superimposing them on the zoning scheme, and then formulating rules on how functions should be located in relation to these, yields what in fact is the core of the Master plan. One such a location rule is that high density, energy intensive functions that attract relatively much traffic and – the closed systems notwithstanding – pose a certain risk of residual bad smell, should be concentrated to the West and South of the central development axis, while being excluded from the area to the North and East due to their closer distance to the vulnerable wetlands and off-shore sedimentation plain. Nor should these functions be located directly at the axis itself. Another such rule is that the low intensity zone bordering directly on the wetlands should be kept free from buildings, with only some minor exceptions for light construction directly related to tourism, recreation or nature conservation. Yet another rule would be to keep functions that produce voluminous output flows to be processed by the CPU close to the central axis. The same holds for functions that use substantial inputs produced by the CPU. Also functions attracting many visitors (agro-tourists, student groups, and etcetera) should be located here. Functions that allow for superimposing on each other (e.g. greenhouses on top of pig stables or storage sheds) should seriously be considered to be constructed in this way because of the reduction of built up area and energy consumption. For the Master plan these examples of setting rules for location decisions should suffice. Further formulation of rules should be undertaken by elaborations of the Industrial Plan that are to follow the Master plan and should strengthen the consistency between Strategic Plan, Master plan and Industrial Plan by means of an iterative approach.



Density zoning



overall water network



Coherence between the water network and ecological network

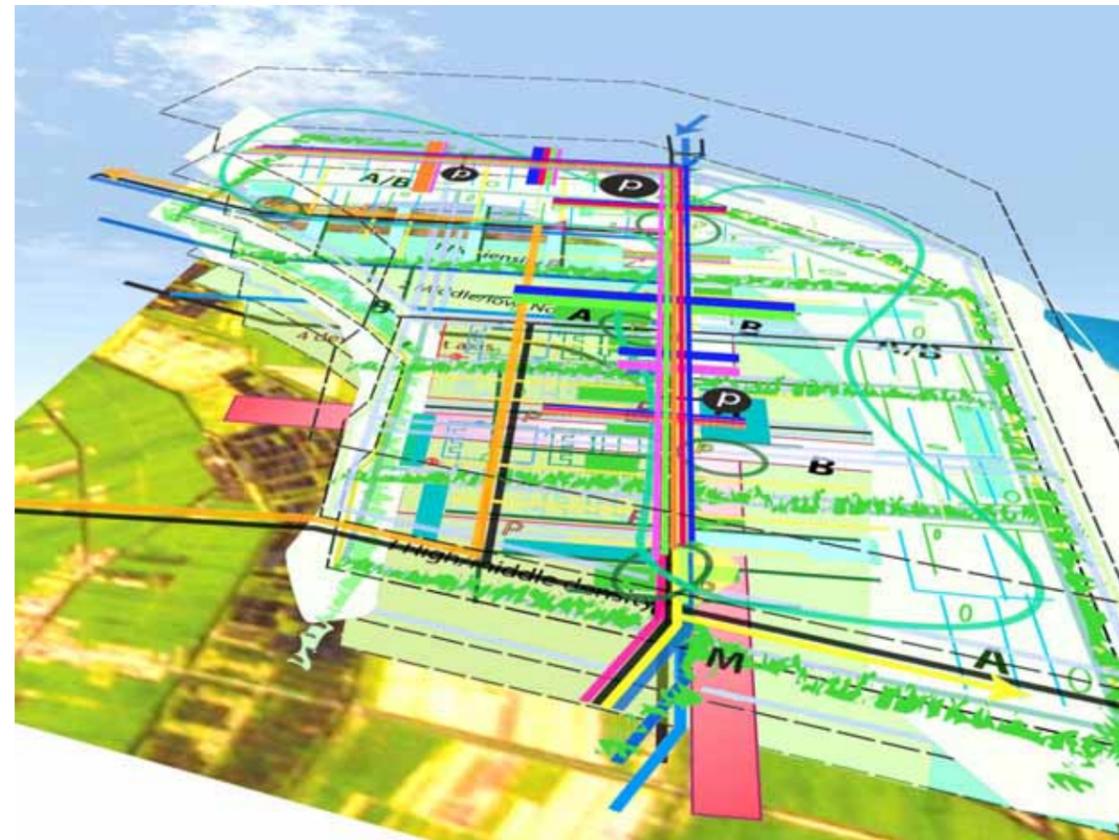


Fig integration of zones and networks  
Bringing all the networks together with the basic zoning scheme we arrive at the core of the Master plan. These are the structural elements that offer the robust framework for fitting in the widest possible range of implementation options. For each activity, according to its fundamental characteristics, the optimum location follows from the density zoning and from its most efficient linking to the various networks.

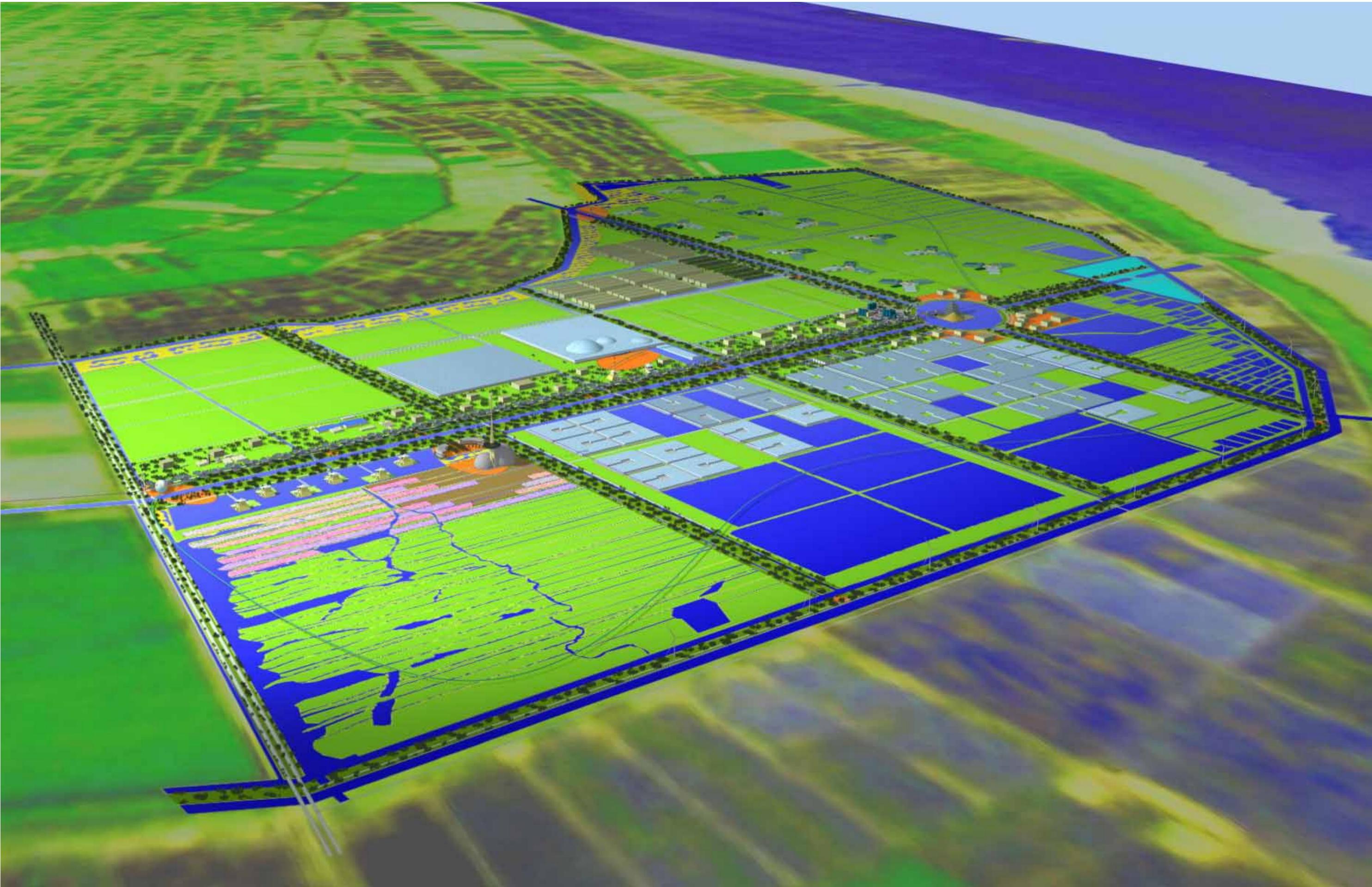


internal transportation network and the string of hotspots



The network of central processing units (CPU's) and connecting pipe systems

# Master plan Greenport Shanghai Agropark: A possible scenario



# 6 CPU and Agro- Industrial design: The Demonstration park

*This chapter describes the Demonstration Park, the Trade Park and the Central Processing Unit. It develops the principles for linking agro-production and processing activities and striking a balance between these, in such a way that closed cycles can be maintained with zero emission and independence of fossil energy. The Agropark, the Central Processing Unit, the Demonstration Park and the Trade Park are the three indispensable structural elements for the Greenport Shanghai Agropark. As a united concept they are the 3 typical cornerstones of the park, in which production, processing, demonstration, information, research and development, capacity building, training and leisure are all combined.*

*Ending this chapter illustrations of these principles are shown as optional examples. Four scenarios are offered of the flexible outcome of entrepreneurs' and governmental decisions to invest in production and processing facilities that seize the opportunities offered by the CPU concept.*

## 6.1 Introduction

The intended Dongtan agropark is a mixed agro park: it contains various agricultural, processing, trade and demonstration functions. The main hardware innovation of the agropark is this demand driven combination and integration of various agricultural activities. The

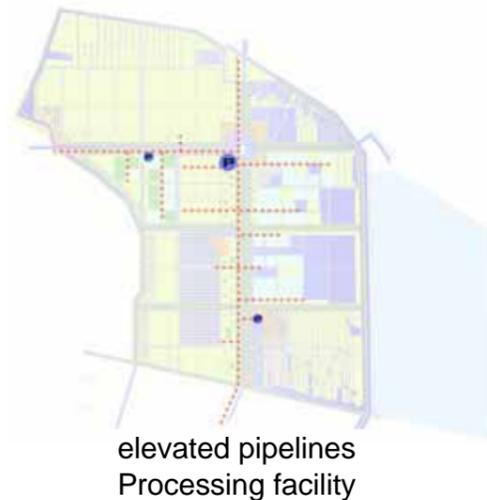


Fig The elevated pipelines and processing facilities are similar in all elaborated scenarios and have been described in chapter 5

demonstration park will show novel products and services for consumers and producers in the broad spectrum of agro-production and if there is a market potential for these products they will be brought in, either by trade or by production within the park. Production in the park is not only primary production but also processing of these products and of traded products that have been produced elsewhere. In this way it becomes possible to aim at the end of the production and trade chains where usually most surplus value is generated.

## 6.2 Demonstration park

The Agro Park will demonstrate sustainable development of agriculture aiming at high quality safe food. It will show intensive facility agriculture, including methods for preventing infections (and thus minimization of chemicals use) in high-tech closed systems as greenhouses and stables. In the demonstration park these principles of the Agropark will be shown in a small-scale laboratory set-up, i.e. for biological processes such as fermentation, composting, and water treatment processes. This unit can also be used for research, testing and optimization of the CPU processes. Elsewhere in the park, large scale production facilities will be open for public, although direct contact between visitors on the one side and workers, animals and plants on the other will be reduced to a minimum to prevent contaminations. Via webcams, connections will be made with other excellent examples in China of agricultural production, located close by or, if need be, thousands of kilometres away.

The demonstration function will also be connected with the agro-trade: citizens can buy products in the Agro Park, in shops and restaurants. Through this direct branding, consumer products are related with the Agro Park and the demonstration contributes to the high-quality image of the products. In terms of business to business relations, the Agro Park will act as a show case for regional Chinese agribusiness, but also for the international market

Many Chinese regard the Netherlands as a country that supplies food products of exceptional quality. Greenport Shanghai will take this qualification further: if the Netherlands is able to produce quality then they are also in a position to set standards for quality. The showing of these food quality standards and how they are being realized will be an

important part of the demonstration area; as for instance a transparent food chain, a circular and well administrated food-production, clear food processing systems and insight in the service agriculture system. The demonstration area will also provide a virtual link to other agricultural parks that are being set up throughout the world. Many building structures in the demonstration park will be semi-permanent, as they should be sufficiently flexible to put up new exhibits following new inventions, and changes in time.

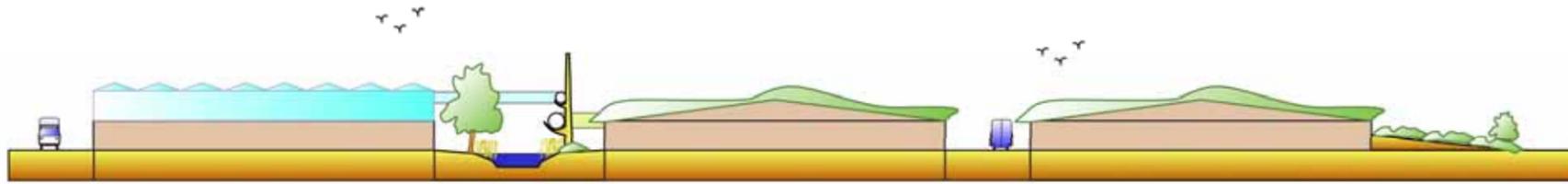
The demonstration park will also be a place for research and education as a crossroad of Chinese and Dutch universities and centres of excellence. This is where Wageningen-UR has a special interest, because in China its university and research institutes are well known and respected as knowledge institutions.

The agropark will function as a research laboratory and generate knowledge on sustainable development of agriculture, on organisation of industrial ecology and on facilitation in environmental approval and compliance targeting trade, production and processing under the specific conditions of Shanghai. Education will aim at training Chinese managers, employees and farm workers and meanwhile be a showcase of skills for Dutch entrepreneurs while they learn about Chinese production circumstances and markets.



Fig Circular agriculture

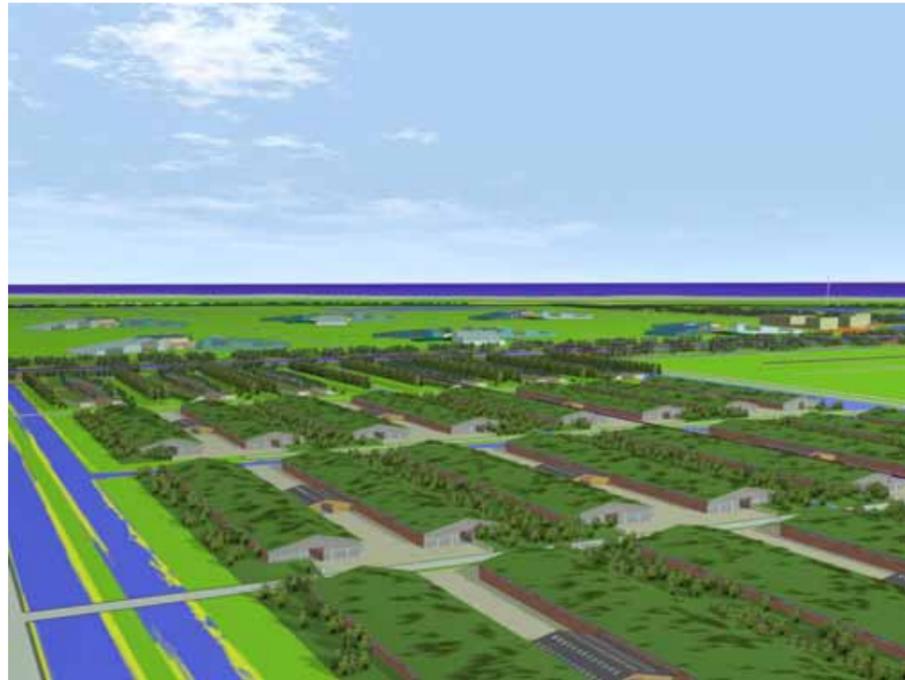
# 6 CPU and Agro- Industrial design: Illustrations of the pig farm & chicken farm



*Fig profile F Multilayered Pig stables and Glasshouses  
The glass house complexes are single layered, double layered, being build on production units for mushrooms or on compost units.  
The production units for pigs are energy saving, two layered buildings, with green roofing, with innovative heat regulation*



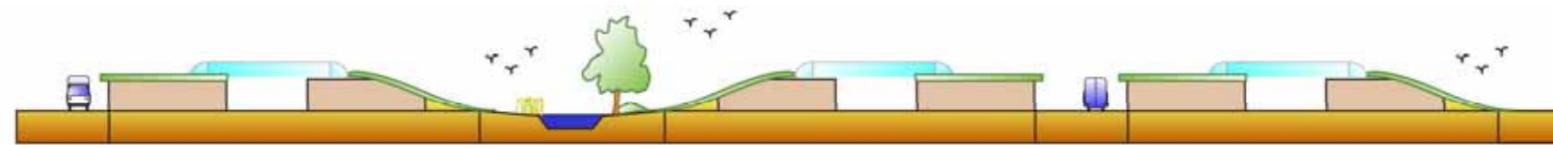
*Fig ground plan with cross sections*



*Fig Green roofed pig stables fitted carefully into the context of the landscape*



*Fig Green roofed semi closed chicken stables fitted carefully into the context of the landscape*



*Fig profile G Production unit chicken stables The stables are designed to make a contribution to the landscape*

# 6 CPU and Agro- Industrial design: The Trade park

## 6.3 The Agro Trade and Logistics Park

The second important function of the agropark is to engage in trade. The trade park intends to have two functions: a business centre where business people and tradesmen meet, and a trade centre where products, services and knowledge are being bought and sold. The trade park will be closely aligned with the demonstration park, sharing many of its research, communication and training facilities.

The business centre will attract international business people from the agro-food sector by offering an array of facilities. It offers access to the world. Together with the business people specialized service providers, commercial as well as knowledge brokers, lawyers, bankers and accountants, will get commerce up and running. It will contain the information and communication centre from The Agropark towards the world. There are hotels, restaurants, travel agencies and retail stores and there are also government services: a Chinese Chamber of Commerce and the much lauded one-stop window, where all the needed permits can be arranged once someone is ready to start doing business in Dongtan or elsewhere.

The business centre has a much greater reach than the Agropark only. It should strive to be the entrance way through which international agro-logistic business people in and around Shanghai will first come in to set up their business.

The Agro Park will combine food production and processing with trade in which food safety and sustainable production have high priorities. Because this production location is very close to the customers (in the city of Shanghai), production of perishables seems most appropriate. Most suitable are those activities that address the combination of these aspects. Moreover the most added value of any food product is generated in the final steps, close to the consumer, such as (final) processing, packaging and



wholesaling and retailing. Therefore, we propose to include total production chains in the agropark, including end products. These end products that are put on the market are more and more complex.

This goes not only for modern dairy products like light drinks but also for semi-processed foods and microwave dinners. Producing such products will always be a combination of production and processing of some components produced within the park with other components that are acquired on the market. Thus extended and flexible trade will be an important part of the processing chain.

Trade will be organised on the basis of examples from the Netherlands of trade parks as a centre for commercial and auction transactions, real and virtual. These trade transactions are a source of knowledge by themselves. They offer insights into the agricultural markets of Shanghai with its 18 million consumers. As such, the marketplace and demonstration park provide sources of mutual inspiration for each other. Trade is not restricted to agricultural products, but deals also with knowledge about the products and about how the products can be made in a sustainable fashion.

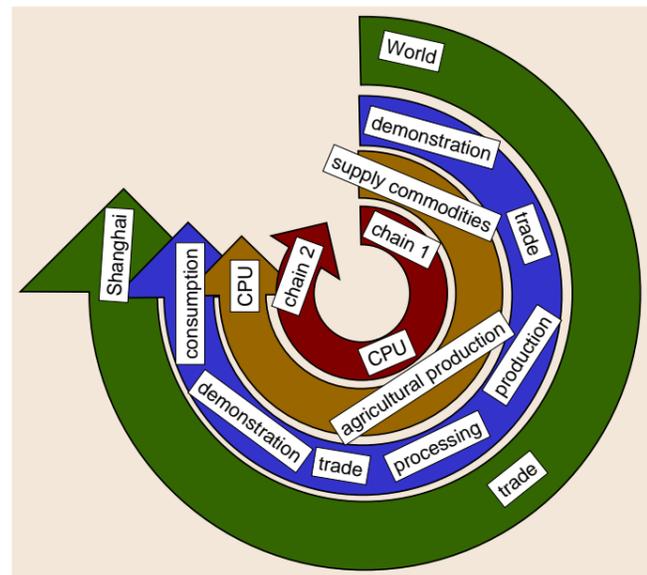


Fig The agro park is an integrated design.

Focusing on top breeding (or seeds production) also fits well because it fits well with the demonstration character of the park. Still the end product processing and trade can be incorporated in the Agro Park.

In more detail, the following trading and logistics are expected:

- Supply of feed and other primary materials to the Agro Park. This will include commodities for feed and fertilizers. Dependency on single suppliers outside the Agro Park may be dangerous (unless their kind of products can be bought elsewhere with minimal extra costs).
- Trade of waste and other biomass (CPU)
- Trade of food and flower products. Part of the products flows will be locally produced; others may be bought elsewhere (China or on the international market). Transport via the Shanghai Sea harbours, airport and the new bridge/tunnel connections to Chongming Island. Long term tight relations with western trade centres (for instance Dutch auctions) reduce risk of supply shortages. The demonstration functions in the agropark combined with direct selling add extra value to the food products. Branding and active marketing of the products will be very important for that.
- Convenience food: half prepared food products. This segment is fast growing. Food processing connects well with the trading activities. This segment will include:
  - meat products (packaged, fresh, consumer-size, prepared for cooking);
  - cut vegetable products;
  - fresh meals (such as pizza's, Chinese meals, and other trendy meals)
  - Etc.
- Food quality and safety certification & control organisations
  - for imported products and for products produced in the agropark;
  - in the future: extend the business to agro-production elsewhere in China;
- Trading of breeding & nursing products: for production in the agropark, in neighbouring regions or elsewhere. This activity is highly interesting for international entrepreneurs.
- Technology suppliers that have a high interest in demonstration and World Expo.

# 6 CPU and Agro- Industrial design: The Central Processing Unit (CPU)

## 6.4 The CPU

The integration in production and processing is powered by the Central Processing Unit (CPU): the heart of a mixed agro park. The CPU, in return, enables sustainable innovations of the agricultural activities.

In the following sections two aspects of the CPU are addressed:

1. The main focus will be on technological design of the CPU
2. Furthermore, some attention will be paid to the CPU management.

The CPU of a mixed agro park combines and processes biomass waste flows to valuable materials and energy. As a result, waste from one activity can be used as valuable input for an-other process. This results in a reduction of the input needed for the activities of the Agro Park and a reduction of the amount of waste (ecological burden). Thus, the CPU contributes to closing cyclic loops in the Agro Park.

Energy produced in the CPU can be used for heating, cooling and de-humidification. As a result, (semi-)closed agricultural systems (stables, greenhouses) can be used instead of the usual open-field systems. Through application of climate controlled closed systems, infection pressures can be minimized, so that use of chemicals can be minimized. Furthermore, product quality and production yields can be increased. All these ecological functions and characteristics of the CPU contribute to significant cost reduction and in the case of quality control to higher returns.

The functions of CPU management are:

- Designing and developing the integration of agricultural ecological and economical chain within the agro park,
- Interacting with all the producing and non-producing units in the agro park about their waste management issues,
- Forming the liaising with potential parties outside of Dongtan agro park interested in joint waste management,
- Tracking the flow of waste materials produced inside the park,

- Maximizing resource utilization through integrated waste management,
- Controlling waste discharge leaving the premises of the Agro Park.
- Reporting waste management performance to agro park management.

### 6.4.1 CPU Design conditions

The task set for the "Hardware design CPU" has been to contribute significantly to sustainable development of agriculture and to design options for parallel combinations of production activities and chains that are mutually linked, with the following focuses:

- Agricultural production & food processing & trade
- Linked with local and regional need (i.e. consumers in Dongtan, Chongming and Shanghai)
- Linked with CPU (waste streams, energy, water, CO<sub>2</sub>)
- Demonstration of sustainable food production and "closed cycles agriculture"

The general specifications of the assignment have been translated in the following pre conditions by the CPU-design.

- There is a priority for ecological development, meaning the ecological burden must be lowered.
- The design should be industrialized on large scale and has to consider the needs of the population.
- The different production chains should be combined in the park for optimal closing of cyclic loops and the system should be flexible and adaptable.
- The starting resource of any specific chain should not be dependent on limited (local) availability. Thus, being dependent on a small amount of chicken manure available on the island would be very risky and it would be preferred to produce it within the park. On the other hand, pig feed resources are worldwide available commodities; dependency on external pig feed resources is not risky for the park.

- The beneficial use of agriculture waste must be encouraged by the government.
- It is not allowed to add new water bodies for aqua culture at this moment 8000 mu (5.3 km<sup>2</sup>) is available now.
- The aim is a high-tech agro production, this means characteristic agricultural production which is globally oriented. The momentous Dutch agriculture is exemplary.
- There will be involvement of international companies and high knowledge input and continuous development is a critical success factor for the Agro park development.
- It is the aim to serve first China and then serve the world. Therefore food supply for China (and especially Shanghai) is most relevant.
- All products from the agropark will be put on the market with a brand expressing high quality and food safety. Within any group of production classes, attention will be on specialties.
- The Agro Park will be a showcase of modern urban agriculture and in that it should be beneficial to attracting visitors. Functions of leisure, production and landscape ecology should be integrated and combined.

The agropark will form an integrated design: This means an integrated approach of consumers that connects demonstration-production-trade-consumption. All production chains are mutually connected through the Central processing Unit. The trade centre connects Shanghai to the rest of China and the world and the agricultural production is connected with the world market (supply commodities) as well as within the Agro Park itself.

# 6 CPU and Agro- Industrial design: The processes and chains

## 6.4.2 CPU processes

The Central Processing Unit (CPU) is the heart of the Agro Park. The CPU recycles nutrients, water, energy and biomass and it converts "waste" into valuable materials and energy.

Various processes can be incorporated, such as:

- Biogas production with anaerobic digesters, by gasification or burning dry biomass (inputs: manure and/or other biomass);
- Production of electricity and heat from biogas;
- Cooling using sustainable cooling methods;
- Water treatment and storage
- Mushroom compost production;
- Production of organic fertiliser and soil structure enriching materials;
- Carbon dioxide recycling
- And possibly other bio-mass and bio-energy related activities.

Short cyclic loops, where only one agricultural activity and one recycling activity are involved, are generally technically impossible or expensive. Through connecting different large scale production chains, the recycling becomes more feasible. Thus, the CPU should preferably be combined with a broad range of large scale agricultural and agro-industrial activities. By way of the spatial clustering of various activities in the Agro Park, the CPU performance can be optimised.

This means that low-valued voluminous waste products are locally handled and transport is being prevented. Heat and cooling will be used locally with minimal investments in pipes and no loss of heat. Biological CPU processes like biogas production, composting and water treatment in general prefer a mixed input of materials.

Because of the large scale-size the central CPU will have the most optimal benefit/costs ratio.

## 6.4.3 The CPU facilitates sustainable agro-food production chains

Not only will the CPU profit from short connections to the other activities, but also the agricultural activities can profit from the CPU. The local presence of the CPU can largely

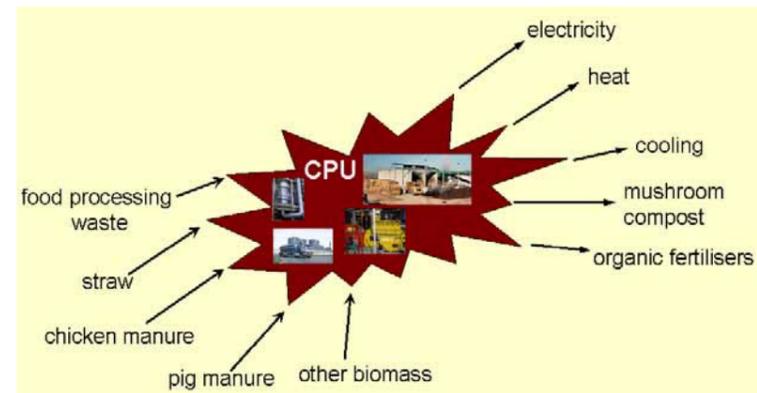


Fig The CPU contributes to closed cyclic loops in the agro park through upgrading waste to valuable materials and energy.

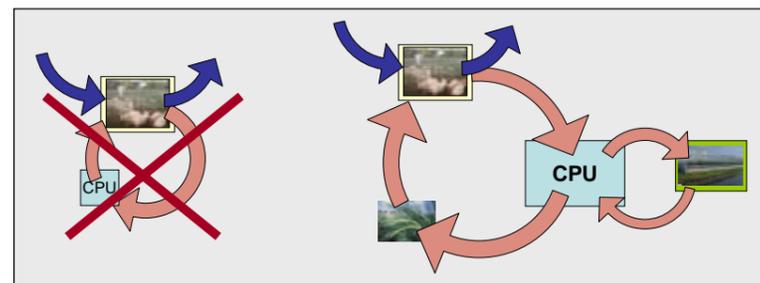


Fig The CPU is most effective when connected to various production processes.

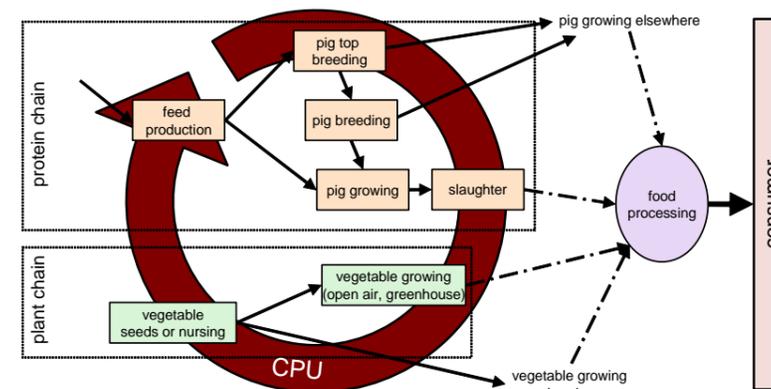


Fig The CPU connects different production chains

contribute to sustainable development, of the agricultural and food production activities because "Waste" is converted to valuable materials. This aspect of the CPU as creator of added value is a considerable asset for the whole agropark development

The cooling and heating of agricultural production is possible (greenhouses, stables) with the locally generated heat and electricity. As a result, a "closed climate controlled system" can be used, resulting in

- Reduced risks of infections, so that the use of chemicals can be minimised;
- Higher product quality;
- Increased productivity.

The increased supply of manure will enhance crop and vegetable production; and the processed manure will result in reduction of emissions. Ventilated air from one activity can be used for cooling or heating of another activity. For instance the conditioned ventilation air from mushroom production can be used directly for greenhouses.

The CPU can also serve parties outside the ago park. For instance domestic organic waste from the Eco-city or food waste from Shanghai restaurants can and should be used for bio-energy production; for that purpose innovative systems are being developed in the Netherlands and can be implemented within the regional context of the Agropark.

# 6 CPU and Agro- Industrial design: Possible crops and foods

## 6.5 Hardware elements in the agropark: agro-food production chains

As stated, the choice of foodcrops for the Agropark belongs to the optional elements. The choice depends on the entrepreneurs willing to invest and produce, depends on soil and water conditions for land dependant agriculture and depends on the risks involved to produce land independently considering coping with the Chongming climate and basic conditions. The CPU can function with a broad degree of freedom in choice of crops and foodproducts, but needs a balanced dimension of production activities (see 6.7). A long-list of possible agro-food production chains in the park has been thoroughly considered. The mentioned crops and (food) products have been screened for the contextual situation on Chongming and for each remarks and positive/negative considerations are given (see table). This table forms the screening tool for the implementation phase.

Basic chains	Considerations
Crops	<ul style="list-style-type: none"> <li>- Commodity produce can be produced anywhere.</li> <li>- Commodities can be easily transported; local production is not highly relevant</li> <li>- Added value low</li> <li>- If not managed according to precision agriculture standards, uncontrolled losses are high</li> <li>- Vulnerable for weeds and pests</li> <li>- Salinity of water and soil and unripe soils</li> <li>+ Rice and rapeseed can be used for transition period in desalinisation</li> <li>+ Rice: groundwater level is high</li> <li>+ Straw can be used for compost production</li> <li>+ Rice and rapeseed have a landscape function</li> <li>+ Ecological rice: double price</li> </ul>
Vegetable chains (open-field)	<ul style="list-style-type: none"> <li>- Difficult to distinguish from other agro parks</li> <li>- Can the region support large scale processing?</li> <li>- Vulnerable for weeds and pests</li> <li>- Salinity of water and soil and unripe soils</li> <li>+ Needed for convenience food products</li> <li>+ Needed for local production</li> <li>+ Needed as fashion foods and new products (experiments)</li> <li>+ Needed for demonstration</li> <li>+ Use of compost and minerals from CPU</li> <li>+ Saline agriculture with salt modern resistant crops (Beta maritima, Salicornia spp and Aster maritima)</li> </ul>

Vegetable chains (closed greenhouse)	<ul style="list-style-type: none"> <li>- High-tech systems already exist; we must take care of complementarily</li> <li>- Groundwater (aquifer) cannot be used for cooling.</li> <li>+ River water can be used for cooling; Chinese researchers concluded that greenhouses are useful under Shanghai climate conditions.</li> <li>+ Utilise ventilation air from another activity to reduce energy use.</li> <li>+ Overcomes seasonality in production</li> </ul>
Aquatic vegetables	<ul style="list-style-type: none"> <li>- Vulnerable for weeds and pests</li> <li>+ Traditional production, availability of market for products.</li> <li>+ Use of 'endemic' aquatic plants well adapted to saline or brackish water conditions</li> <li>+ Production of algae for fish production</li> <li>+ Lotus and other aquatic plants can add to the landscape value</li> <li>+ Contribution to water quality</li> </ul>
Greenhouses: ornamental plants	<ul style="list-style-type: none"> <li>Flowers, pot plants, bonsai, ...</li> <li>- there will be a strong competition because there are many glasshouse producers.</li> <li>+ specialize to breeding material, tissue culture, etc.</li> </ul>
Pigs	<ul style="list-style-type: none"> <li>- Need cooling (when kept in closed stables)</li> <li>+ Pig manure is useful in CPU</li> <li>+ Pigs are fed with remainders from food processing</li> <li>+ Pork is most consumed meat in China with a growing demand</li> <li>+ Use connection with harbour for import of feed materials</li> <li>+ Top breeding is a no-regret option</li> <li>+ Reduction of inner chain transports reduces veterinary risks and increases animal welfare.</li> </ul>
Poultry Chicken, goose, turkey, pheasant, duck.	<ul style="list-style-type: none"> <li>- Migratory birds pass Chongming Island</li> <li>- Chicken is politically sensitive</li> <li>- The added value of end products is not very high</li> <li>+ China needs demonstration of save (closed) system</li> <li>+ Poultry is very common in China</li> <li>+ Poultry manure is very suitable for mushroom compost production.</li> </ul>
Dairy	<ul style="list-style-type: none"> <li>- Competition from existing developed (Bright) chain</li> <li>- High methane production</li> <li>+ Most efficient way of existent protein production</li> <li>+ Inclusion of non digestible food crops (grass) as raw materials</li> <li>+ Growing (huge) demand</li> <li>+ Existing knowledge on high value added processing of basic dairy food</li> <li>+ Transition to functional and health foods</li> <li>+ Grasslands on salty meadows for dairy farming</li> </ul>
Beef	<ul style="list-style-type: none"> <li>- High methane production</li> <li>+ Enables grazing of non digestible food crops as raw materials on more or less brackish meadows</li> <li>+ Efficient management of buffer zones and natural landscape elements</li> </ul>
Reptiles	<ul style="list-style-type: none"> <li>Snakes, turtles, Yangtze alligator, etc</li> <li>+ High added value</li> <li>+ Reptile production in facilities needs low quality heat which is available from the CPU</li> <li>+ Good knowledge of reptiles production available in China.</li> </ul>

Insects	<ul style="list-style-type: none"> <li>Grasshopper, rain worms, snails, maggots, ants, scorpions, ...</li> <li>- Danger of escape and invading species</li> <li>- It might disturb the natural system</li> <li>- The commercial aspect is not yet obvious</li> <li>+ Can be a very distinguished attraction</li> <li>+ Protein production by insects is very efficient</li> <li>+ Potential as animal feed under mass production, especially for poultry</li> <li>+ It should be developed as facility agriculture</li> <li>+ The climate is very suitable</li> <li>+ This is a typical example of demo à trade à production.</li> <li>+ Food waste from eco-city may serve as food for the insects.</li> </ul>
Fresh water protein production	<ul style="list-style-type: none"> <li>Eel, Baby crab breeding, shrimps, crayfish, abalone, atun, shells, etc, the total spectrum of present aquacultures</li> <li>+ High added value</li> <li>+ Needs low quality heat which is available from the CPU</li> <li>+ Good knowledge of these types of production available in China</li> <li>+ Existing production is seasonal; year-round production would create added value.</li> </ul>
Horse breeding	<ul style="list-style-type: none"> <li>- Lack of knowledge on economic perspective.</li> <li>- Leisure and esthetical function in the integrated high-tech agropark not yet acknowledged?</li> <li>- The climate (may be) too hot in the summer.</li> <li>+ Popularity of horse rises with growing economy.</li> <li>+ Source for the horse leisure centre.</li> <li>+ It's a fashion product.</li> <li>+ Can be used in landscape management.</li> <li>+ Can be used as tourist attraction.</li> <li>+ Horse manure fits very well in composting.</li> </ul>
Trees nursery	<ul style="list-style-type: none"> <li>- There are many producers around and after Olympic games in Beijing and Shanghai 2010 market may decline?</li> <li>+ Trees needed for landscaping and nature management</li> </ul>
Mushrooms	<ul style="list-style-type: none"> <li>+ White button mushrooms can use the rice straw as basic material</li> <li>+ Fits very well in the CPU concept</li> <li>+ Mushrooms in its present Chinese variety have potency in pharmaceutical production.</li> </ul>
Fruits blueberry, oranges, pomegranates, melons, grapes, apricots, green plum, ...	<ul style="list-style-type: none"> <li>- New varieties are needed: with sweeter taste.</li> <li>+ High added value</li> <li>+ Decorative value, for demonstration and leisure purposes</li> </ul>
Pharmaceutical plants and fragrant oil producing plants	<ul style="list-style-type: none"> <li>+ Can be grown in closed greenhouse</li> <li>- Many of pharmaceutical plants are only effective when produced in their natural habitat</li> <li>+ This production does not need the metropolitan environment</li> <li>+ Very suitable for demonstration and research project</li> </ul>
Biodiversity	<ul style="list-style-type: none"> <li>+ Use of endemic species for production purposes</li> <li>+ (Re)breeding of (migratory) species</li> <li>Fish, shells, abalone and crustaceans, birds, higher plants, algae and seaweeds, insects, endemic species as Yangtze Alligator, Chinese Deer etc</li> </ul>

# 6 CPU and Agro- Industrial design: Food safety and balance in production

## 6.6 Sustainable agro-food production with focus on food safety

In the perspective of sustainable development of agriculture, the use of chemicals, antibiotics and other products that require high energy use in production and of which the waste is potentially harmful, should be minimized. The productivity should be maintained or increased compared to existing production systems. Therefore, systems that prevent contamination should replace the conventional methods.

The following approaches are suggested:

1. Prevent incoming contaminations, weeds and pests by use of (semi-)closed stables, green-houses, fish basins and other facilities;
2. Apply biological pest control in closed greenhouses
3. Use cooling in combination with dehumidification to bring back the humidity in the closed systems
4. Stop using antibiotics and other harmful additives in feed; use modern alternatives developed for instance by western companies.
5. Apply controlled hygienisation treatment to feed and biomass in the Agro Park

The CPU is an enabler for such safety measures, since the CPU as a "centralized system" is very suited for product tracing and safety control, ISO- certified. Electricity and heat produced by the CPU is needed for heating, cooling and dehumidification. Because the heat is produced and transported efficiently within the system, it minimizes fossil fuel input and is available at a relatively low price.

## 6.7 Balanced dimensions of production activities

Most of the CPU inputs and outputs are voluminous streams. At most a small part of that can be traded with parties outside the Agro Park. The scale of waste streams from Eco city and Shanghai itself are trade offs that are brought in the present scenarios in a balanced way. Thus, matching inputs and outputs of the CPU will be a key driver for balanced

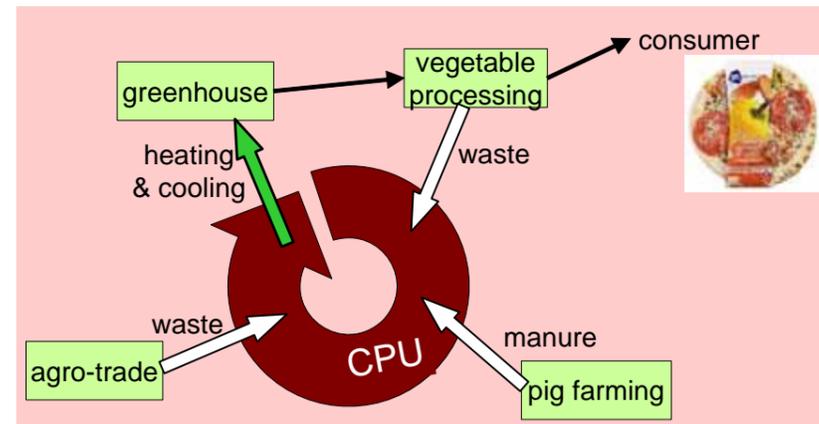


Fig Waste from various food processing industries and manure from pig farming are used for energy production. This energy serves for heating and cooling of the greenhouse. The CPU discharges treated remainders of waste in stable form that can be reused, such as soil conditioners.

dimensioning of the various production activities in the Agro Park. When developing the Agro Park, the dimensioning of the individual activities will be mainly determined by business developments by entrepreneurs. Their first driver will be their primary market.

At the same time however, the CPU will influence the potential added value creation by the business, since the CPU can process waste products at a reduced price and supplies energy and other valuable products with minimal costs for transportation. Matching inputs and output of the CPU will result in best possible cyclic loops. This creation of added value forms a major asset for the whole agropark development

In the adjacent tables some rules for matching inputs and outputs have been indicated matching heat production capacity, electricity production or compost production. Other design rules are the scale size for profitable business per activity or maximum heat storage capacities

Some rules for matching inputs and outputs:

*Matching heat production capacity and use:*

Supply to CPU	manure and other biomass
Size of supply determined by	number and production cycle of manure producing animals
CPU process	biogas production, combined heat & power station
CPU output	heat (for greenhouses, stables, freshwater production, drying manure residue)
Amount needed determined by	area of greenhouses, stables, amount of manure residue

Heat can also be stored in the ground or in larger freshwater bodies.

*Matching electricity production and use:*

Supply to CPU	manure and other biomass
Size of supply determined by	number and production cycle of manure producing animals
CPU process	biogas production, combined heat & power station
CPU output	electricity (main use: cooling greenhouses and stables)
Amount needed determined by	area of greenhouses and stables

Note that surplus of electricity can be easily transported, sold. High efficiency cooling will be possible by using water from the river.

*Matching compost production for white button mushrooms*

Supply to CPU	layer chicken manure straw
Size of supply determined by	number of layer chicken
CPU process	Composting
CPU output	mushroom compost
Amount needed determined by	total mushroom production capacity

# Scenario's



# 6 CPU and Agro- Industrial design: Scenario 1 Basic for mushrooms

Based on the design rules mentioned in the previous paragraphs and chapters four scenarios have been developed:

In this 'Basic for mushrooms' the built up area is relatively small, due to a modest scale of productive activities and a limited number of residents involved in Agropark activities (manual workers, service personnel, knowledge workers, managers). Also the number of suburbanites from Shanghai city is supposed to be small in this scenario. This might well be the picture the Agropark is offering in a relatively early stage of its development.

Already well developed is the Landscape Park with the Entrance hot spot and the Demo Centre. The Trade Centre is already there, be it at a moderate size. For production and processing of products there is a full-size mushroom operation near the central CPU-unit, with related pig and chicken stables close by. There is a limited area of greenhouse and closed freshwater production. Finally there are the 'world farms' along the western part of the main axis and a small residential settlement near the Central Square, sharing its community facilities with visitors and tourists. Because of its location near the square sewage and household waste of the residents can be easily treated by the central CPU-unit.

In this scenario there is not yet a need for the separate cargo road, for doubling the number of lanes of the main axis roads, nor for the solar cell roofing over the main axis, the central pagoda, etcetera. There is no need either for building harbour facilities.

Ecological relations and landscaping need not wait for further development but should as non optional elements be implemented in this stage already.

Note: the balanced sizes of the activities were determined with 'best available' estimations for CPU process yields and cooling and heating capacity needs. The suggestion is to update the results with better data in the next phase of the project.

Scenario 1.	Basic for mushrooms	
Activities	Pigs, chicken, greenhouses, mushrooms, fish and open-field agriculture	
Leading design criterions	<input type="checkbox"/> minimum scale size for profitable mushroom compost production <input type="checkbox"/> match energy production and need for heating and cooling	
Intensive farming activities:		
pigs	keep 50,000 pigs (150,000 slaughters per year)	12 ha
broiler chicken	1 million chicken (12,000 ton chicken per year)	8 ha
layer chicken	1 million chicken (250 million eggs per year)	17 ha
greenhouses	9,000 tons vegetables per year	15 ha
mushrooms	6,000 tons per year	3 ha
fish	not quantified	
Open field farming	vegetables, rice, etc. (areas will depend on need from market)	



- 1 World Farms
- 2 Central square
- 3 Landscape park
- 4 Chicken production
- 5 Pig production
- 6 Reserve production
- 7 Mushroom production
- 8 Reserve Business Support
- 9 Greenhouses
- 10 Tradecentre phase 1
- 11 Tradecenter phase 2
- 12 Fishponds
- 13 Existing
- 14 Demo Center
- 15 Existing
- 16 Service Agriculture
- 17 Housing
- 18 Dairy Farming
- 19 Harbor

Main agropark inputs and output		
<i>Main agropark inputs</i>		
Pig feed	51,500	ton/y
Chicken (broilers) feed	32,400	ton/y
Chicken (layers) feed	36,500	ton/y
<i>Main CPU inputs</i>		
manure (broiler chicken)	11,000	ton/y
manure (pigs and layer chicken)	81,100	ton/y
co-substrates	81,100	ton/y
(from food industry in the park; Shanghai restaurant waste; etc.)		
straw	14,165	ton/y
cooling water (from Yangtze river)	3,502,407	ton/y
<i>Main CPU outputs</i>		
heat (for heating greenhouses, ...)	119,217,000	MJ/y
electricity (for cooling)	29,961,944	kWh/y
mushroom compost	47,218	ton/y
digestate (organic fertilizer)	145,980	ton/y
<i>Main agropark outputs (except open-field agriculture)</i>		
slaughter pigs	150,000	/year
pig meat	12,000	ton/y
chicken slaughtered	12,000	ton/y
eggs	250,000,000	eggs/y
vegetables from greenhouse	9,000	ton/y
Mushrooms	6,111	ton/y
Champost (soil structure enriching material)	18,054	ton/y
net electricity surplus	-889,105	kWh/y



Scenario 1 Basic for mushrooms

-  Open field
-  Green zone
-  Squares
-  Small hotspot 'pearl'
-  Demonstration area
-  Bulb Fields
-  Water
-  Wetland
-  Helophyte filters
-  Drainage
-  Entrance building
-  Business center/ solar cell Pagoda
-  Tradecentre
-  Greenhouses
-  Multilayered Green houses
-  Stables greenroofing
-  Stables glassroofing
-  Stables
-  Building with green roofing
-  Harbour
-  Demonstration farms
-  Housing
-  Road
-  Touristic route
-  Light Rail
-  CPU route
-  CPU and Water purification

# 6 CPU and Agro- Industrial design: Scenario 2 Large scale

In many ways the 'Large scale' scenario is the opposite of the previous one. Here there is a large production facilities of pigs, chicken and mushroom combined with large areas of greenhouse and freshwater production. Land use efficiency is improved by building stables in two levels and building greenhouses on top of stables and the Trade Centre. The Trade Centre itself is much further developed, with ample space for a second expansion phase. With the Trade Centre goes a fully functional third hot spot, including communication and information centers. Part of the fish ponds is transformed into modern closed systems, again with greenhouses on top. Where no greenhouses are built on top of other activities, flat roofs will be covered with grass, to improve isolation, retard water run off, contribute to ecological linkages, and generally create more attractiveness.

In this scenario there is much more need for infrastructure and for residential space. The harbour facilities should be in place, both in the North and in the centre. The special cargo road needs to be constructed, with links to internal roads in such a way that a separation between 'clean' and 'dirty' trucks can be maintained. The main axis road needs doubling. The solar cell panels all should be there as well as the central pagoda. The central CPU-unit will need a much higher capacity here and fulfill more functions, while there is also need for secondary units connected to the CPU-network in other places.

There is more space for service agriculture, for business support, for hotels, for restaurants and other tourist facilities. An important issue is to accompany all infrastructure elements by 'blue/green veining' ecological links as structural elements. An other important issue is the realisation of enough parking spaces, that has to be found at each of the hot spots as well as near the major production and processing activities or connected with the airbus stations

With the much larger amount of space needed for residential purposes goes a more decentralized occupation pattern: the main settlement still near the Central Square (close to the central CPU-unit), but also secondary settlements in various other parts of the Agropark.

various other parts of the Agropark.

Scenario 2.	Large scale	
Activities	Pigs, chicken, greenhouses, mushrooms, fish and open field agriculture	
Leading design criterions	<input type="checkbox"/> minimum scale size for profitable pig meat packaging plant <input type="checkbox"/> match energy production and need for heating and cooling	
Intensive farming activities:		
pigs	keep 1 million pigs (3 million slaughters per year)	232 ha
broiler chicken	5 million chicken (60,000 ton chicken per year)	42 ha
layer chicken	2 million chicken (500 million eggs per year)	33 ha
greenhouses	240,000 tons vegetables per year	400 ha
mushrooms	30,000 tons per year	13 ha
fish	not quantified	
Open field farming	vegetables, rice, etc. (areas will depend on need from market)	



- 1 World Farms
- 2 Central square
- 3 Landscape park
- 4 Chicken production
- 5 Pig production
- 6 Reserve production
- 7 Mushroom production
- 8 Reserve Business Support
- 9 Greenhouses
- 10 Tradecentre phase 1
- 11 Tradecenter phase 2
- 12 Fishponds
- 13 Existing
- 14 Demo Center
- 15 Existing
- 16 Service Agriculture
- 17 Housing
- 18 Dairy Farming
- 19 Harbor

Main agropark inputs and output		
<i>Main agropark inputs</i>		
Pig feed	1,030,000	ton/y
Chicken (broilers) feed	162,000	ton/y
Chicken (layers) feed	73,000	ton/y
<i>Main CPU inputs</i>		
manure (broiler chicken)	55,000	ton/y
manure (pigs and layer chicken)	1,693,500	ton/y
co-substrates	1,693,500	ton/y
(from food industry in the park; Shanghai restaurant waste; etc.)		
straw	70,826	ton/y
cooling water (from Yangtze river)	71,579,202	ton/y
<i>Main CPU outputs</i>		
heat (for heating greenhouses, ...)	2,489,445,000	MJ/y
electricity (for cooling)	625,654,167	kWh/y
mushroom compost	236,088	ton/y
digestate (organic fertilizer)	3,048,300	ton/y
<i>Main agropark outputs (except open-field agriculture)</i>		
slaughter pigs	3,000,000	/year
pig meat	240,000	ton/y
chicken slaughtered	60,000	ton/y
eggs	500,000,000	eggs/y
vegetables from greenhouse	240,000	ton/y
Mushrooms	30,553	ton/y
Champost (soil structure enriching material)	90,269	ton/y
net electricity surplus	259,533,750	kWh/y



Scenario 2 Large scale

-  Open field
-  Green zone
-  Squares
-  Small hotspot 'pearl'
-  Demonstration area
-  Bulb Fields
-  Water
-  Wetland
-  Helophyte filters
-  Drainage
-  Entrance building
-  Business center/ solar cell Pagoda
-  Tradecentre
-  Greenhouses
-  Multilayered Green houses
-  Stables greenroofing
-  Stables glassroofing
-  Stables
-  Building with green roofing
-  Harbour
-  Demonstration farms
-  Housing
-  Road
-  Touristic route
-  Light Rail
-  CPU route
-  CPU and Water purification

# 6 CPU and Agro- Industrial design: Scenario 3 Pig top breeding

The overall intensity of this 'Pig top breeding' scenario is somewhere between the previous two, but the mix of activities is quite different with its emphasis on pig breeding. With it go chicken stables, greenhouses, mushrooms, fishponds (also partly closed), and open field agriculture. Flat roofs should again be covered either by greenhouses or by grass roofings and all infrastructures are accompanied by blue-green veining. To keep more reserved areas for later developments, the whole Northern part of the Agropark is kept more or less empty in this scenario, including deferring the world farms to a later phase. For residential purposes the concentration near the Central Square will suffice.

Scenario 3.	Pig top breeding
Activities	Pigs top breeding, chicken, greenhouses, mushrooms, fish and open field agriculture
Leading design criterions	<input type="checkbox"/> substantial market penetration (top breeding) <input type="checkbox"/> match energy production and need for heating and cooling <input type="checkbox"/> no button mushroom production because of shortage of broiler chicken manure or other suitable basic bio-materials.
Intensive farming activities:	
pigs	1 million piglets per year 40 ha
broiler chicken	--
layer chicken	3 million chicken (750 million eggs per year) 50 ha
greenhouses	50,000 tons vegetables per year 80 ha
mushrooms	--
fish	not quantified
Open field farming	vegetables, rice, etc. (areas will depend on need from market)



- 1 World Farms
- 2 Central square
- 3 Landscape park
- 4 Chicken production
- 5 Pig production
- 6 Reserve production
- 7 Mushroom production
- 8 Reserve Bussiness Support
- 9 Greenhouses
- 10 Tradecentre phase 1
- 11 Tradecenter phase 2
- 12 Fishponds
- 13 Existing
- 14 Demo Center
- 15 Existing
- 16 Service Agriculture
- 17 Workers Village
- 18 Dairy Farming
- 19 Harbor

Main agropark inputs and output		
<i>Main agropark inputs</i>		
Pig feed	100,000	ton/y
Chicken (broilers) feed	0	ton/y
Chicken (layers) feed	109,500	ton/y
<i>Main CPU inputs</i>		
manure (broiler chicken)	0	ton/y
manure (pigs and layer chicken)	312,500	ton/y
co-substrates	312,500	ton/y
(from food industry in the park; Shanghai restaurant waste; etc.)		
straw	0	ton/y
cooling water (from Yangtze river)	2,496,448	ton/y
<i>Main CPU outputs</i>		
heat (for heating greenhouses, ...)	459,375,000	MJ/y
electricity (for cooling)	115,451,389	kWh/y
mushroom compost	0	ton/y
digestate (organic fertilizer)	562,500	ton/y
<i>Main agropark outputs (except open-field agriculture)</i>		
piglets	1,050,000	/year
chicken slaughtered	0	ton/y
eggs	750,000,000	eggs/y
vegetables from greenhouse	48,000	ton/y
Mushrooms	0	ton/y
Champost (soil structure enriching material)	0	ton/y
net electricity surplus	52,417,093	kWh/y



Scenario 3 Pig top breeding

- Open field
- Green zone
- Squares
- Small hotspot 'pearl'
- Demonstration area
- Bulb Fields
- Water
- Wetland
- Helophyte filters
- Drainage
- Entrance building
- Business center/ solar cell Pagoda
- Tradecentre
- Greenhouses
- Multilayered Green houses
- Stables greenroofing
- Stables glassroofing
- Stables
- Building with green roofing
- Harbour
- Demonstration farms
- Housing
- Road
- Touristic route
- Light Rail
- CPU route
- CPU and Water purification

# 6 CPU and Agro- Industrial design: Scenario 4 Dairy included

This 'Dairy included' scenario is an in-between scenario for its general intensity, but due to the introduction of dairy farming, the proportion of open land is markedly higher. The entire northern part of the Agropark is occupied by dairy farms and grazing land. For the remainder this scenario is much similar to the first scenario.



Scenario 4.	Basic with dairy
Activities	Pigs, chicken, greenhouses, mushrooms, fish, dairy and open-field agriculture
Leading design criterions	<ul style="list-style-type: none"> <li>□ based on the 'Basic for mushrooms scenario'</li> <li>□ add dairy industry (that annually processes 100,000 tons milk for a specialty like ice-cream production); half of the milk will be produced in the agropark, and the rest will be collected in the neighbourhood.</li> <li>□ because of the large amount of electricity and heat available from the cow manure, a large-scale glasshouse will be possible</li> </ul>
Intensive farming activities:	
pigs	keep 50,000 pigs (75,000 slaughters per year) 6 ha
broiler chicken	1 million chicken (12,000 ton chicken per year) 8 ha
layer chicken	1 million chicken (250 million eggs per year) 17 ha
greenhouses	24,000 tons vegetables per year 40 ha
mushrooms	6,000 tons per year 3 ha
cattle	Keep 8,000 cows (6,250 kg milk per cow per year) +/-1000 ha (stables) (grassland)
fish	not quantified
Open field farming	vegetables, rice, etc. (areas will depend on need from market)



- 1 World Farms
- 2 Central square
- 3 Landscape park
- 4 Chicken production
- 5 Pig production
- 6 Reserve production
- 7 Mushroom production
- 8 Reserve Business Support
- 9 Greenhouses
- 10 Tradecentre phase 1
- 11 Tradecenter phase 2
- 12 Fishponds
- 13 Existing
- 14 Demo Center
- 15 Existing
- 16 Service Agriculture
- 17 Workers Village
- 18 Dairy Farming
- 19 Harbor

Main agropark inputs and output		
<i>Main agropark inputs</i>		
Pig feed	51,500	ton/y
Feed concentrates for cows	14,600	ton/y
Roughage feed for cows	8,000	ton/y
Chicken (broilers) feed	32,400	ton/y
Chicken (layers) feed	36,500	ton/y
<i>Main CPU inputs</i>		
manure (broiler chicken)	11,000	ton/y
manure (pigs and layer chicken)	324,600	ton/y
co-substrates	324,600	ton/y
(from food industry in the park; Shanghai restaurant waste; etc.)		
straw	14,165	ton/y
cooling water (from Yangtze river)	4,829,583	ton/y
<i>Main CPU outputs</i>		
heat (for heating greenhouses, ...)	477,162,000	MJ/y
electricity (for cooling)	119,921,667	kWh/y
mushroom compost	47,218	ton/y
digestate (organic fertilizer)	584,280	ton/y
<i>Main agropark outputs (except open-field agriculture)</i>		
milk (processed by local dairy industry)	50,000	ton/y
slaughter pigs	150,000	/year
pig meat	12,000	ton/y
chicken slaughtered	12,000	ton/y
eggs	250,000,000	eggs/y
vegetables from greenhouse	24,000	ton/y
Mushrooms	6,111	ton/y
Champost (soil structure enriching material)	18,054	ton/y
net electricity surplus	79,811,358	kWh/y



Scenario 4 Dairy included

-  Open field
-  Green zone
-  Squares
-  Small hotspot 'pearl'
-  Demonstration area
-  Bulb Fields
-  Water
-  Wetland
-  Helophyte filters
-  Drainage
-  Entrance building
-  Business center/ solar cell Pagoda
-  Tradecentre
-  Greenhouses
-  Multilayered Green houses
-  Stables greenroofing
-  Stables glassroofing
-  Stables
-  Building with green roofing
-  Harbour
-  Demonstration farms
-  Housing
-  Road
-  Touristic route
-  Light Rail
-  CPU route
-  CPU and Water purification

# 6 CPU and Agro- Industrial design: Comparison of the scenarios

## 6.8 Comparison of the scenarios

Scenarios enable the comparison of different explorations of possible business lay outs.

When comparing the four scenarios, based on the comparisons of quantities of of pigs, chickens, cows, vegetables and mushrooms, the numbers speak for themselves.

Scenario 2 with 7 million chicken en 1 million pigs, has the largest built up area (22.5% plus 6.8 %), uses but also gains a very large surplus of power via de CPU.

Scenario 2, 3 and 4 all gain energy, a thorough balancing of the ecological loading capacity for the eco city and for the ecological footprint for Dongtan Area. Hereby it can be stressed again that the starting point for the design of the Agro Park in all scenarios was, no input of fossil fuel for agricultural production.

## 6.9 The residential function and other non-agrarian built up land uses

Because of the sensitivity of urban functions and built up area within his urban rural planning situation, an estimation has been made of the population, the housing and the built up areas for the different agricultural functions and its workers.

For each of the scenarios an estimate has been made of the number of workers, experts and managers that may need to be housed in the Agropark. This number is highest for the 'large scale' scenario, where it amounts to 25,000. When this scenario is seen as fully developed, leaving hardly any more space for further settlement of production, processing and trade functions, then the remaining capacity for housing may be turned over to residents that have no direct economic relation to the Agropark but are just looking for a very comfortable green place to live. Based on a total residential capacity according to present ecological footprint calculations of 25,000 this space for suburban dwellers may turn out at around 2,500,

In other scenarios the number of residents with a direct economic relation to the Agropark lies lower: 4,000 in the 'basic for mushrooms' scenario, 12,000 in the 'top pig breeding' scenario, and 6,000 in the 'diary included'

	1: Basic mushroom	2: Large Scale	3: Pig top breeding	4: Dairy included
Open Area	2,542 ha (94.1%)	1,908 ha (70.7%)	2,356 (87.3%)	2,522 (93.4%)
Built up facility agriculture	93 ha (3.4%)	608 ha (22.5%)	233 ha (8.6%)	107 ha (4.0%)
Built up non agriculture	65 ha (2.4%)	184 ha (6.8%)	111 (4.1%)	71 ha (2.6%)
Internal use of power (kWh/y)	29 mln	625 mln	115 mln	120 mln
Surplus of power (kWh/y)	- 0.9 mln	260 mln	52 mln	80 mln
Internal use of heat (MY/y)	119 mln	2,490 mln	459 mln	477 mln
Nr of pigs	50.000	1 mln	1 mln (piglets)	50,000
Nr of chicken	2 mln	7 mln	3 mln	2 mln
Nr of cows	0	0	0	8,000
Vegetables (tons/y)	9,000	240,000	50,000	24,000
Mushrooms (tons/y)	6,000	30,000	0	6,000
Inhabitants	4,000	25,000	12,000	6,000

Tabel: Comparison of the 4 scenario's, production within agro food chains, human population, built up areas, and energy consumption or production.

scenario. This doesn't mean, however, that the remaining capacity can be simply given over to suburbanisation because these are all scenarios that leave space for further development of production, processing and trade functions (most so in the 'basic for mushrooms' scenario). It seems wise to reserve at least a large part of the remaining capacity for such future expansion.

All of this needs more precise calculations, based on information of what activities will actually settle in the Agropark, which is a task for further elaboration of the Industrial Plan.

The table on the next page gives an example how to calculate land use for housing. The calculation is based on the following elements:

- A rough estimate of the number of workers needed in each scenario based as output figures and labour productivity parameters; with addition for other activities such as education, hotel, restaurants, etc.

- A distinction between types of workers (manual labour, knowledge, managerial) with an estimated distribution.
- A distinction between single workers and workers with family; a family is supposed to consist mostly of two workers, with or without a child, with or without other family members (e.g. grandparents) living in. Average family size is set at 3.2.
- Typical spatial requirements for each type of worker/family.
- Not all workers living in the Agropark will have a job in the park, or on the other hand, not all jobs will be occupied by workers living in the park; for the calculation these are set off against each other.
- A modest allowance has been made for suburban residents
- The outcome (ha for housing) is entered in the comparison of land uses for the four scenarios

# 6 CPU and Agro- Industrial design: Comparison of land use and housing

*Table: Land use for housing, per scenario*

	m2/ Person	m2/ fam (parcel)	Person/ ha	Fam /ha	Scenario1				Scenario 2				Scenario 3				Scenario 4							
					Workers	Families	Persons	ha	Workers	Families	Persons	ha	Workers	Families	Persons	ha	Workers	Families	Persons	ha				
Handworkers (70%)*	Single		35%	Dormitories	20		500		1050		1050	2.0	7000		7000	14.0	2625		2625	5.0	1575		1575	3.0
	with Family		35%	Workers cottages		40		250	1050	525	1680	2.0	7000	3500	11200	14.0	2625	1300	4200	5.5	1575	800	2520	3.0
Knowledge workers (20%)	with Family		20%	Nice appartments, small villas		80		125	600	300	960	2.5	4000	2000	6400	16.0	1500	750	2400	6.0	900	450	1440	3.5
	with Family		5%	Large villas		200		50	150	75	240	1.5	1000	500	1600	10.0	375	190	600	4.0	225	110	360	2.0
Managers (10%)	local		3%	Hotel suite	50		200		90		90	0.5	600		600	3.0	225		225	1.0	135		135	0.5
	expat		2%	Large villas		200		50	60	30	96	0.5	400	200	640	4.0	150	75	240	1.5	90	45	145	1.0
<b>subtotal economically bound</b>									<b>3000</b>	<b>930</b>	<b>4116</b>	<b>9.0</b>	<b>20000</b>	<b>6200</b>	<b>27440</b>	<b>61.0</b>	<b>7500</b>	<b>2315</b>	<b>10290</b>	<b>23.0</b>	<b>4500</b>	<b>1405</b>	<b>6175</b>	<b>13.0</b>
suburbanites		with Family		Large villas		200	50		600	300	960	6.0	1500	750	2400	15.0	1200	600	800	12.0	900	450	600	9.0
<b>total</b>									<b>3600</b>	<b>1230</b>	<b>5076</b>	<b>15.0</b>	<b>21500</b>	<b>6950</b>	<b>29840</b>	<b>76.0</b>	<b>8700</b>	<b>2915</b>	<b>11090</b>	<b>35.0</b>	<b>5400</b>	<b>1855</b>	<b>6775</b>	<b>22.0</b>

\*40% Manual labour (production/processing)

30% Personal services (Hotel business)

Now that we have also dealt with residential land use, we can make a final assessment of the proportion of non-agrarian built up functions as related to the total area of the Agropark. This is an important indicator for the sustainability of rural development according to present Chinese planning practice.

The assessment is made in the table below:

As may be seen, the proportion of built-up area for non-agricultural (or non-direct agricultural) functions varies between 2.4% and 6.8%. Even though the Agropark is an example of fully developed urban-rural integrated development through typical metropolitan agriculture, this percentage is still quite low, safeguarding the overall green aspect of the park and also creating optimum conditions for the park's recreational and ecological functions. This still holds when also built-up agricultural area is taken into account: even in the large scale intensive production and trade scenario 2 the open area (green and water) remains at over 70%.

*Tabel: land use per scenario (ha)*

	scenario 1	scenario 2	scenario 3	scenario 4
green/water ha (open)	2542	1908	2356	2522
<b>percentage open area</b>	<b>94.10%</b>	<b>70.70%</b>	<b>87.30%</b>	<b>93.40%</b>
World farm buildings (ha )	3	3	3	3
Greenhouses (ha)	23	250	80	23
Pig stables, chickens, mushrooms (ha)	32	232	90	46
Trade centre (warehousing function)(ha)	35	123	60	35
<b>subtotal built-up direct agrifunction(ha)</b>	<b>93</b>	<b>608</b>	<b>233</b>	<b>107</b>
<b>percentage</b>	<b>3.40%</b>	<b>22.50%</b>	<b>8.60%</b>	<b>4.00%</b>
Trade centre (other functions) (ha)	15	43	25	15
Service agriculture/food processing industries	10	30	20	10
CPU (ha)	6	6	6	6
Demonstration park /science buildings(ha)	20	30	25	20
Residential/social	14	75	35	20
<b>subtotal built-up non (direct) agricultural</b>	<b>65</b>	<b>184</b>	<b>111</b>	<b>71</b>
<b>percentage</b>	<b>2.40%</b>	<b>6.80%</b>	<b>4.10%</b>	<b>2.60%</b>
total area (100%)	2700	2700	2700	2700

## 7 Looking towards implementation: business planning

The second phase, which will be entered after completion of the Master plan, is the development phase. The combination of strategic plan, Master plan and industrial plan produced in the previous phase, should be the beginning of an active development of Greenport Shanghai, rather than executing the blue print plan. A probably even more important deliverable of the Master plan phase is the multi-actor network of entrepreneurs, governmental and knowledge organisations, that as a whole must continue to attract businesses and develop the services and facilities needed by these companies. This development phase ought to become an ongoing process. Even when businesses are already in operation, new businesses need to be attracted and selected and the network and infrastructure within which these businesses operate need to be adapted and developed.

In order to have the Agropark implemented, four development processes can be distinguished. These are described in this final chapter of the Master plan:

- The business planning for which entrepreneurs are primarily responsible
- The process of development policy, that ensures the ongoing formal legislation and planning procedures for which the government is primary responsible.
- Knowledge development managed by the knowledge institutes
- Communication, internal and external, to non-governmental organisations and to the public

Although these processes can be distinguished they should develop in a highly integrated and iterative way. Intermediate parties will guard this integration process.

### 7.1 Business Planning

The key message of the orgware development process is: **Structure follows Strategy.**

The Strategic Plan, the Master plan and the Industrial Plan together will determine the strategy of Greenport Shanghai. After the strategy is determined, the entrepreneurs and investors can be attracted.

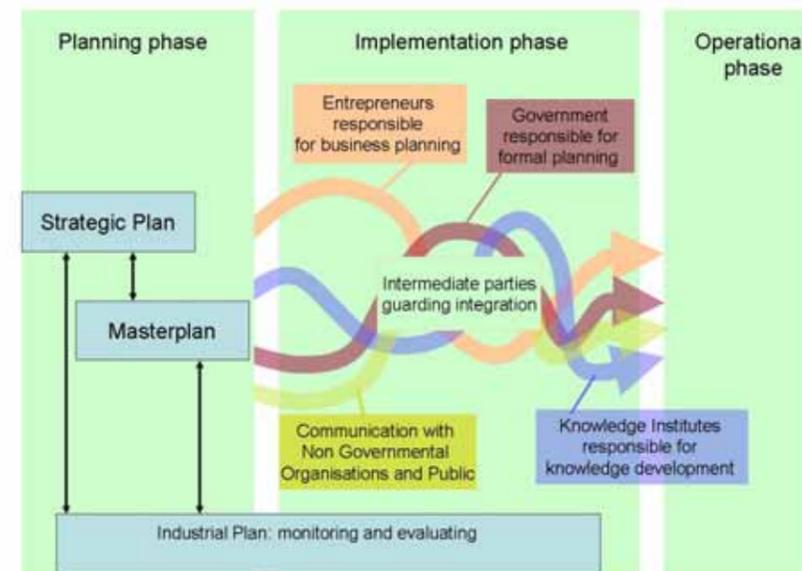


Fig. Integrated and iterative progress of four stakeholders and intermediate parties during implementation.

These entrepreneurs will determine the structure needed for their business. Thus the infrastructure follows the requirements of the entrepreneurs and not only the plan of the designer, within the boundaries of the non optional principles of the Master plan.

The change in the working process towards development planning, has major implications for the organisation. First of all, a clear distinction is made between designers, park management and entrepreneurs. In the traditional process, the designer partly took the role of the entrepreneur. However, in the new process, the designer has only his own role. He does not determine what kind of business should take place in the park. Rather he designs a strategy and thereafter fills in the detailed infrastructure based on the specifications of the entrepreneur. Furthermore, the park management has its own specific role, to develop and manage the Agropark. They are responsible for facilitating the entrepreneurs and improving the prospects of circular agricultural economy. In this development planning the entrepreneur is entrepreneur again and not a stand holder. He determines the type of business set up in the park and the needed investments.

One of the main assets of Greenport Shanghai will then be the entrepreneurial skills. The businesses in the park are set up and managed by entrepreneurs rather than by employees. These entrepreneurs will join the park only if they see opportunities to set up a profitable business. If needed, these entrepreneurs will change the business when the market changes. Furthermore, the park management is not based on state-ownership, but uses the combined skills of the individual entrepreneurs as a platform for its own performance. The park management will be an business on its own. It should react at changing circumstances in order to facilitate the entrepreneurs and realize the aims of the circular economy and sustainable development. Together the entrepreneurs and an agile park management will create a dynamic Agropark that adapts to changing market situations and new technological conditions, all within the boundaries of the sustainability criteria

Conditions needed for the success of GPS

However, to realise a profitable Greenport Shanghai that improves the prosperity of circular economy and is able to react at changing situations, it is a necessity to adhere to some conditions. These conditions are:

- The businesses have to be set up based on international and Chinese experience. This will secure optimal use of entre-preneurial skills. As mentioned the business infrastructure should follow the demands of the entrepreneur. The entrepreneurs need to decide what kind of business, demonstration or trade should take place in the Agropark. Furthermore, they have the experience and knowledge on how the business should be formed in order to make it profitable.
- The international entrepreneurs will need Chinese partners to operate fruitfully and vice versa . The international entrepreneurs lack knowledge of doing efficient business in China and probably they do not have the business relations in China to be successful.
- This asks for development of a intercultural network, in which understanding of each others codes and languages is very important.
- Sufficient risk capital must be available for the further development of the Agropark and to set up the businesses in the park.

# 7 Looking towards implementation: Formal Planning

- Public and business infrastructure have to take into account the empirical knowledge of the participating entrepreneurs. As mentioned before, structure follows strategy.
- The entrepreneurs need a competent agropark management to facilitate their businesses, adapted to the specific Chinese conditions for entrepreneurship. The park management should enable the entrepreneurs to do business by providing them services like training facilities, education & research facility, quality control, energy saving, waste management, legal services, investment support, trading facilities and many more. The park management should have the knowledge and experience to provide these services. These services need to result in more profitable businesses of the entrepreneurs and realise the ecological sustainability.
- Continuous improvement and development of the Agropark is crucial. A dynamic agropark that adapts to changing market and technological conditions will be extremely attractive to entrepreneurs and investors. The continuous development, combined with management and facility services will greatly improve the profitability of the entrepreneurs and the park management. This development of the Agropark never stops.

To turn the Master plan of Greenport Shanghai into an inspiring and profitable Agropark, a joint, multiple and international strategic approach is needed. Therefore an Agropark development and management company is needed and can be set up directly after the Master plan has been adopted as development strategy.

## 7.2 Formal planning

The formal planning needs to apply principles of development policy as an experiment in future formal planning. Following these principles, the first step, which is directly at hand now, is to take two related decisions. One is to decide on the three plans (Strategic Plan, Master plan, Industrial Plan) as one package. In this decision the relations between the plans, together with the specific role of each separate plan, need as clear a definition as possible. Two is to decide on an institutional framework to deal with the

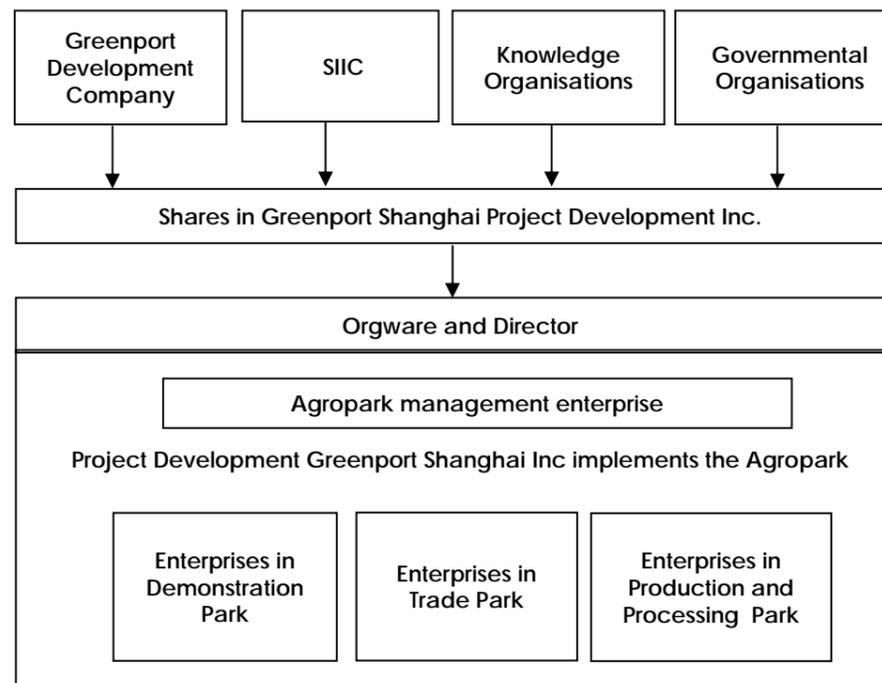


Fig. Proposed organisation structure of stakeholders during implementation

necessary experimental status of the project.

For this institutional framework a good solution might be the establishment of a small permanent committee of evaluators that will continuously follow the project over the coming years, and will provide additional guidelines whenever necessary. This committee needs a good grasp on the way entrepreneurs/investors do their thinking and make their decisions and in doing so react at the environment offered by the public authorities. The committee must be able to 'speak the language' of the commercial investor. It might even be an option to invite a business representative to join the committee.

What needs permanent attention in the committee's work is the interaction between further elaboration of public plans (especially the Industrial Plan, but also feedbacks to the Master plan) and emerging business plans, both on the level of the management of the Agropark as a whole and on the level of individual entrepreneurs. All this should result in a

public planning framework that is always up-to-date, always ready to serve as a basis for a smooth and speedy process of granting the necessary permits, licenses etcetera.

At the same time this experimental approach itself needs permanent evaluation as well, eventually leading to further reaching conclusions for adjustments to the Chinese planning and licensing system in general.

### The relation between governmental and entrepreneurial investments

As a second step there is an important question with regard to the investing role of SIIC in relation to the role of the park management organisation (and in fact also in relation to the role of individual entrepreneurial investors). Is SIIC willing to make a 'sunken fund' investment in general infrastructure, in order to give the Agropark a flying start and not to deter entrepreneurial investors by having them shoulder this type of investment as well? Is SIIC willing to make risk sharing investments? And if so in the park management only? Or also in individual enterprises? Or is SIIC even willing to invest in all these together?

As far as may be judged now, at least part of the necessary general infrastructure investments need to be made beforehand by SIIC (or some other public organisation) on a sunken fund basis, otherwise the burden of this kind of investment will 'suffocate' each and all emerging entrepreneurial initiatives. This is particularly true of



# 7 Looking towards implementation: The Knowledge value chain

investment in water systems, ecological linkages, and landscaping, which for a successful start of the implementation should not be deferred to later stages. It might also be true for the major transportation infrastructure and parts of the CPU.

But it seems not a good idea to also make this kind of public investment in buildings such as stables or greenhouses. These should always remain the responsibility of entrepreneurial investors. Their willingness to make these investments is the ultimate test of the economic viability of the Agropark.

## 7.3 Knowledge management:

### 7.3.1. Software

Knowledge is a crucial production factor in the Greenport Shanghai Dongtan Agropark. This agropark is based on state-of-the-art knowledge. A metaphor for knowledge management would be software, embedding all necessary knowledge for the development, implementation and management of the Greenport Shanghai Dongtan Agropark.

It is essential to stress that 'knowledge' is both explicit, codified knowledge and tacit knowledge. The software for agropark development has also a strong transdisciplinary character because it connects multi- and interdisciplinary knowledge from scientists with the tacit knowledge of entrepreneurs, developers, government and citizen/consumer-organisations. Software is therefore described as the full cluster of 'know what' (facts), 'know why' (science), 'know-how' (tacit knowledge) and 'know who' (networking).

Only general aspects of knowledge management have to be separately treated in the Master plan. As will be obvious the formal planning procedures as well as the development of business plans need specific data as input and knowledge to be dealt with. For the CPU, the integrated water management and integrated regional management of the non optional functions, as well as for the agropark management to function properly specific software will have

to be developed and information exchange be set up. The same goes for every individual enterprise.

More general aspects of knowledge management concern the development of a knowledge value chain, the human resource management, the set up of a general knowledge network and general research and development activities.

### 7.3.2 Tacit knowledge

In the development of the Dongtan Agropark tacit knowledge is a crucial aspect. The combination of tacit knowledge of Dutch entrepreneurs of how to produce high-end products against very low environmental costs, with the tacit knowledge of Chinese entrepreneurs and workmen of local conditions, markets and cultures is one of the key-factors for the success of the Dongtan Agropark.

Tacit knowledge has been found to be a crucial input to the innovation process. A society's ability to innovate depends on its level of tacit knowledge of how to innovate. By definition, tacit knowledge is knowledge that people carry in their minds and is, therefore, difficult to access. Tacit knowledge is considered more valuable because it provides context for people, places, ideas, and experiences. Effective transfer of tacit knowledge generally requires extensive personal contact and trust.

The tacit aspects of knowledge are those that cannot be codified, but can only be transmitted via training or gained through personal experience. Alternatively, tacit knowledge can be understood to be knowledge that is embedded in a culture (for instance a regional culture, organisational culture or social culture) and is difficult to share with people not embedded in that culture. It involves learning and skill but not in a way that can be written down.

### 7.3.3 The knowledge value chain

The implementation of an agropark requires transfer of knowledge. Learning and education in the countries and regions where an agropark is being implemented must deliver the know-how to use and develop them in a

sustainable way, adapted to the local conditions. The continuous participation of knowledge institutes like Wageningen UR and Chinese universities in a joint venture will be an asset, not only for them to earn revenues on the invested knowledge but also to develop this knowledge on the basis of scientific monitoring and evaluation of the agropark practice that, used in this way turn into laboratories and is the basis for new innovations in the agropark production and processing but also in the way the government is dealing with these systems. This new knowledge on its turn will be transferred to students, some of whom will be the future managers and workers in the Agropark. In doing so the knowledge institutes implement the whole knowledge value chain. The transdisciplinary approach that is characteristic for the agropark knowledge expands the knowledge value chain to the integrated level of the other stakeholders involved (entrepreneurs and government employees and NGO's ) that put in their tacit knowledge.

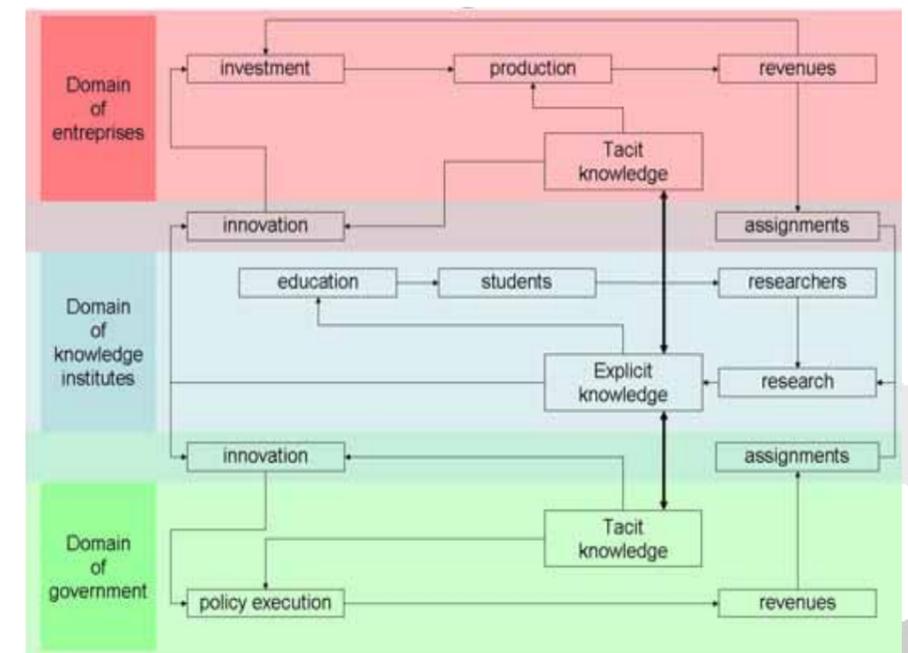


Fig. The knowledge value chain integrating explicit knowledge from knowledge institutes with tacit knowledge of government and entrepreneurs.

# 7 Looking towards implementation: The Knowledge network

## 7.3.4 Capacity building

The crucial phase of the knowledge value chain is the application of knowledge. To realise this in the Dongtan Agropark training facilities for the employees are essential. The ambition is to realize a joint Centre for Agropark Training, Education and Research (CATER) on the Dongtan Agropark. This centre will provide tailor-made trainings for the various employees (ranging from technical production skills to logistic and managerial skills), will provide grass-root research facilities and will focus on major software questions regarding agropark development and management.

## 7.3.5. Building a knowledge network

To be able to respond quickly to new questions on the knowledge agenda of the Greenport Shanghai Dongtan Agropark, efforts will be aimed at developing an international knowledge network. The basis of this network has already been established during the Master planning of Greenport Shanghai. The co-operation between Fudan University, Jiaotong University, Nanjing Agriculture University, Tongji University, Wageningen University and Research Centre, TransForum, SIIC and several governmental and business representatives has proven to be very fruitful.

Within the Netherlands the Greenports Development Corporation, TransForum, Wageningen UR and the Dutch Innovation Network are currently setting up an International Association on Sustainable Agroparks. This Association as an intermediary body, will be an important catalyst in realising and expanding the concept of sustainable agro-industrial symbiosis in an organic and stepwise manner by:

- Sharing and disseminating knowledge
- Creating societal support
- Emphasising triple P opportunities
- Developing further enthusiasm for the concept
- Making the right combinations between partners
- Raising dedicated venture capital

- Realising pilot projects
- Producing scientific and practical evidence
- Implementing the criteria for sustainability

This international association can also be a very helpful instrument for the further development of the Greenport Shanghai Dongtan Agropark. All stakeholders can join this association to share and develop new knowledge.



Fig. Greenport Venlo the Netherlands

## 7.3.6. Research and development projects

Directly after the finishing of the Master plan, the existing knowledge network of co-operating universities will finish the five already undertaken knowledge studies on:

- Modular development of the Central Processing Unit. This study will be taken further and is currently being put forward for an so called 86-3 subsidy from the national Chinese government.
- Assembling basic facts and figures for business planning, a further elaboration of the background of chapter 7.1
- Knowledge management issues, a further elaboration of the background of chapter 7.3
- An evaluation of the learning process during the Master plan Phase, based on the individual experience of the participants.
- A further elaboration of the planning methodology issues as described in Chapter 4.

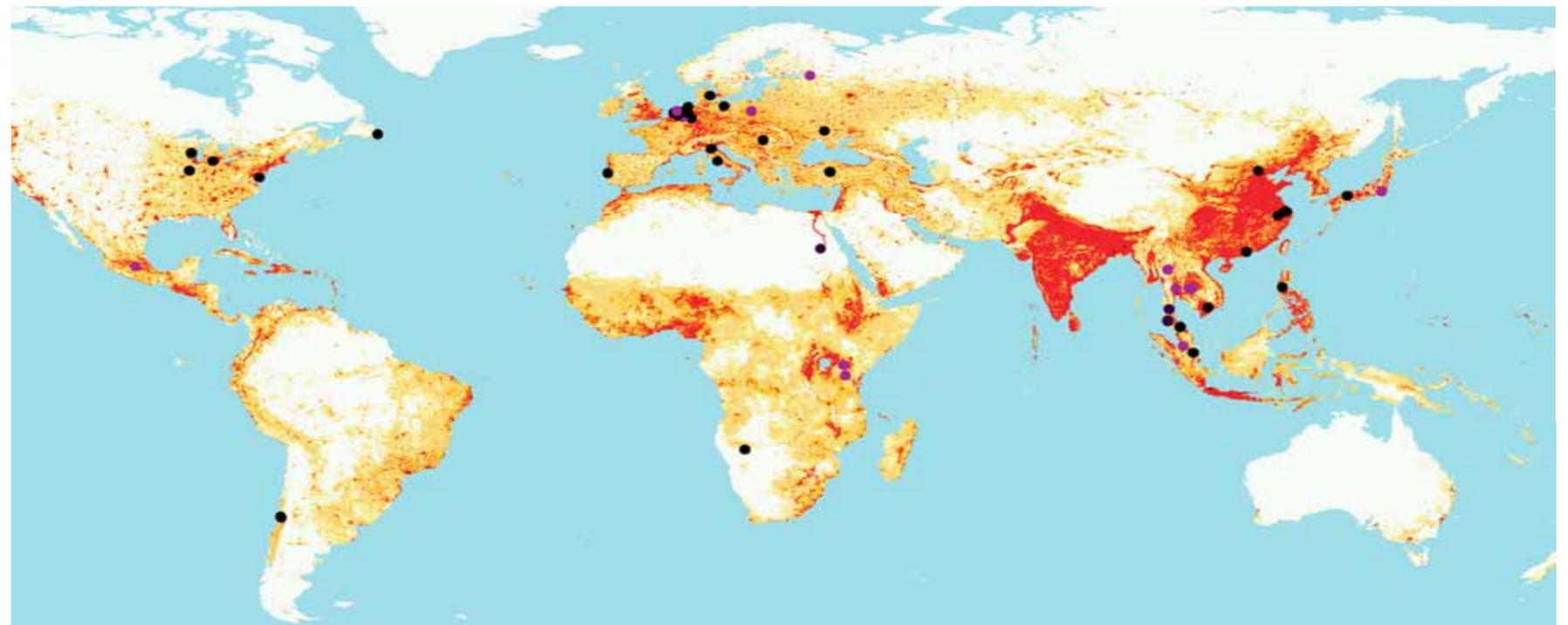


Fig. Agro parks in the world

# 7 Looking towards implementation: Communication

## 7.4 Communication

Dongtan Ecocity offers a unique opportunity to be a model of how the world's great metropolitan areas can transform themselves into sustainable organisms. It should demonstrate that in a densely populated area people can live, work, produce and play without exhausting the basic resources. Greenport Shanghai, next to eco-cities and eco-tourism, forms the agricultural production part of this concept.

The Mission statement of Greenport Shanghai is:

**Greenport Shanghai**  
**is the innovative and ambitious exploration**  
**of how Chinese metropolitan agriculture**  
**will jump into the 21st century:**  
**Circular, Sustainable and Profitable**

In such a way it will not only catch up with the most advanced agricultural techniques, but ultimately aspires to be leading in this field.

Each one of the three stages in the development of Greenport Shanghai will need a tightly coordinated communications plan and address a varying field of target groups and - consequently - of strategies and media. Moreover: to avoid mistakes we need to communicate at each stage, while keeping in mind what we intend to do in the following stages.

Phase 1 of this project is "the drawing board". It means that we have to describe and - more importantly - to sketch where we want to get to. From the first moment on we need to be very clear and undivided on what our Mission and our Vision are. Those need to be shared by every member of the Team working on the Plan. So the first thing we need to do in this stage is give substance to this Vision, which is best done by visualising it. And verbalising what isn't totally clear from the visualisation.

Following the presentation of the Master plan that carries out this description and visualisation, communication on the Master plan can be undertaken in the following three steps:

1. We should start realising our vision **in virtual reality**. This is an ideal - low cost - way to align every team member's views and expectations. We can test our ambitions as to the utilisation of the available resources, the architectural implications and the ideal choices to be made between "make or buy". We can easily change as we go and we can use the input of all stakeholders
2. We should start building **a brand**. At the end of the day we see our ready made products being bought by people looking for high quality food. Meanwhile we offer a demonstration site on circular agricultural production, a trading centre, a commodity exchange and an auction for agricultural produce, one or more processing units and their logistical extensions.  
By branding our project, right in the Planning Stage, we are setting our claims as to our unique position, to the ownership of the Concept and the opportunity to create pride and likeability all over.  
If we build our brand right, this brand should not only stand for the physical side of Greenport Shanghai, it could and should also have the power to stand as the brand for fast moving, high quality, packaged consumer goods.
3. We should immediately **go public**. By publicising the project we make it real and accessible to all stakeholders. We invite them to become part of the project at the earliest stage possible. Thereby we can work incrementally and improve as we go. By going public it will be much easier to find natural partners for our communication efforts. The media to use in this stage are:
  - I. a website
  - II. Second Life?
  - III. interviews, documentary programs, press junkets, press releases for tv, printed financial, trade and general audience media
  - IV. exhibitions
  - V. commercials
  - VI. a (digital *and* analog) newsletter for all stakeholders.



# Colophon

Master plan Greenport Shanghai.  
Better City, Better Agriculture, Better Life.  
Alterra, Wageningen May 2007

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**Better city**  
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