

# The power of Dutch greenhouse vegetable horticulture

An analysis of the private sector and its institutional framework

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**The power of Dutch greenhouse vegetable horticulture: An analysis of the private sector and its institutional framework**

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This report provides an overview of the structure and characteristics of the Dutch greenhouse vegetable sector and its regulatory and institutional framework. It also discusses how sector characteristics and the institutional framework relate to the performance of the sector in the international market. The report focuses on four themes: labour, spatial structure and location, energy and environment, and product and marketing. The results described in the report are based on a desk study and a stakeholder analysis, which was performed by means of interviews with representatives of different stakeholder groups in greenhouse vegetable horticulture.

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# Preface

The Dutch greenhouse vegetable sector is a dynamic and enterprising sector. To a large extent this can be attributed to the historic position of the sector, as it has always operated in an open, competitive market. Knowledge and innovation, together with a cooperative mentality and the attitude of the government, have enabled the sector to maintain its strong international competitive position. The Dutch greenhouse vegetable complex is continually developing in cooperation with government, education, research and other sectors on a national and international playing field.

The Swiss Ministry of Agriculture constantly reviews the agricultural policy. Due to WTO agreements, the Swiss greenhouse vegetable sector will get less protection and more competition from other countries such as the Netherlands. The Ministry has asked LEI to commission a study into the Dutch greenhouse vegetable sector and its regulatory and institutional framework. The study focuses on four themes, which are the main themes on the development of the sector: labour, spatial structure and location, energy and environment and product and marketing. The study was performed by means of desk study and interviews with representatives of stakeholder groups and was carried out by a team of researchers led by Dr Annemarie Breukers. LEI wishes to thank all participants and the Swiss Ministry of Agriculture for their cooperation and the opportunity to carry out this study.



Prof. Dr R. Huirne  
Managing Director LEI

# Summary

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The Swiss Ministry of Agriculture constantly reviews the agricultural policy. In the medium term, major changes are expected for the Swiss farmers due to WTO agreements. The Dutch greenhouse vegetable sector is considered to be an example of a production chain that operates successfully in the free market of the EU. The Swiss Ministry of Agriculture has requested that LEI commission a study into the Dutch greenhouse vegetable sector and its regulatory and institutional framework.

## *The Dutch greenhouse vegetable sector*

The structure of the Dutch greenhouse vegetable production chain has undergone considerable changes over the past decades. Market developments and especially the increasing demand for product differentiation and innovation have caused a shift from supply-driven to market-driven production. Also, the level of chain integration has considerably increased. The number of supply chain partners has strongly reduced and is expected to reduce further within the next ten years. Business-to-business contacts between (associations of) growers and supermarkets are of increasing importance, and will further increase the degree of cooperation between chain segments.

Quality-driven production is stimulated by the food quality and safety requirements imposed by the market and society. Quality guarantees such as Global-GAP, HACCP, and ISO certification currently give the Netherlands a lead, although this unique selling point may disappear in the future when such guarantees become standard requirements.

## *Production and trade*

The Netherlands has a strong export position in greenhouse vegetable products, although this position is threatened by increasing competition. For the three major crops produced in Dutch greenhouse horticulture - tomatoes, peppers, and cucumbers - the Netherlands has the highest export value worldwide, followed by Mexico and Spain. Approximately 80% of the greenhouse vegetables produced in the Netherlands are exported. In 2005, the Dutch greenhouse horticultural sector, including cut flower and pot plant production, had a total added value of 4.6 billion euros, representing more than 20% of the added value of the Dutch agricultural complex based on domestic raw materials.

Greenhouse vegetable horticulture accounts for approximately 23% of the added value of greenhouse horticulture.

#### *Sustainable production*

The Dutch government and the greenhouse horticultural sector have made a Long-Term Agreement on energy objectives, nutrients and pesticides. Regarding energy use, the sector has to meet the maximum CO<sub>2</sub> emission of 6.5 to 7.1 million tonnes in 2010, depending on the expansion of the total acreage until that time. Currently, the emission is still well below this maximum level. With respect to crop protection, the objective is to have reduced pesticide use by 88% in 2010 as compared with the average use in the period 1984-1988. The current use of pesticide is already lower than this standard. More and more horticultural producers apply biological crop protection.

Nutrient use is increasing over time, which may be explained by the ongoing intensification of production and extension of crop production periods. The greenhouse horticultural complex uses increasingly more closed water systems for the supply of nutrients than can readily be controlled. Therefore, a certain increase in nutrient use does not imply a similar increase in the emission of nutrients.

Recently, artificial lightening of greenhouse vegetables has appeared on the scene. This leads to increasing light nuisance and environmental pollution. As from 2014, the screening of artificial light must be 100% during the periods of darkness.

#### *Labour*

In 2005, approximately 51 thousand persons were directly employed in the greenhouse vegetable horticultural sector. Almost 50% of the employed personnel comprises temporary employees. It is estimated that 25% of total wage costs in greenhouse horticulture is spent on hired labour. More than 80% of hired labour is represented by employees from employment agencies. Traditionally, horticulture also employs relatively large numbers of foreign employees, particularly from Eastern European countries. More than 20% of all employers in primary horticulture consider this category to be an important temporary labour source.

#### *Spatial structure*

The major production regions for the greenhouse vegetable sector are located in Westland and Oostland, and the region around Venlo. To acknowledge the economic importance of the greenhouse horticulture complex, these two pro-



duction areas have been designated by the government as Greenports. In addition, these areas are offered greater scope for the development of operations required to retain and reinforce their position. Approximately 75% of the total volume of greenhouse vegetables - production and import - is traded via the Greenports. Of the two vegetable and fruit auctions that still exist in the Netherlands, The Greenery, is located in Westland, while the other, ZON, is located in Greenport Venlo. The Dutch government actively supports Greenports and other greenhouse horticultural centres by investing in reconstruction and infrastructure. These investments have different expected effects on employment, space, economics, and the environment.

#### *Innovation*

The greenhouse horticultural sector is considered to be much more innovative than other agricultural sectors. More specifically, 10% of the companies in greenhouse horticulture are regarded as being innovators, which means that they were the first in the Netherlands to introduce a new product or process. The market continuously forces growers to introduce modifications and efficiency improvements that are often based on new technologies, such as biotechnology and robotisation. In addition to product and process innovations, there are also advancements in the management of the companies and their sales and distribution (for example quality control, tracking and tracing).

Regulations and subsidiary programmes developed by the government have led to a number of regional initiatives to stimulate reconstruction and innovation of areas with greenhouse (vegetable) horticulture.

#### *Farm results and development*

In the period 2004-2006, the average cultivated area under glass of greenhouse vegetable companies was 1.9 ha. However, this is rapidly changing. Increasingly more farms of 10 ha or more are being established and small farms are being closed - mainly bought by other, larger farms. Greenhouse vegetable companies had a negative net farm result in the period 2004-2006, i.e. total costs exceeded total output. When categorising companies according to their size, companies with a large greenhouse acreage appear to have better farm results on average than small companies. Large greenhouses achieve a higher production per hectare at lower costs.

Considerable investments have been made in machinery and equipment, particularly CHP installations. New greenhouses signified another important investment. One objective of these investments is to increase profit by quality improvement and year-round production. Another reason for investments is to

reduce labour and energy costs, which are the two most important cost factors in greenhouse horticulture.

### *Legal framework*

#### *Labour*

Following the Act on Collective Labour Agreement, employers and employers' organisations (or organisations of employees) can conclude a collective labour agreement (known as the CAO in Dutch). A CAO is a written agreement covering provisions about working conditions. Specific agreements for employees in the Dutch greenhouse horticultural sector have been specified in the greenhouse horticulture CAO. These agreements include, amongst others, future increases in wages, rights and obligations regarding working hours, and maximum compensation of housing costs for foreign employees. Regardless of the contents of the employment contract, the employee is protected against unreasonable conditions by a number of legislations such as the Civil Code, the Minimum Wage and Minimum Holiday Allowance Act and the Working Hours Act.

Working in the Netherlands is permitted to inhabitants of member countries of the European Economic Area (EEA), with the exception of Romania and Bulgaria. For other persons, so-called 'third-country' nationals, the Foreign Nationals Employment Act ('Wet Arbeid Vreemdelingen' - WAV) applies.

The legal framework for safe and healthy working conditions is defined in the Dutch Working Conditions (Health and Safety) Act ('Arbowet'). Its main objective is that, together, employers and employees bear responsibility for safety, health and reintegration into the workforce.

#### *Spatial structure*

The general outline of the current spatial planning policy is described in the National Spatial Strategy ('Nota Ruimte') of the Ministry of Housing, Spatial Planning and the Environment. The aim of the Dutch government is to decentralise responsibilities to regional and local levels of government. Currently, the spatial policy for greenhouse horticulture can be summarised in five objectives:

1. concentration of greenhouse horticulture; according to future visions for the greenhouse horticultural sector, spatially concentrated greenhouse development will increase sustainability of the sector;
2. offering space for the development of sustainable, future-oriented greenhouse horticulture (Agricultural Development Areas (LOG) and Satellite areas);

3. facilitation of clearing existing, outdated and dispersed greenhouse horticultural centres, by providing alternative areas for investment;
4. implementation of the national government's vision by regional governments in the development of regional spatial policies for greenhouse horticulture;
5. contribute to the objectives of Clustering, Connection, and Direction, formulated in the Visie Agrologistiek.

The National Spatial Strategy designates five 'Greenports', or internationally significant horticultural areas. Greenports are concentrations of knowledge-intensive horticulture and agribusinesses with a strong, stable position in the global market. Two of these Greenports, Westland/Oostland and Venlo, comprise agglomerations of greenhouse vegetable horticulture. Governmental support for the agricultural development areas for horticulture has been provided by means of several instruments.

#### *Energy and environment*

The government and greenhouse horticultural sector have jointly defined a number of objectives for 2010 regarding the performance of horticulture with respect to energy and the environment. These objectives, recorded in the so-called GlaMi covenant, are:

- a 65% improvement in energy efficiency compared to 1980 and a 4% contribution of sustainable energy to the total energy input;
- reduction in pesticide use of 72% for the cut flower sector and 88% for the greenhouse vegetable sector, compared to the average use in the period 1984-1988;
- a reduction in phosphate and nitrogen emission of 95% compared to 1980.

Individual standards for greenhouse companies resulting from these objectives, as well as a number of other regulations, are recorded in the Greenhouse Horticulture Decree. Several additional national and EU legislations concerning energy and the environment apply, covering issues such as packaging material, light emission, water quality, and CO<sub>2</sub> emission trade.

Numerous subsidies and grants are available to support the development, introduction, and application of new technologies that contribute to energy efficiency and the use of sustainable resources.

#### *Product and marketing*

Food safety issues are governed by regulations and directives established at EU level. The general principles of the EU Food Law are recorded in EU Regulation

178/2002. At national level, this regulation is embedded in the Commodities Act. Contamination of food with residues of crop protection chemicals is regulated through the establishment of Maximum Residue Limits. Vegetable, fruit and other food product companies have the legal obligation to produce their products according to a so-called HACCP system (Hazard Analysis Critical Control Points). For primary producers, hygiene measures apply. Furthermore, several international food safety and quality systems are applied, such as GlobalGAP and ISO 9000.

The EU has established trade standards for a large number of fresh vegetables and fruit, the objective being to promote international trade. Growers' organisations can receive EU financial support for promotional and information activities aimed at quality and food safety of products, which stimulate the marketing of their products inside or outside the EU.

#### *Stakeholder impression in practice*

Some general positive and negative characteristics of the greenhouse vegetable sector that were identified during the interviews are:

- innovative/progressive mentality;
- strong entrepreneurship;
- negative image.

#### *Labour*

Some remarkable contrasts were observed. For instance, the high labour intensity in greenhouse vegetable horticulture is simultaneously considered a strength and a weakness. Also, the institutional framework regarding education is perceived as being both positive and negative. Important issues within this theme are: labour supply and demand, education, and foreign labour.

#### *Spatial planning*

The government initiatives regarding spatial structure are generally acknowledged and appreciated by most respondents. However, there are some differences in opinion regarding these initiatives and the approach chosen to implement them. Also, experiences regarding infrastructure vary among respondents. Important topics regarding spatial planning are: competition for space, clustering, the role of the government, and infrastructure.

#### *Energy and environment*

The general observation is that considerable improvements have been made, but much improvement is still required. Both positive and negative aspects of

the institutional framework for energy and the environment were mentioned, but there was too little consensus to draw any general conclusions on these. Actual discussions about this theme cover: energy efficiency, sustainable production, and government support.

#### *Product and market*

The government plays a minor role in this theme; developments are mainly driven by market forces. Respondents mentioned mainly positive characteristics. Nevertheless, they also had some criticism about observed trends. The following main issues were identified: organisational structure, market position and orientation, and product quality and safety.

#### *Strengths and weaknesses*

Current strengths and weaknesses of the Dutch greenhouse vegetable sector were summarised and structured according to the 'Greenport building'. The theoretical Greenport building consists of four floors and pillars. The floors are the domain of the sector (or market), and are carried by the pillars (the domain of the government).

<b>Strengths and weaknesses of the sector</b>			
	<b>Strengths</b>	<b>Weaknesses</b>	<b>Uncertainties</b>
<i>Production</i>	<ul style="list-style-type: none"> <li>- Development of Greenports</li> <li>- Strong entrepreneurship</li> </ul>	<ul style="list-style-type: none"> <li>- Poor image</li> </ul>	<ul style="list-style-type: none"> <li>- High level on foreign labour</li> </ul>
<i>Logistics</i>	<ul style="list-style-type: none"> <li>- General logistic position of Greenports</li> <li>- Fine logistics around distribution centres</li> </ul>	<ul style="list-style-type: none"> <li>- Congestion of roads</li> </ul>	
<i>Technology</i>	<ul style="list-style-type: none"> <li>- Fast development and application rate of innovations</li> <li>- Fulfilment of additional functions</li> <li>- High level of knowledge infrastructure</li> </ul>		
<i>Vitality</i>	<ul style="list-style-type: none"> <li>- Strong organisational structure</li> <li>- Leading position in product quality and safety</li> </ul>	<ul style="list-style-type: none"> <li>- High market power of supermarkets</li> </ul>	<ul style="list-style-type: none"> <li>- Market orientation has improved, but can be better</li> <li>- Strong international, but weak domestic market position</li> </ul>

<b>Strengths and weaknesses of government</b>			
	<b>Strengths</b>	<b>Weaknesses</b>	<b>Uncertainties</b>
<i>Space and infrastructure</i>	<ul style="list-style-type: none"> <li>- Designation of Greenports</li> <li>- Provision of space for greenhouse horticulture</li> </ul>		<ul style="list-style-type: none"> <li>- Facilitation of land development and infrastructure, but slow progress</li> <li>- Clustering is sometimes successful, sometimes not</li> </ul>
<i>Innovation climate</i>	<ul style="list-style-type: none"> <li>- Support of innovation and development of knowledge</li> </ul>	<ul style="list-style-type: none"> <li>- Unattractiveness of stimulatory financial instruments</li> </ul>	<ul style="list-style-type: none"> <li>- Innovations are not always beneficial</li> </ul>
<i>Sustainability</i>	<ul style="list-style-type: none"> <li>- Financial support for increase of sustainability</li> <li>- Participation in sustainability projects</li> <li>- Progressive legislation gives Dutch sector a lead</li> </ul>		
<i>Labour and education</i>			<ul style="list-style-type: none"> <li>- High social security</li> <li>- Poor connection between education and sector</li> <li>- High wages (but low compared to other sectors)</li> </ul>

#### *Current and future perspectives*

The Dutch greenhouse vegetable sector is a dynamic and enterprising sector. Knowledge and innovation, together with a cooperative mentality, have enabled the sector to maintain itself in international competition. Government support is generally focused on moving forward, rather than helping out in crisis situations. Considerable progress has recently been made in the field of energy consumption. Financial support of the government has contributed to this. Major limitations of the sector are scarcity of land and a scarce supply of labour. In the near future, multifunctional land use will become more common and productivity

will increase further. Also, there should be joint efforts of the government and the sector to increase the influx of Dutch employees in the labour market for greenhouse horticulture. Furthermore, a better sector image may, amongst others, improve its position on the domestic market, ease the dialogue with citizens regarding spatial competition, and contribute to a higher labour supply.



# 1 Introduction

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The Swiss Ministry of Agriculture constantly reviews the agricultural policy. In the medium term, major changes are expected for the Swiss farmers due to WTO agreements. Amongst the objectives of the Doha Round, which was started in November 2001 in Doha, Qatar, is the improved access to European markets, through the reduction of import tariffs and domestic support. For the Swiss greenhouse vegetable sector, this implies less protection and more competition from other countries. Greenhouse vegetable producers in countries within the European Union experience a much higher level of trade liberalisation. The Dutch greenhouse vegetable sector is considered to be an example of a successful production chain that operates in the free market of the EU. The Swiss Ministry of Agriculture has requested LEI to commission a study on the Dutch greenhouse vegetable sector and its regulatory and institutional framework.

The objectives of this study are: (1) to provide insight into the structure and characteristics of the Dutch greenhouse vegetable sector and its regulatory and institutional framework, and (2) how these structure and characteristics have contributed to the success of the sector. The study focuses on the following four themes: labour, spatial structure and location, energy and environment, and product and marketing. The study is divided into a theoretical and a practical part. The theoretical part comprises a desk study of the Dutch greenhouse vegetable sector and the institutional framework that relates to it. The practical part consists of an analysis of stakeholders' perspectives towards the sector and institutional framework. The latter part of the study was performed by means of interviews with representatives of different stakeholder groups in greenhouse vegetable horticulture: primary producers, marketing and sales, and (local and regional) government.

The report is organised as follows. Chapter 2 provides a description of the structure and characteristics of the Dutch greenhouse vegetable sector. Three levels are distinguished: national, regional, and individual. The chapter describes the horizontal and vertical structure of the sector, current developments and concerns, and provides statistics and economic data. Chapter 3 discusses the institutional framework related to Dutch greenhouse vegetable horticulture. It gives an overview of government objectives, legislation, and financial instruments related to the four themes mentioned above. Chapter 4 contains the results of the interviews. For each of the four themes, major strengths and

weaknesses of the sector and government are identified. Also, recurrent topics of the interviews are elaborated in more detail. The fifth and final chapter contains a summary of all previous chapters. Theory and stakeholders' opinions on the sector and its institutional framework are combined into an integrated view of Dutch greenhouse horticulture. The chapter concludes with a summary of the sector's current position and the outlook towards the future.

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## 2 The Dutch greenhouse vegetable sector

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In this chapter, the structure and characteristics of the Dutch greenhouse vegetable sector are discussed. Special attention is given to the four themes: labour, spatial structure and location, energy and environment, and product and marketing. The chapter is structured as follows. Section 2.1 focuses on the national level, providing insight into the vertical and horizontal structure of the greenhouse vegetable production chain. It also addresses issues related to the sector in general, such as trade, sustainable production, and labour. Section 2.2 discusses regional development, particularly for two specific greenhouse vegetable production regions in the Netherlands. The two regions are compared with respect to a number of characteristics. Section 2.3 provides individual farm data regarding farm structure, production, labour, and financial results.

### **2.1 National level: the Dutch greenhouse vegetable production chain**

#### 2.1.1 General structure

During the final decade of the 20th century, the organisational structure of the Dutch greenhouse horticultural production chain has undergone a rigorous change. Traditionally, the chain had a homogenous structure. A large group of small-sized growers were supplied by a small group of seed companies. Growers supplied their products to the auction, where they were sold to wholesalers and through retailers to end consumers in the Netherlands and surrounding countries. The auctions were a common marketplace where growers, wholesalers, and retailers met and the price of goods was determined by the auction clock. By the end of the 1980s, the marketing structure of Dutch greenhouse vegetables consisted of over 150 exporters, over 400 wholesale and retail organisations and commissioners, and over 20 auctions.

In the 1990s, the popularity of cooperative auctions rapidly decreased, largely as a consequence of the increasing power of supermarkets on the greenhouse vegetable market. Supermarkets obtained an increasing share in the sale of greenhouse vegetables to consumers. Also, the concentration level of supermarkets increased, resulting in a relatively small number of large su-

permarket chains. Price competition between these chains had a negative effect on the profit margins for producers. This occurred in a period when prices were already under strong pressure as a result of increased production in other countries. Moreover, the market power of supermarkets allowed them to demand specific product (quality) requirements, which, until then, was uncommon to the auctions. The initial response of the auctions was to merge into larger auctions in an attempt to obtain a stronger position in the market. To remain an interesting prospect for large buyers, auctions had to invest in buyers' accommodations. Simultaneously, they started experimenting with price and supply negotiations through agencies (Buurma, 2001).

A considerable number of growers did not agree with the mergers of auctions. Their concern was that the position of individual growers in the chain would weaken. Moreover, they believed that the traditional structure and marketing system of large co-operations would complicate cooperation between suppliers and large buyers. Uniformity in treatment and reward, as well as an openness in price development and production freedom of members were considered barriers in the compliance of growers with the increasing demand for product differentiation. Instead of joining the co-operations, they formed growers' associations to market their own products. Another group of growers made delivery arrangements with large exporters or wholesalers on a yearly basis (Alleblas and Varekamp, 1998; Van der Kroon et al., 2002).

The abovementioned events have caused a shift in the greenhouse vegetable market from supply-driven to market-driven. Also, the level of chain integration has considerably increased. The number of supply chain partners has strongly reduced and is expected to reduce further still within the next ten years, to approximately ten to fifteen international retailers that dominate the European market for fresh vegetables. Business-to-business contacts between associations of growers and supermarkets will remain important, and will further increase the degree of cooperation between chain segments in product development and differentiation (Aramyan et al., 2006; Buurma, 2001). A schematic overview of the fresh (greenhouse) vegetable production chain is provided in figure 2.1.

#### *Auctions, co-operations, and wholesalers (food providers)*

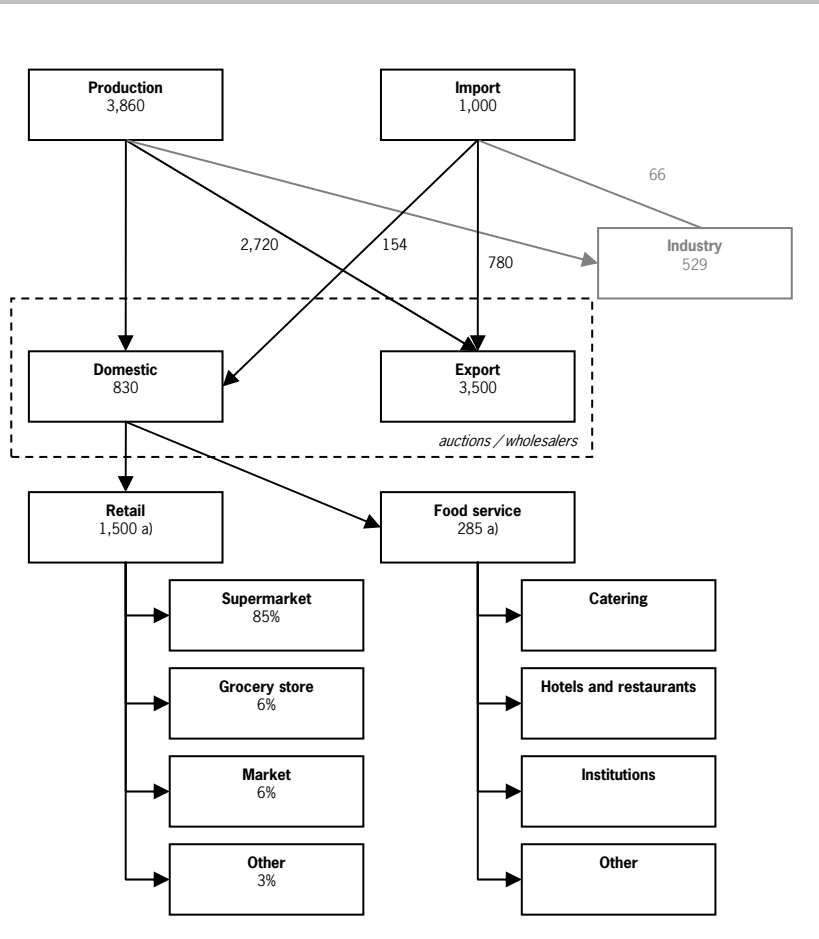
Food providers supply greenhouse vegetables to both domestic and foreign buyers. Their most important task is to collect and distribute vegetables. Wholesalers buy from primary producers, but also more frequently import products from other countries. This allows them to provide a broader range of products and to offer these all year round. Large volumes are imported - and

exported - through main port Rotterdam, which strengthens the position of sales companies (Wijnands et al., 2004).

In the nineties, nine Dutch auctions and several trading companies merged to form The Greenery. Through the merger, the traditional auction, which only offered products to potential buyers, has converted into a market organisation selling products through long-term relationships, arranging weekly prices and delivery according to the requirements of the client. The Greenery (annual turnover of 1.52 billion euros) is the largest food provider of The Netherlands. On a European scale, however, it has a market share of considerably less than 5%. Nowadays, The Greenery has a partner in the UK, to and - for logistics reasons - sub-branches in several other countries. Currently, one large vegetable auction remains: ZON, with an annual turnover of 220 million euros, which includes 25% from ornamentals. A small volume of Dutch products is auctioned in Belgium and Germany, mostly by growers that live close to the borders of these countries. Together, The Greenery and ZON are still responsible for the sale of the majority of Dutch greenhouse vegetables.

After The Greenery, the largest wholesalers in the Netherlands are Bakker Barendrecht, Haluco, Frankort & Koning, and Vers Direct Nederland (VDN). These companies have annual turnovers ranging from roughly 150 to 350 million euros. Bakker Barendrecht is the main supplier of one of the largest Dutch supermarket chains. Bakker Barendrecht and Haluco supply products provided by Dutch growers' associations Holland Crop and Best Growers Benelux, respectively. VDN is a collaboration of three trading companies and growers' organisation Vers Direct Teelt (VDT), and consequently has an even higher degree of chain aggregation. Frankort & Koning has locations in Poland and Austria next to its main location in Venlo, and supplies mainly to European retailers (Aramyan et al., 2006; Silvis and Bont, 2005).

**Figure 2.1** Schematic representation of the Dutch (greenhouse) vegetable production chain. Numbers represent million kg vegetables (greenhouse and arable) and are based on 2004



a) number also includes fruit.  
Source: Van den Berg (2005).

### *Growers' associations*

The number of growers' associations has increased considerably since their first appearance in the 1990s. Also, growers' associations have become more professional and broadened their scope with additional activities, such as packing, sorting, and marketing. Growers in associations are considered more flexible in meeting specific product demands, allowing them to seize added value from wholesalers by making production demand-specific. Moreover, growers' associations generally have transaction security by means of contracts assuring product sale. Two types of growers' associations can be distinguished:

- market-oriented growers' associations, which have a retail or consumer focus and market products that distinguish themselves from other products in terms of characteristics or quality;
- growers' interest associations, which focus on the growers and aim for a more explicit positioning of their products within the existing market structure, through purchase and sale.

The first type of association often collaborates with auctions or wholesalers, which include the products of an association in their range. Growers who are a member of this type of association generally aim for a financial benefit from joining this association. Other benefits for members of a market-oriented growers' association are increased transparency for all segments in the production chain, shared investment in new marketing concepts, and better insight into the market. Benefits for members of growers' interest associations are an improved negotiating position, more buying power - production factors - due to size and price benefits, and scale benefits through, for example, joint sorting, packing and transporting.

Growers' associations have greatly benefited from the provision of European CMO (Common Market Organisation) subsidies. Through these subsidies, growers' associations can finance up to 50% of costs related to investment, management, and administration. Examples of applications of the subsidies are: improvement of product quality, increase of trade value of products, sales promotion of products to consumers, improvement of sustainable production methods, and limitation of product withdrawal from the market. In 2005, the total value of CMO subsidies paid out in the Netherlands was 73 million euros. Growers' associations used this money, amongst other things, for investments in greenhouses and equipment, immovable property, e.g. sorting halls, and, to a lesser degree, for biological control, sustainability measures such as waste management, and promotion (Van der Kroon et al., 2002).

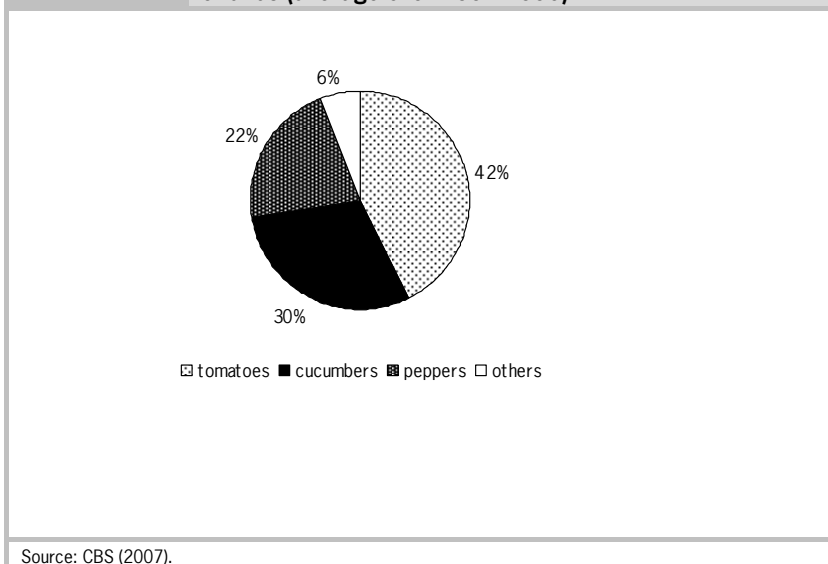
## 2.1.2 Production and trade

### *Domestic production*

The total production volume of Dutch greenhouse vegetable horticulture is currently approximately 1.5 million tonnes. This results in a production value of approximately 1,330 million euros. The most important crops are tomatoes, cucumbers, and peppers, which together, comprise more than 90% of the total production volume (figure 2.2). New production technologies and innovations have also resulted in higher production volumes. The average production per m<sup>2</sup> in the period 2002-2006 was 46.8 kg for tomatoes, 68.3 kg for cucumbers, and 26.3 kg for peppers.

The contribution of the Netherlands to global production of greenhouse vegetable products is relatively minor, accounting for less than 2% of the total production volume. Within the EU, important producers of greenhouse vegetables are Spain and Italy.

**Figure 2.2** Relative importance of vegetable crops to total production volume of greenhouse vegetable horticulture in the Netherlands (average over 2002-2006)





### Export

The Netherlands has a strong export position in greenhouse vegetable products, although this position is threatened by increasing competition. For the three major crops produced in Dutch greenhouse horticulture, the Netherlands has the highest export value worldwide, followed by Mexico and Spain (table 2.1). When looking at the net trade balance - export value minus import value - the Netherlands ranks third, after Spain and Mexico. Approximately 80% of the greenhouse vegetables produced in the Netherlands are exported. Almost half of the exports of Dutch greenhouse vegetables go to Germany; another important destination is the UK. On the domestic market, the most important retail channel is the supermarket, which is responsible for 84% of the domestic sale of fresh vegetables.

**Table 2.1** Absolute and relative export values of tomatoes, cucumbers, and peppers for the three largest exporting countries and the rest of the world (2006)

	Tomatoes		Cucumbers		Peppers	
	export value (euros)	%	export value (euros)	%	export value (euros)	%
Netherlands	1,331,119,143	24	422,078,439	25	924,016,890	32
Mexico	1,119,341,215	20	380,719,319	24	583,503,608	21
Spain	1,009,908,150	18	407,353,639	22	581,899,463	21
Others	2,169,659,836	38	498,509,372	29	734,117,983	26

Source: United Nations (2006).

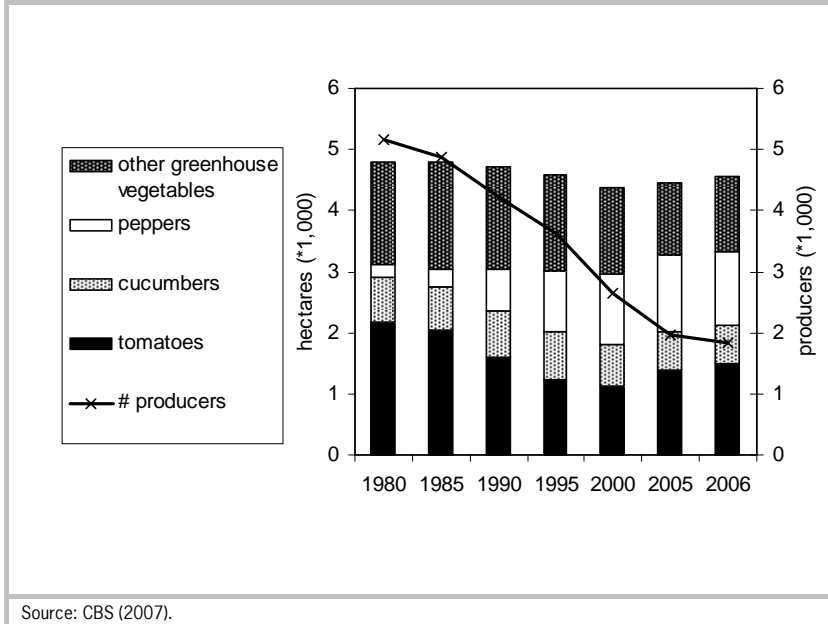
In 2005, the Dutch greenhouse horticultural sector, including cut flower and pot plant production, had a total added value of 4.6 billion euros (table 2.2), representing more than 20% of the added value of the Dutch agricultural complex based on domestic raw materials. Approximately 23% of the added value of the greenhouse horticultural complex is generated by greenhouse vegetable horticulture. Primary production is the largest contributor to the added value, followed by input manufacturing.

Table 2.2	Added value of the different segments of the greenhouse horticultural sector in 2005			
	Gross value added, greenhouse horticulture		Gross value added, Dutch agricultural complex	
	billion euros	% of total	billion euros	%
Primary production	3.0	65	7.6	33
Processing industry	0.1	2	4.1	18
Input manufacturing	1.2	27	8.5	37
Distribution	0.3	6	2.5	11
Total	4.6		22.6	
<i>Share in national gross value added</i>		<i>1.0</i>		<i>5.1</i>

Source: Berkhout and Van Bruchem (2007).

Figure 2.3 shows the trend in the number of specialised greenhouse vegetable producers and total greenhouse vegetable acreage. Specialised producers are growers for whom greenhouse vegetable production is a core activity. The number of specialised greenhouse vegetable production companies has strongly decreased over the past decades, from more than 5,000 in 1980 to 1,843 in 2006. The total acreage of greenhouse vegetable production has remained relatively stable in this period, although a shift in the acreage per crop has occurred towards a larger pepper acreage, mainly at the cost of tomato acreage.

**Figure 2.3** Total greenhouse vegetable acreage and specialised greenhouse vegetable producers



### 2.1.3 Product quality, food safety, and organic production

Originally, the Dutch greenhouse horticultural sector strived for minimisation of cost prices. In the 1980s, new technological developments were introduced, such as information technology, climate control, and the introduction of artificial substrate (rock wool). This resulted in a more or less 'industrial production method' for fresh vegetables. Artificial light, climate control, integrated and biological pest control, and fertigation in hydroponics enabled year-round production of a consistent quality. In the second half of the 1980s, consumer demand for Dutch greenhouse vegetable products declined, due to growing competition from other countries and image damage because of the 'Wasserbombe' scandal in the tomato sector. This forced the Dutch tomato production chain to shift from supply to demand driven. The greenhouse horticultural sector shifted from a production cost minimisation strategy to a strategy that aimed at high-quality products. An example of this market strategy is the development of the tomato brand Tasty Tom (Aramyan et al., 2006).

Quality-driven production is stimulated by the food quality and safety requirements imposed by the market and society. Quality guarantees such as Global-GAP, HACCP and ISO certification currently give the Netherlands a lead, although this unique selling point will disappear in the future as such guarantees become standard requirements. As from 2004, retailers that have joined GlobalGap only accept vegetable products that have been produced according to the GlobalGap guidelines. Consequently, it is very difficult for a greenhouse vegetable growing business to market its products if it is not GlobalGap certified. This has resulted in a certification percentage of almost 100% of all horticultural vegetable producers in the Netherlands (Boone et al., 2007; Silvis and Bont, 2005).

The Food and Consumer Product Safety Authority tests vegetables and fruits to check compliance with the Maximum Residue Limit (MRL). Each year, both domestically produced and imported products are tested. Results show that Dutch products perform very well compared to other countries. More than half of the Dutch products do not contain any residues. It should be noted here that MRLs can differ per country; harmonisation at EU level will probably lead to a higher compliance. Moreover, data cannot be corrected for the risk-directed sampling of imported products. Finally, compliance with MRLs does not guarantee complete food safety as more aspects play a role in this (Boone et al., 2007).

Organic production of greenhouse vegetables takes place at a small scale, comprising 74 ha in 2006. More than one third of this acreage is covered by tomatoes, followed by peppers and cucumbers. In 2005, in total there were 62 organic greenhouse vegetable companies.

#### 2.1.4 Energy consumption

The Dutch government and greenhouse horticultural sector have entered into a Long-Term Agreement on energy objectives, which is known as GlaMi (Greenhouse Horticulture and the Environment Agreement; in Dutch: *Convenant Glas-tuinbouw en Milieu*). More information on this covenant will be provided in the next chapter in section 3.3.1. One of the objectives of this covenant was to improve the energy efficiency index (EE index) to 35% in 2010, as compared with 1980. The EE index is defined as the primary fuel consumption per unit product, relative to the base year 1980. Whereas in 1995 an energy efficiency of 60% had already been realised, since then the results have lagged behind. It is expected that the objectives for 2010 regarding energy efficiency will not be achieved. The reasons for this are a decrease in the contribution of third-party

heat due to liberalisation of the energy market, and the increase in energy-consuming processes such as assimilation lighting (Boone et al., 2007; Silvis and Bont, 2005). Also, increasing mechanisation, automation, and intensification require more and more CO<sub>2</sub> input and electricity.

As a consequence of the climate policy, the sector's focus is moving from increasing energy efficiency towards reducing CO<sub>2</sub> emission. This indicator differs from the EE index in several aspects. For instance, the EE index is based on primary fuel consumption, whereas CO<sub>2</sub> emission is determined by the actual use of fossil fuels using the IPPC method, consequently excluding purchased electricity and heat. Also, unlike the EE index, CO<sub>2</sub> emission is not related to the development of physical production. The maximum CO<sub>2</sub> emission by the greenhouse horticultural sector, including flower and pot plant production, is set at 6.5 to 7.1 million tonnes in 2010, depending on expansion of the total acreage until then. In 2003, the CO<sub>2</sub> emission of the greenhouse horticulture complex was determined at 6.44 million tonnes. The use of fossil fuels decreased until 2002, followed by a small increase due to lower availability of industrial heat and CHP heat from energy companies. Nevertheless, the emission is still below the maximum level set for 2010.

Several energy-saving options are applied in the greenhouse horticultural sector. A number of these relate to the construction of new greenhouses. Another option that has been introduced on a large scale in the past years is the use of Combined Heat and Power (CHP). A more recent initiative was the development of a CO<sub>2</sub> emission trade system for the greenhouse horticultural sector (see box *Energy saving options in greenhouse horticulture* for more information).

Another objective of the GlaMi covenant is the share of 4% sustainable energy in the total energy consumption of the sector in 2010. Sustainable energy is defined as energy that is generated through renewable processes from sun, wind, water power, earth warmth and biomass. In the period between 2000 and 2005, the share of sustainable energy increased from 0.1 to 0.4% (table 2.3), which is still far below the objective for 2010.

**Table 2.3 Sustainable energy consumption in greenhouse horticulture in the period 2000-2005**

Sustainable energy source	Unit	2000	2001	2002	2003	2004	2005
Heat	GJ*10 <sup>6</sup>	0.10	0.10	0.12	0.13	0.14	0.27
Electricity	kWh*10 <sup>6</sup>	0	0	25	65	86	66
<i>Total</i>	<i>GJ*10<sup>6</sup></i>	<i>0.10</i>	<i>0.10</i>	<i>0.21</i>	<i>0.36</i>	<i>0.45</i>	<i>0.51</i>
Share in total energy consumption	%	0.1	0.1	0.2	0.3	0.3	0.4

Source: Van der Velden and Smit (2007).

The current sustainable energy consumption is largely generated by three sources: purchase of green electricity, solar energy, and biomass. In 2005, the relative contribution of these sources was 46, 30, and 24%, respectively (see *Options for sustainable energy consumption in greenhouse horticulture*).

*Energy-saving options in greenhouse horticulture*

*New greenhouses*

New greenhouses perform better in terms of light input, insulation, climate control, etc. It is estimated that the modernisation of greenhouses saves 1% of energy per m<sup>2</sup> of modernised area per year (Hietbrink et al., 2006). Since 1997, the average acreage of new greenhouses built per year is approximately 400 ha, which corresponds with 4% of the total Dutch greenhouse acreage. This is rather low, given an economic lifespan of greenhouses of 10 to 20 years. Examples of energy-saving facilities that are being applied in new or existing greenhouse complexes are movable energy screens, heat storage tanks, temperature integration, and wall insulation.

*Combined Heat and Power (CHP)*

CHP installations combine heat and power production. Thereby, 90% of the fuel is efficiently utilised, compared to 44% for traditional electricity production. Greenhouse horticultural companies can purchase CHP or industrial heat from energy companies, or they can install a CHP installation themselves. In the latter case, they purchase natural gas, use part of the produced electricity, as well as the generated heat, and sell the surplus on the electricity market. Since 2003, the total power of CHP installations owned by hor-

ticultural producers has increased by 1200 MW<sub>e</sub> (e = electric), which is equivalent to two power plants. Consequently, the use of fossil fuel and the sale of electricity have increased, while the purchase of electricity has decreased. CHP installations thus have a positive effect on energy efficiency, but lead to increased total CO<sub>2</sub> emission. Moreover, they have caused a delay in the introduction of sustainable energy in greenhouse horticulture. Investment in a CHP installation is attractive because of its high efficiency and the high electricity price.

#### *Emission trade*

In combination with this CO<sub>2</sub> emission space, a CO<sub>2</sub> emission trade system for the greenhouse horticultural sector is currently being developed. The objective of CO<sub>2</sub> emission trade is to achieve an optimal allocation of energy saving, by saving energy on those locations where it can be realised against the lowest costs. Currently, a number of large greenhouse horticulture companies already participate in the European system of CO<sub>2</sub> emission trade (Boone et al., 2007; Van der Velden and Smit, 2007).

#### *Options for sustainable energy consumption in greenhouse horticulture*

##### *Green electricity*

At the end of the 20th century, green electricity - electricity generated from renewable resources, such as wind, water, and solar energy - became available. Until 2003, the price for green electricity was comparable to that for non-sustainable electricity, due to dispensation from energy tax. This supporting regulation ended in 2003, after which green energy became more expensive. Consequently, there are less incentives to switch to green energy. The reasons for growers to elect for green electricity are (1) to qualify for the Green Label Greenhouse regulation and (2) to increase their score required for environmental certification.

##### *Solar energy (thermal).*

A development that has recently been introduced is the closed or semi-closed greenhouse. The basic principle of this type of greenhouse is capturing solar heat in an aquifer during the summer months, and the extraction of heat from this aquifer during the winter months. Recent estimates of energy saving through these systems lie between 40 and 50%. The associated investment costs currently range from 15 to 25 euros per m<sup>2</sup>. In 2005, five companies introduced the semi-closed greenhouse system; in 2006, this number had increased to 11 (Boone et al., 2007).

#### *Biomass.*

Biomass projects in greenhouse horticulture mainly provide heat, and a small amount of electricity generated by the combustion of waste wood. The contribution of biomass to sustainable energy sources is declining. A major reason for this is the discontinuation of subsidisation of small-scale biomass projects. Also, there is a debate about the sustainability of biogases and energy crops. Finally, it takes considerable time and effort to obtain the required permits for purchasing a biomass installation.

#### *Alternative energy sources*

While semi-closed greenhouses efficiently utilise solar energy, several other potential energy sources are also being evaluated. In 2007, the first greenhouse switched from natural gas to geothermal energy sources. A feasibility study has shown that the application of earth warmth in greenhouse horticulture can potentially reduce the use of natural gas by 10%. Other energy sources utilised on a small scale are wind and (electric) solar energy.

### 2.1.5 Crop protection and environment

#### *Crop protection*

One of the strengths of the Dutch sector is the use of biological control of crop pests and diseases (Aramyan et al., 2006; Silvis and Bont, 2005). Recently, the European legislation with respect to pesticide use has become more stringent. However, as the Dutch legislation was already more stringent than the European one, this will have virtually no effect on Dutch greenhouse horticulture. Table 2.4 shows the application of pesticides and nutrients by the entire greenhouse horticultural complex. Pesticide use is decreasing over time, albeit slowly. Pesticide use by greenhouse vegetable producers is less than the average use in greenhouse horticulture; the average is increased by a higher use in the cut-flower sector. Apart from an overall reduction in pesticide use, the types of chemicals used in greenhouse vegetable horticulture have also become less harmful to the environment. In the GlaMi covenant, a reduction in pesticide use of 88% in 2010 compared with the average in the period 1984-1988, was agreed. The current use of pesticide is already lower than this standard. More and more horticultural producers apply biological crop protection.

#### *Nutrients*

According to table 2.4, nutrient use is increasing over time, which may be explained by the ongoing intensification of production and the extension of crop



production periods. Contrary to EU pesticide legislation, the changing EU manure policy will have consequences for the sector. The greenhouse horticultural complex uses closed systems for the supply of nutrients that can readily be controlled. Therefore, a certain increase in nutrient use does not imply a similar increase in the emission of nutrients. However, in the near future, the EU will stipulate the specification of limits for greenhouse horticulture, which will probably result in more stringent requirements with respect to emission of fertilisers (according to the EU Water Framework Directive).

Table 2.4	Pesticide and nutrient use in kg per hectare in the period 2002-2005. Pesticide use is measured in kg of active compound			
	2002	2003	2004	2005
Pesticides	21.1	19.6	17.2	17.0
Nutrients: nitrogen	830	911	915	926
Nutrients: Phosphorus	175	191	198	196

Source: Boone et al. (2007).

#### *Water*

Horticultural producers collect water in basins, cellars or collective rainwater pools to irrigate their crops. Most companies recirculate water, thereby making highly efficient use of rainwater. Only in the event of rainwater shortage is tap water used. Costs of water are, therefore, low, although they may be higher in years with a period of drought during crop production.

#### *Light*

The application of artificial light is common in greenhouse cut flower production. Recently, artificial lighting for greenhouse vegetables has appeared on the scene. In 2006, approximately 190 ha of greenhouse vegetables were artificially lit. The intensity of artificial light is also increasing. These trends lead to increasing light nuisance and environmental pollution. To reduce these effects, restricting legislation for the application of artificial light has been introduced (see chapter 2). Moreover, the greenhouse horticulture section of the Dutch Organisation for Agriculture and Horticulture and the Netherlands Society for Nature and Environment, have agreed upon a plan to reduce the emission of light. Since January 2008, a dark period of six hours per day has been in force, during which artificial lighting should be interrupted or screened by at least 95%. As

from 2014, the screening of artificial light must be 100% during the dark period (Boone et al., 2007; Van der Knijff et al., 2004).

## 2.1.6 Labour

### *Employment*

In 2005, approximately 51 thousand persons were directly employed in the greenhouse vegetable horticultural sector (table 2.5) (Kans et al., 2007). The total demand for labour in the greenhouse vegetable production chain is decreasing slightly, which is largely due to the decline in the number of greenhouse vegetable companies. Auctions offer a relatively large number of labour positions, however, the majority of these are attributable to the cut flower sector, where auctions still have a dominant position in the production chain.

Almost half of the employed personnel consist of temporary employees (Kans et al., 2007). Temporary contracts increase the flexibility of labour availability, enabling a better match with the (fluctuating) amount of work. Moreover, the recent change in legislation regarding occupational disability, resulting in a higher responsibility of employers towards sick employees, may have increased the attractiveness of temporary contracts.

Table 2.5	Employment (# persons) in various segments of greenhouse horticulture in 2005, and contribution of different personnel categories to total employment							
	2003				2005			
	total	% o	% p	% t	total	% o	% p	% t
Greenhouse vegetable horticulture	28,300	16	45	39	26,000	18	44	38
Wholesale (vegetables and fruit)	11,300	14	69	17	10,500	14	73	13
Retail (vegetables and fruit)	8,800	36	54	10	7,900	36	51	13
Auctions (vegetables, fruit, flowers, bulbs)	7,000	0	90	10	7,000	0	91	9

o=owners and family; p=permanent employees; t=temporary employees.  
Source: Kans et al. (2007).

Permanent employees in primary greenhouse horticulture are relatively young; 80% of all employees are younger than 45, compared to 65% for the Netherlands as a whole. Most permanent employees, 62%, in primary greenhouse horticulture work between 32 and 40 hours per week. The proportion of women in permanent employment in horticulture (specific data for greenhouse horticulture is not available) is 41%, which is the same proportion in total permanent employment in the Netherlands. The estimated contribution of foreign employees in permanent employment is around 10%.

According to employers, students are the most important source of temporary employment in horticulture - table. 2.6, specific data for greenhouse horticulture is not available. This includes students who work in greenhouse horticulture during the summer holidays, as well as students who help out during the weekends. A second important category of temporary employees are housewives and househusbands, who are often active in peak periods. Traditionally, horticulture also employs relatively large numbers of foreign employees, particularly from Eastern European countries. More than 20% of all employers in primary horticulture consider this category as an important temporary labour source.

Table 2.6	Fraction of employers that consider particular categories of employees as an important source of temporary labour in 2006	
	primary sector	non-primary sector
Students	38	46
Housewives/househusbands	33	44
Foreign employees, Eastern Europe	21	4
Foreign employees, other countries	6	3
Hired personnel (for example employment agencies)	2	3

Source: Kans et al. (2007).

Besides permanent and temporary employees, an employer can hire personnel without personally employing them. It is estimated that 25% of total wage costs in greenhouse horticulture is spent on hired labour. The majority of hired labour - more than 80% - is represented by employees from employment agencies. In primary horticulture, an estimated 35 thousand employees are hired, 24 thousand of which in greenhouse horticulture. In primary horticulture,

hired labour amounts to approximately 40% of the total sum of labour payments. In non-primary horticulture, this amount is about 20%. Table 2.7 provides an indication of the proportion of different categories of hired labour in the total amount of hired labour. Employment agencies are the most important source of hired labour. Approximately 10% of all hired personnel is hired from other temporary work companies. For the past few years, the concept of pay rolling has been gaining popularity. Pay rolling implies that a specialised agency takes over administrative tasks and all legal employment risks from the employer. The employer is still responsible for recruitment, planning, and communication with the employees. Hiring freelancers or employees from colleagues is uncommon in horticulture.

<b>Table 2.7 Indication of the total amount of hired labour in horticulture and the relative contribution of different categories, in 2006</b>		
	<b>primary sector</b>	<b>non-primary sector</b>
Total	34,811	13,738
of which:	84%	83%
- employment agencies		
- other temporary work companies	12%	11%
- freelancers	4%	3%
- from colleagues	0%	2%

Source: Kans et al. (2007).

Greenhouse vegetable producers are coping with a shortage in labour supply. Since 2004, the balance of inflow and outflow of employees is negative. A recently published report about the image of greenhouse horticulture showed that Dutch citizens are generally averse to working in greenhouse horticulture (Productschap Tuinbouw, 2008). For instance, they believe that working in greenhouses is dirty, physically demanding, poorly paid, and offers few career perspectives.

*Illegal employment*

Each year, the Labour Inspectorate monitors the employment of illegal personnel in the agricultural and horticultural sector. Illegal employment has strongly decreased over the past few years as a result of the extension of the EU. The majority of illegal employees came from Poland, which has now become an EU country. Nevertheless, inspections in the horticultural region Westland in 2005

showed that 28% of all producers had committed an offence, indicating that illegal employment is still a problem in greenhouse horticulture. Sometimes, it is possible to hire foreign personnel from employment agencies; some agencies have even specialised in this. Not all of these agencies are reliable regarding labour legislation and fair treatment of personnel. To acknowledge reliable employment agencies, the RIA (Register Inleenarbeid Agrarisch) certificate has been developed. Employment agencies that are registered by RIA act according to the rules.

#### *Health and safety*

Sick leave in greenhouse horticulture is below the average for the entire agricultural sector, and far below the national average for the Dutch economy. One reason for this are the joint efforts taken by the sector to minimise and prevent sick leave. Since 2001, more and more greenhouse horticultural companies are performing a Risk Inventory and Evaluation, through which health risks can be identified.

#### 2.1.7 Spatial structure

The major production regions for the greenhouse vegetable sector are located in the Westland and Oostland areas, and the region around Venlo (see also section 2.2). While the greenhouse horticultural sector is the only agricultural segment that can, to a degree, compete with an urban destination in terms of land prices, expansion possibilities also depend on land use plans. Primary producers, service providers, supply companies, processing industry, auctions, and wholesalers are concentrated in these areas. These centres have originated due to the favourable climate, the location of centres of population, and the proximity of logistical nodes.

The expansion of greenhouse horticulture requires modification of land use plans, which is dependent on local spatial planning policies. The western production regions in particular are situated in densely populated, urban areas, where demand for land for new housing is high. Consequently, there is friction between the desire to be in proximity of auctions and logistics nodes and the availability of land. The limited availability of land stimulates multifunctional use of space. Examples at the local level are production in multiple layers and subterranean storage of water and heat. Examples at regional level are the combination of business, water, nature, and housing.

To acknowledge the economic importance of the greenhouse horticulture complex, major horticultural production areas have been designated as Green-

ports. In addition, these areas are offered greater scope for the development of operations required to retain and reinforce their position. Potentials for greenhouses located in areas with other land use plans, for instance urban or natural development, are less favourable. Possibilities for expansion in such areas are limited, resulting in a smaller economic perspective. Moreover, it will be more difficult for these companies to have a sustainable production, as this requires a minimal greenhouse size or region size in order to be economically and technically beneficial (Boone et al., 2007).

#### 2.1.8 Innovation

The market continuously forces growers to introduce modifications and efficiency improvements that are often based on new technologies, such as biotechnology and robotisation. In addition to product and process innovations, innovations are also being introduced in the management of the companies and their sales and distribution, for example quality control, tracking and tracing. In 2005, approximately 30% of all greenhouse horticultural companies had introduced a product or process innovation. For the entire agricultural complex, this value lies around 10%. Apparently, the greenhouse horticultural sector is much more innovative than other agricultural sectors. More specifically, 10% of the companies in greenhouse horticulture are considered to be innovators, which means that they were the first in the Netherlands to introduce a new product or process. In addition, 5% of all companies are seen as being early followers, implying that they are amongst the first 25% of all companies that have introduced a product or process innovation (Boone et al., 2007). See the box below for a number of examples regarding product and process innovation.

*Examples of recently introduced process and product innovations in Dutch greenhouse horticulture*

*Product innovation*

- Varieties with respect to new market segments (Tasty Tom, Tommies, other sizes and shapes of sweet pepper (block, pointed), etcetera).
- Progressive developments in biological control and integrated pest management.
- Disinfestation of drain water and substrate material: steaming, UV or ozone.
- Mechanisation and moving cultivation systems: Walking Plant System (potted plants), mobile gutters (Chrysanthemum) and containers for other crops (roses, Gerbera, tomatoes and sweet pepper).

- Cover materials with higher PAR transmission (photosynthetic active radiation).
- Mechanisation and automation of internal transport: viz. automated guided vehicle (AGV), train (common for fruit vegetables), and hanging roses.
- Mechanisation and automation of processing of harvested fruits: stacking and unstacking machines, sorting products with vision techniques.

*Process innovation*

- New sensors: Infrared Plant indicator, Humidity Deficit, lysimeter, ion-selective sensors, etc.
- Climate control applications: temperature integration, climate control based on weather forecasting.
- Scouting diseases and pests.
- Administration tools: labour registration, registration of diseases and pests
- Certification: EurepGap, ISO, HACCP.
- Management structure: joint management, complex labour organisation within large companies.
- Finance structure: lease-back construction. A grower sells his newly built greenhouse to a bank, which leases this back to the grower. The grower thereby has a higher capital and receives the benefits of environment-friendly investments at the start of production.

## **2.2 Regional level: Greenports**

### 2.2.1 General structure

Greenhouse vegetable production in the Netherlands is mostly concentrated in two regions: Westland/Oostland and Venlo (A and B in figure 2.4). The Dutch government acknowledges the economic importance of the greenhouse vegetable sector and particularly of these two regions, and has designated them as Greenports. Greenports are defined as clusters of geographic concentrations of related companies and institutes in a particular market (see also next chapter). In total, the Netherlands has five Greenports, the other three being agglomerations of cut flower and pot plant production. Together, all Greenports comprise 65% of the total acreage greenhouse horticulture. Table 2.8 summarises the main characteristics of the two greenhouse vegetable Greenports.

**Table 2.8**      **General characteristics of the two Greenports with concentration of greenhouse vegetable production**

	<b>Westland</b>	<b>Venlo</b>
Total size (ha)	98,800	136,900
Share of agriculture / horticulture in land use (%)	39	65
population density (#/km <sup>2</sup> )	2,365	357
Companies with greenhouse vegetable production	783	325
of which specialised in vegetable production	739	273
Area with greenhouse vegetable production (ha)	1,898	579
of which on specialised companies (ha)	1,865	552

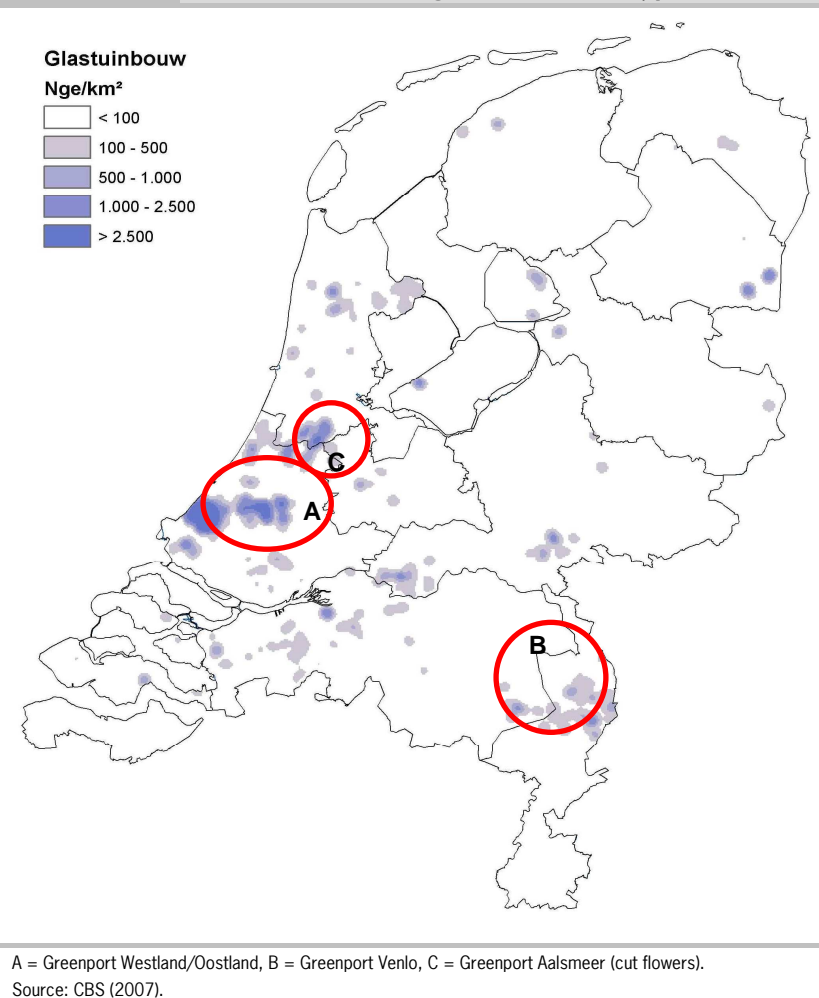
Source: Hietbrink et al. (2006).

Greenport Westland is located in the Randstad, the urban area representing the four largest cities in the Netherlands and their surrounding areas. The Greenport is in the proximity of Schiphol airport and Rotterdam harbour. It is 988 km<sup>2</sup> and has a population of almost two million. Because of its location, agriculture has a relatively low share (39%) in total land use in this area. Greenport Westland is the largest international greenhouse horticultural cluster in the Netherlands, comprising almost 50% of the total greenhouse horticultural area in the Netherlands. It contains 783 greenhouse vegetable companies with a total acreage of 1,898 ha, containing mostly tomatoes and peppers. With over one thousand cut flower producers, the Greenport is also an important cut flower production centre.



Figure 2.4

Spatial distribution of greenhouse horticulture in the Netherlands in 2004, in Dutch size units (dsu, = indicator for the economic size of agricultural activities) per km<sup>2</sup>



Greenport Venlo has the largest surface area of the five Greenports; it covers an area of 1,369 km<sup>2</sup> and has 475 thousand inhabitants. It is located in the southeast of the Netherlands and is part of the Technological Top Region Southeast Netherlands. It is an important logistical link within the international relationship between Rotterdam and the Ruhr region. Furthermore, the Greenport lies in the proximity of several important urban areas in the Netherlands, Germany, and Belgium. Approximately 65% of its land is used for agricultural production, including greenhouse horticulture. In 2005, the Greenport contained 325 greenhouse vegetable companies, which, together, covered an area of 579 ha. The types of vegetables produced on this area are diverse. Apart from greenhouse vegetable production, Greenport Venlo contains a relatively large number of tree nurseries.

## 2.2.2 Economic importance of Greenports

Approximately 75% of the total volume of greenhouse vegetables - production and import - is traded via the Greenports. Two vegetable and fruit auctions still exist in the Netherlands, one of which, The Greenery, is located in the Westland area, while ZON is located in Greenport Venlo.

	<b>Westland</b>	<b>Venlo</b>	<b>Netherlands</b>
Primary production	298	89	456
Processing	1	0	1
Delivery	332	42	375
Distribution	44	13	76
Total production chain	675	144	908

Source: Hietbrink et al. (2006).

The gross added value of the greenhouse vegetable production chain (until retail) in Greenport Westland is 675 million euros (table 2.9). For Greenport Venlo, this is 144 million euros. Together, they represent 90% of the added value of the Dutch vegetable production chain. Primary production and delivery are the main contributors to this. Since delivery includes wholesalers (for exam-

ple the auctions), the joint added values of Westland and Venlo almost equate to the total Dutch added value of supply.

### 2.2.3 Employment

Table 2.10 shows the employment in the greenhouse vegetable production chain per Greenport and for the Netherlands, in annual working units (awu). Greenports Westland and Venlo, together, account for approximately 50% of the total employment in greenhouse vegetable horticulture. Westland accounts for 40%, while Venlo accounts for 10%. The majority of employment is generated in primary production, followed by delivery.

	<b>Westland</b>	<b>Venlo</b>	<b>Netherlands</b>
Primary production	4,567	1,355	11,484
Processing	87	26	218
Delivery	2,525	749	6,350
Distribution	985	292	2,476
Total production chain	8,164	2,423	20,527

Source: Hietbrink et al. (2006).

### 2.2.4 Energy, crop protection, and nutrients

#### *Energy consumption*

Table 2.11 shows the average use of energy, pesticides, and nutrients per Greenport in 2004. Differences in energy consumption are largely caused by differences in crops grown in each region. Greenhouse horticulture distinguishes between energy-intensive and energy-extensive crops. Energy-intensive crops require an energy consumption of more than 20 m<sup>2</sup> of natural gas equivalent per m<sup>3</sup>. In Greenport Venlo, 72% of the greenhouse horticultural acreage contains intensive crops, which is the same as in the Netherlands as a whole. In Westland, the portion of intensive crops is 78%.

<sup>1</sup> An annual working unit equals one person who provides 2,000 hours (or more) of labour.

### *Crop protection*

Both Greenports have a lower average use of pesticides per hectare than the national average. As was the case for energy consumption, this difference is mainly explained by a difference in crops. Averages per Greenport apply to the entire acreage of horticulture under glass. The Westland area has a higher ratio of cut flower production to total horticultural production than Venlo. The use of crop protection chemicals is particularly high in cut flower production: 22.7 kg active compound/ha in 2004, as compared to 14.4 kg in greenhouse vegetable production.

### *Nutrient use*

Nutrient use in greenhouse vegetable horticulture is almost twice as high as in cut flower production. Both Greenports have a relatively high ratio of greenhouse vegetable production to total greenhouse horticulture, resulting in higher nutrient use than the national average.

	<b>Westland</b>	<b>Venlo</b>	<b>Netherlands</b>
Energy consumption (GJ/ha)	13,300	11,600	12,800
Pesticide use (active compound/ha)	16.5	14.6	17.1
Nutrient use: nitrogen (kg/ha)	928	1,106	913
Nutrient use: phosphorus (kg/ha)	202	226	197

Source: Hietbrink et al. (2006).

## 2.2.5 Reconstruction: expected consequences

The Dutch government actively supports Greenports and other greenhouse horticultural centres by investing in reconstruction and infrastructure. These investments have different expected effects on employment, space, economics, and the environment (Hietbrink et al., 2006).

### *Space*

Reconstruction causes a decline in greenhouse acreage, because more space will be created for infrastructure, environment, etc. It is expected that, after reconstruction, 2.2 ha of planning area is required to realise 1 ha glass. Prior to reconstruction, 2.0 ha of planning area was required.

### *Employment*

In Greenport Westland/Oostland, a 1% change in greenhouse acreage results in a 0.74% change in employment in primary production. In Greenport Venlo, this ratio is 1:1.84. Reconstruction will require a greater need for high-grade labour. Changes in other segments of the sector are expected to cause a reduction of employment in supply and processing of 2 and 8%, respectively, and an increase of employment in distribution of 3%, over the period 2003-2015.

### *Infrastructure and logistics*

Reconstruction leads to better accessibility of Greenports and improves congestion on the roads. On the other hand, more frequent and small-scale transport causes an increase in the number of transport movements. Important infrastructural bottlenecks are currently being tackled, which will improve efficiency in logistic nodes and connections with markets.

### *Energy*

Reconstruction results in the modernisation of greenhouses, with higher energy efficiency, energy-saving options and alternative energy sources. Yet, intensification of production requires a higher input of energy per m<sup>2</sup>. Producers currently seem to focus on energy cost reduction and supplementary income from selling electricity. Consequently, it may be expected that, while energy efficiency increases, the net energy use and CO<sub>2</sub> emission will also increase.

### *Environment*

At individual level, new greenhouses can be equipped with facilities that reduce pesticide emission, such as insect nets and rainwater basins. At regional level, infrastructural improvements can be combined with the construction of collective water basins and the extension of sewage system, which reduces draining into surface water.

### *Farm development and innovativeness*

Reconstruction gives an impulse to modernisation to maintain a strong competitive position. Clustering facilitates collective initiatives, such as energy clusters - shared production and use of energy - and collective water management. This offers economic as well as spatial advantages.

### *Composition of Greenports*

Reconstruction results in a faster reduction in the number of greenhouse vegetable companies. Yet, the improved infrastructure will cause a concentration of business and trade around existing logistic nodes. Additionally, suppliers will move towards Greenports.

### *Spatial quality*

The reconstruction of old greenhouse areas in the Greenports facilitates spatial incorporation of greenhouse horticulture in these regions. Also, the implementation of measures in and around companies can reduce the negative effects (for example light emission, industrial image) of greenhouse horticulture to an acceptable level.

## 2.2.6 Regional initiatives to stimulate reconstruction

Regulations and subsidiary programmes developed by the government - see next chapter - have led to a number of regional initiatives to stimulate the re-structure of areas with greenhouse (vegetable) horticulture. This section addresses some of them.

### *Stichting Herstructurering Westland (SHW)*

This foundation is engaged in the reallocation of land in the Westland area, which is one of the Greenports. SHW strives for a smooth reallocation of obsolete greenhouse horticultural areas in the Westland area. It provides personal and intensive information, motivation and coordination of growers, municipalities, and other governmental organisations regarding reallocation. Once reconstruction has actually started in a particular area, SHW has a less prominent role and monitors the process from a distance. SHW is financed by companies and institutions that are stakeholders in the reconstruction process. Currently, the foundation is inactive.

### *Stallingsbedrijf Glastuinbouw Nederland (SGN)*

The SGN is a development company that started in 2001 as a joint initiative of several national organisations representing growers and the government. Its task is to stimulate the reconstruction of greenhouse horticulture by contributing to an accelerated and sustainable spatial structure of new and existing greenhouse horticultural areas. Before SGN starts any activities in a region, it performs a feasibility study. If the result is positive, a regional development company is founded, in which preferably the local government and regional

greenhouse horticultural organisations participate. As a reward for the contribution of these institutions, SGN provides the company with knowledge and financial capacity. SGN has a relatively low profit of a maximum of 15% on its private property.

*Raamplan woningen (Framework residences) municipality of Westland*

Residences belonging to a greenhouse company increase considerably in value once they are permitted to have a non-agricultural designation. Consequently, horticultural producers who have ended their activities are often reluctant to sell their greenhouses if the 'agricultural designation of their residence cannot be changed in the municipal development plan. To anticipate this problem, the regional and local government and growers' association in the Westland area have initiated the 'Framework residences'. This framework, amongst others, allows municipalities to change the designation of agricultural residences and enables the relocation of houses under certain conditions. In addition, it stimulates reconstruction.

*Ruimte-voor-Ruimte regeling (Space-for-space regulation) municipality of Pijnacker-Nootdorp*

The municipality of Pijnacker-Nootdorp has initiated a collective implementation of what was originally intended to be an individual-oriented 'space for space' regulation. A development plan has been designed for a specific area, in which the presence of several scattered greenhouses obstructs the creation of a natural environment. According to this development plan, 18 ha of greenhouses are to be removed, for which, in turn, 44 houses can be built. To date, a number of greenhouse owners (but not all) have signed an agreement with the municipality.

### **2.3 Individual level: greenhouse vegetable companies**

The quantitative information provided in this section is largely based on the LEI Farm Accountancy Data Network (FADN). This Network contains data from a random sample of agricultural companies that are representative for the different sectors in Dutch agriculture. The actual companies included may slightly change over time as a result of farm closures and the extension of the FADN. The data presented are averages from the years 2004-2006. The number of greenhouse vegetable companies included in the FADN in this period ranged from 95 to 109, which is enough to present data with reasonable certainty. The number of companies in the different subgroups, e.g. crop and size category,

ranges from 18 to 50. Data on subgroups should therefore be interpreted as indications, which are nevertheless likely to be reasonably close to the actual average numbers .

### 2.3.1 General structure of greenhouse vegetable companies

Tables 2.12a and b show the general characteristics of greenhouse vegetable companies, categorised by size and by the main crop produced. The average cultivated area under glass of greenhouse vegetable companies in the period 2004-2006 was 1.9 ha. The majority of companies have less than 2 ha of greenhouse vegetable production (CBS, 2007). However, this portion is declining: increase in scale has caused the average area of greenhouse vegetable production per company to increase by more than 0.2 ha between 2004 and 2006. Growers specialised in the production of tomatoes, peppers, or cucumbers have a larger acreage than the average.

<b>Table 2.12 General characteristics of greenhouse vegetable companies, averaged over the period 2004-2006</b>				
<b>Table 2.12a Number of companies by greenhouse area</b>				
	<b>&lt;2 ha</b>	<b>2-4 ha</b>	<b>4-6 ha</b>	<b>average</b>
Area under glass (ha)	1.0	2.7	5.3	1.9
Number of households	1.1	1.2	1.3	1.1
Number of entrepreneurs	1.6	2.0	2.4	1.8
Annual work units (awu)	3.9	10.1	18.4	6.9
Awu per hectare	3.9	3.7	3.5	3.7
Source: FADN.				
<b>Table 2.12b Number of companies by main crop produced</b>				
	<b>Tomato</b>	<b>Pepper</b>	<b>Cucumber</b>	<b>Other crops</b>
Area under glass (ha)	2.5	2.3	2.4	1.0
Number of households	1.2	1.2	1.2	1.0
Number of entrepreneurs	2.0	2.1	1.7	1.5
Annual work units (awu)	9.6	6.7	10.7	3.8
Awu per hectare	3.8	2.9	4.5	3.8
Source: FADN.				



The number of households and entrepreneurs per company increases with size of the company. The average greenhouse vegetable company represents a little more than one household and contains almost two entrepreneurs. Also the average number of annual work units (awu) increases with company size, but the average number of awu per hectare decreases with size. This is due to scale efficiencies of larger holdings. Cucumber producers have a relatively high number of awu per hectare, whereas the number of awu per hectare of pepper production is lower than on average for greenhouse vegetables. This is explained by differences in harvesting frequency and crop maintenance activities.

### 2.3.2 Financial farm results

Tables 2.13a and b show the average financial company results in the years 2004-2006. Greenhouse vegetable companies had a negative net farm result in this period, i.e. total costs exceeded total output. The total costs comprise both the actually paid costs and the calculated costs (for example own labour, depreciation). Categorised by size, companies with a large greenhouse acreage appear to have better farm results on average than small companies. Large greenhouses achieve a higher production per hectare at lower costs.

Labour is the most important cost factor for greenhouse vegetable companies, followed by energy. The importance of labour costs decreases as greenhouse size increases, due to a relative decrease in the contribution of calculated labour costs of entrepreneurs and family members). Labour costs specified per type of employee are available for 2006. Average paid labour costs in that year were approximately 0.2 million euros, of which 46% comprised permanent or temporary employees and 43% comprised hired labour (for example from employment agencies). The remaining 11% was covered by contract work. Large companies have relatively high costs for energy, interest and depreciation. This is probably the result of a more intensified and more technologically advanced crop production strategy.

Family income from follows from farm output minus paid costs, depreciation, and exceptional costs and benefits. Large fluctuations are observed between years and companies. In the past three years, average family farm income varied from almost 23 to more than 60 thousand euros. Large companies have a higher income on average than small companies. Note, however, that these companies more frequently represent more than one household. Cucumber companies had a much higher income than companies producing other crops. Differences between years and crop categories are largely explained by fluctuations in price. Given the large proportion of vegetables that are exported,

prices are highly dependent on the international market situation. This is reflected in differences in output. Activities such as electricity production for the energy market also contribute to differences between companies.

**Table 2.13** Average financial farm results of greenhouse vegetable companies in the period 2004-2006, in euros per year

<b>Table 2.13a</b>		<b>Companies categorised according to producible greenhouse acreage</b>			
	<b>&lt;2 ha</b>	<b>2-4 ha</b>	<b>&gt;4 ha</b>	<b>Average</b>	
Total output	332,771	1,027,293	2,076,420	683,329	
Total costs	390,398	1,092,770	2,097,007	739,937	
of which	73,433	239,445	471,752	155,567	
- energy					
- labour	145,644	357,576	668,163	252,184	
- interest and depreciation	56,583	197,924	407,227	127,292	
- other costs	114,738	297,824	549,864	204,893	
Net farm result	-57,627	-65,477	-20,588	-56,608	
Income from farm	32,512	48,327	109,718	43,719	
Savings	-12,488	-30,919	-24,535	-19,250	

Source: FADN.

<b>Table 2.13b</b>		<b>Companies categorised according to main crop produced.</b>			
	<b>Tomato</b>	<b>Pepper</b>	<b>Cucumber</b>	<b>Other crops</b>	
Total output	957,568	807,871	1,012,692	312,758	
Total costs	1,084,342	871,744	1,011,887	360,197	
of which	267,472	192,953	222,272	47,144	
- energy					
- labour	372,635	263,247	344,079	143,775	
- interest and depreciation	179,040	167,127	161,669	61,476	
- other costs	265,194	248,417	283,867	107,802	
Net farm result	-116,773	-63,873	805	-47,439	
Income from farm	8,134	27,373	108,692	42,706	
Savings	-69,742	-38,486	33,116	-3,625	

Source: FADN.

The average family income for greenhouse horticulture companies in the Netherlands is higher than in the entire primary agricultural sector. Relatively high family incomes are essential for the greenhouse horticultural sector, given its capital-intensive character and the low proportion of land owned by this sector. Approximately 25% of all companies per year manage to generate a family income of over 100,000 euros (Berkhout and Van Bruchem, 2007).

### 2.3.3 Investment

Table 2.14 gives an overview of the value of investments recently made in the greenhouse vegetable horticulture. Large investments have been made in machinery and equipment, particularly CHP installations. New greenhouses were another important investment entry. One objective of these investments is to increase profit by quality improvement and year-round production. Another reason for investment is to reduce labour and energy costs, which are the two most significant cost factors in greenhouse horticulture.

In order to finance investment plans, it is important for greenhouse vegetable companies to have sufficient own resources at their disposal. Due to a relatively low proportion of land used for production in greenhouse horticulture, compared to other sectors, greenhouse companies often have a low solvability (equity divided by total liabilities). Instead, financing of investments on greenhouse companies occurs more and more on the basis of availability of cash flow in order to meet interest and depreciation liabilities. Cash flow consists of depreciation costs and the savings that result from family income from basic farm activities, less family expenses and taxes. Consequently, family income farm (see previous section) and depreciation costs largely determine the opportunities for new investments.

When comparing cash flows between companies, larger companies appear to have a higher cash flow on average, but also a larger variation in cash flow than smaller companies. Large companies often have high depreciation costs, which they use to generate cash flow from their own resources. This enables them to obtain borrowed capital for new investments. All investments, except for land, depreciate over time. In the Dutch greenhouse vegetable sector, the average depreciation costs are usually lower than the amount of investment on which depreciation occurs. This implies that the sector avoids ageing of production facilities by investing in modern techniques. This benefits modernity and economic sustainability of companies. Nevertheless, similar to the availability of cash flow, the amount of investment also demonstrates a considerable variation between companies and years.

**Table 2.14** Average investment and depreciation costs per greenhouse vegetable farm in the period 2004-2006, in euros per year

<b>Table 2.14a</b>		<b>Farms categorised according to producible greenhouse acreage</b>			
	<b>&lt;2 ha</b>	<b>2-4 ha</b>	<b>&gt;4 ha</b>	<b>Average</b>	
Investment	43,638	247,249	949,891	195,275	
of which					
- land	8,091	54,124	233,621	45,369	
- buildings and greenhouses	10,968	81,108	302,092	60,462	
- machinery and equipment	13,992	86,936	337,423	67,962	
- other	10,587	25,081	76,755	21,482	
Depreciation	35,938	141,601	287,677	87,503	

Source: FADN.

<b>Table 2.14b</b>		<b>Farms categorised according to main crop produced</b>			
	<b>Tomato</b>	<b>Pepper</b>	<b>Cucumber</b>	<b>Other crops</b>	
Investment	264,437	274,881	294,482	52,428	
of which					
- land	62,947	58,860	72,455	5,248	
- buildings and greenhouses	88,867	94,655	80,847	15,567	
- machinery and equipment	103,451	90,044	109,153	16,456	
- other	9,172	31,322	32,027	15,157	
Depreciation	124,194	113,444	115,734	40,314	

Source: FADN.

### 2.3.4 Greenhouse production costs

Tables 2.15a and b provide an insight into the general costs of greenhouses, i.e. costs that are not directly attributable to crop production. The average replacement value of durable production facilities (for example greenhouses, production facilities) on greenhouse vegetable companies is 1.6 million euros. This corresponds with approximately 0.86 million euros per hectare. For large companies, the replacement value per hectare is slightly lower on average, while for medium-sized companies (2-4 ha), the average value is higher. This is probably because greenhouses in both categories have invested in production facilities of which the costs are (partly) independent of the scale on which they are applied (for example CHP installations, ICT). The relative cost of such facilities decreases as greenhouse size increases.

**Table 2.15 Replacement value and costs of durable production facilities per greenhouse vegetable company, averaged over the years 2004-2006, in euros per year.**

<b>Table 2.15a</b>		<b>Farms categorised according to producible greenhouse acreage</b>			
	<b>Tomato</b>	<b>Pepper</b>	<b>Cucumber</b>	<b>Other crops</b>	
Replacement value of durable production facilities	2,275,139	2,010,118	2,209,738	800,176	
Maintenance and interest costs/year	29,621	25,044	31,857	15,493	
General costs/year	51,475	45,313	50,602	15,841	
of which- administration	11,004	8,581	9,426	3,744	
- communication	1,963	2,040	2,214	1,108	
- information and promotion of interests	8,844	9,046	10,905	3,680	
- environmental and hygiene services	10,799	9,964	7,693	1,447	
- insurances	14,203	12,827	13,273	5,125	
- water	1,931	2,105	2,629	764	
- other	2,730	750	4,462	-25	
Source: FADN.					

**Table 2.15** Replacement value and costs of durable production facilities per greenhouse vegetable company, averaged over the years 2004-2006, in euros per year.

<b>Table 2.15b</b>	<b>Farms categorised according to main crop produced</b>			
	<b>&lt;2 ha</b>	<b>2-4 ha</b>	<b>&gt;4 ha</b>	<b>Average</b>
Replacement value of durable production facilities	888,494	2,441,574	4,411,721	1,631,860
maintenance and interest costs/year	14,059	30,620	66,037	23,556
general costs/year	20,162	54,285	94,664	36,270
of which				
- administration	4,696	11,144	15,331	7,348
- communication	1,088	2,290	4,217	1,710
- information and promotion of interests	4,554	10,544	17,419	7,364
- environmental and hygiene services	2,873	10,518	18,622	6,399
- insurances	5,721	14,733	27,623	10,201
- water	1,319	1,847	3,356	1,676
- other	-88	3,210	8,096	1,571
Source: FADN.				

High costs are spent each year on insurances. Other important general cost factors are administration, information and promotion of interests, and environmental and hygiene services. Water costs vary between different crops, which is due to a difference in water demand. However, even the highest average water cost is still rather low, showing that water use in the greenhouse vegetable sector is very efficient.

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## 3 Legal framework of Dutch greenhouse vegetable horticulture

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In the following sections, an overview of the institutional framework related to Dutch greenhouse vegetable horticulture is provided. The sections address the four themes around which this report is concentrated, in the following order: Labour, Spatial structure and location, Energy and environment, and Product and marketing. The major government objectives are discussed for each theme. The sections also provide information on the most important legislation and financial instruments developed by the government to realise its objectives. Official English translations of legislations and regulations do not always exist; therefore, their official Dutch name is always included in brackets.

### 3.1 Labour

#### 3.1.1 Employment contracts

All employees who are in the service of an employer receive wages for the work, and have an employment contract. An employment contract can be agreed in writing or verbally. Employment contracts are for a fixed or an indefinite period. If no agreements have been made concerning the duration of a contract, it is considered to be a permanent contract. A temporary contract automatically becomes a fixed contract if (1) it is the fourth contract between the same employer and employee and the time between successive contracts is less than three months, or (2) if the successive contracts (at least two) together cover more than three years. A CAO (see below) can include exceptions to these rules. Every employee younger than 65 years of age has the right to earn a minimum income. For employees of 23 and older, the minimum wage applies. Currently, the gross minimum wage is 1,335 euros per month in the case of a full employment contract (usually 36 or 38 hours a week). Employees younger than 23 years of age should earn at least the minimum youth wage, which increases with age. The legal number of holidays that an employee should receive each year equates to four times the number of days he or she works per week.

Students (from the age of 14) and housewives can be contracted on the basis of a so-called zero-hour contract. The law contains special rules for the em-

ployment of young people, to ensure that their safety, health, development, and education will not be at stake. These rules define the type of work young people are allowed to do and for how many hours. Employees can also be hired from an employment agency. The actual employer, in that case, is the employment agency. Employment agencies are not allowed to demand money from an employee in return for placement at a company. Payment of the employee occurs according to the CAO of the employment agency. Only when the agency does not have its own CAO does the CAO of the company where the employee is placed apply. It is becoming more common for employers in the greenhouse horticultural sector to hire self-employed persons without staff ('zelfstandigen zonder personeel', zzp'ers). A zzp'er accepts a predefined task for a predefined price and a predefined period, can work for more than one employer, and has his or her own responsibilities and risks. A zzp'er consequently has no employment contract with his or her employee and does not have a CAO.

### 3.1.2 Collective Labour Agreements

Following the Act on Collective Labour Agreement, one or more employers and one or more employers' organisations or one or more organisations of employees can conclude a collective labour agreement (CAO). A CAO is a written agreement covering provisions about working conditions, for example about wages, bonuses, payment of overtime, working hours, trial periods, notice periods or pensions. Issues such as schooling, child care and early retirement may also be covered. Provisions in the CAO are often more advantageous than the statutory provisions, but the agreements may never violate the law. CAOs can be concluded per sector or per company. An employer must apply the CAO when (1) the company itself has drawn up the CAO (company CAO), or (2) if the company is a member of an employers' organisation that has drawn up the CAO on its behalf (sector CAO), or (3) a sector CAO within the employer's industry has been extended by the Minister of Social Affairs and Employment (SZW). The CAO then automatically applies to all employers in that sector. Specific agreements for employees in the Dutch greenhouse horticultural sector have been included in the greenhouse horticulture CAO. These agreements include, amongst other things, future wage increases, rights and obligations regarding working hours, and maximum compensation of housing costs by foreign employees.



### 3.1.3 Mutual obligations

Regardless of the contents of the employment contract, the employee is protected against unreasonable conditions by a number of legislations:

- the Civil Code (BW), which, for example, contains rules about a probationary period, holidays, notice period and dismissal. It will also indicate whether or not the CAO or employment contract is allowed to deviate from these rules;
- the Minimum Wage and Minimum Holiday Allowance Act. This states that the employer must pay the employee at least the minimum wage;
- the Working Hours Act (ATW), which forms a statutory framework for working hours. The latter of these two acts contains certain rules for hours of work and hours of rest per day and week;
- the Health and Safety Act. The government sets targets for safety and health in companies. They contain protection standards that must be offered by companies to employees, so that the latter can work safely and healthily;
- the Work and Care Act, which contains information about several types of leave that employees may be entitled to. Examples of leave with (partly) continued payment are maternity leave, emergency leave, short-term care leave, adoption leave, and parental leave;
- legislation about equal treatment. This states, among other things, that there should be no discrimination in working conditions between men and women, indigenous people and foreigners, full-time and part-time employees, employees with a permanent or temporary contract and between people with or without disablement or chronic illness.

Apart from these legislations, there is the Extraordinary Decree on Labour Relations (BBA) and the Decree on Dismissals, which contain rules about the termination of employment. For example, in which cases your employer must seek permission from the Centre for Work and Income (CWI) to dismiss an employee. Many employers fall within the scope of a collective labour agreement (CAO). The CAO often covers provisions about wages, holidays, notice periods etc. It will also outline whether or not an employer is allowed to deviate from any of the CAO provisions.

The employee also has certain obligations towards the employer. For instance, the law prescribes that he or she should behave as a 'good employee'. What exactly is meant by that is not specified. It covers situations such as working additional hours to finish off an urgent order, taking over tasks from ill col-

leagues who are ill for a limited period of time, and complying with work instructions, such as wearing a helmet and observing a smoking ban.

#### 3.1.4 Foreign employees

Inhabitants of member countries of the European Economic Area (EEA), with exception of Romania and Bulgaria, are permitted to work in the Netherlands. For other persons, so-called 'third-country' nationals, the Foreign Workers Employment Act (Wet Arbeid Vreemdelingen - WAV) applies. This act specifies the grounds on which a work permit can or must be refused and the grounds on which a work permit that has been issued can be withdrawn. To obtain a work permit for third country nationals, the employer must first of all apply for approval from the Centre for Work and Income (the CWI). Approval will only be given if the employer can prove that workers from within the EEA are not available for the specific job and a number of other conditions are met, such as terms of employment and working conditions. In practice, the WAV in particular relates to seasonal labour in agriculture and horticulture and some specific branches and occupations experiencing shortages in labour supply. In conformity with the EU Directive 96/71/EC concerning the posting of workers in the framework of the provision of services, employees from other countries can claim the same terms of employment from their employer as Dutch employees.

#### 3.1.5 Health and social security

The legal framework for safe and healthy working conditions is defined in the Dutch Working Conditions (Health and Safety) Act (Arbowet). This Act prescribes that (1) the employer should ensure optimal working conditions, and (2) the employer and employee should cooperate to improve safety, health and welfare of all company members. Its main objective is that employers and employees together bear responsibility for safety, health and reintegration into the workforce. The Health and Safety Act is elaborated in the Working Conditions Decree and the Working Conditions Regulations. These documents only prescribe general requirements for a safe and healthy working environment; their implementation in practice is recorded in a Health and Safety Catalogue and may be company-dependent. For instance, the Health and Safety Catalogue can include agreements between employers and employees, measures derived from former regulations, norms based on research, etc. In some cases, Health and Safety catalogues have been developed for an entire sector. Companies that belong to such a sector do not need to compile a catalogue themselves. The Labour In-

spectorate performs regular inspections of companies to check their compliance with the Health and Safety Act. The Health and Safety catalogue is used as a frame of reference for this inspection. Another part of the Health and Safety Act is the obligation to have performed a Risk Inventory and Evaluation (Risico-Inventarisatie en -Evaluatie, RI&E). Part of this RI&E is a project implementation plan, which describes how the impact on the company of identified risks will be minimised. Employees normally do not have the required expertise for implementation of the Health and Safety Act. Therefore, they are obliged to contract assistance from certified experts.

An important principle in Dutch government policy is that everyone capable of working is encouraged to do so. Implementation of this principle has recently resulted in the Work and Income according to Labour Capacity Act (WIA). The WIA provides for employees entitled to occupational disability benefit upon full and permanent occupational disability. Those still able to work partially will receive a supplement to their wage. If an employee becomes ill for a long period of time, the employer must continue to pay (70% of) the employee's wage for two years. The employer and employee should also try their best to have the employee recommence work. After the two-year period, the employee undergoes tests. The extent to which the employee is considered to be occupationally disabled (for example, the extent to which he or she is incapable of earning his or her most recently received wage) determines whether or not the employer will still be (partially) responsible for the payment of wages to the employee. Employees that become occupationally disabled have their own responsibility to obtain an alternative income. The employee may generate this income using his or her savings, but it is also possible to purchase an occupational disability insurance.

### 3.1.6 Subsidies and grants

#### *Matching labour demand and supply*

Under certain circumstances, employers can be exempted from employee insurance premiums for persons that are employed for short periods, such as students and persons entitled to a social benefit. This regulation particularly applies to temporary employment during peak periods. Note that temporary contracts increase flexibility for the employer. It is easier to dismiss employees with temporary contracts. In addition, temporary contracts allow the employer to contract personnel solely during periods with labour peaks.

If an employer has a temporary overcapacity of employees due to unexpected exceptional circumstances, such as a fire or an epidemic, the former

can apply for a temporary social benefit for its employees to cover a portion of the contracted working hours. The social benefit is bound by a maximum period and a maximum fraction of the total contracted working hours.

#### *Employment of persons with poorer employment perspectives*

There are a number of financial benefits for employers who employ a (partially) disabled person. Examples are (temporary) dispensation from particular premium payments and compensation of costs of required adjustments to the work floor.

Persons that have been unemployed for at least six months can be employed, without payment, at a company for at maximum of three months, as long as the employer has the intention to offer the person a contract for at least six months if the probationary period is successfully completed.

#### *Subsidies for education and training*

A number of funds are available for subsidisation of education and training projects. One of these is the European Social Fund (ESF), which is an EU financial instrument for investment in people. The Dutch strategy for ESF funding aims to increase labour productivity and participation in the labour market. Education and development funds that are acknowledged by the Dutch government can be eligible for partial funding of education projects. Other, private funds in the Netherlands aim, amongst others, to improve labour market access for specific target groups (for example women, foreign people).

#### *Subsidies for improving health and safety*

By means of the subsidies that are available for the purchase of new equipment, employers are encouraged to invest in labour-friendly equipment, provided that this equipment is indicated on a list of innovative, labour-friendly products known as the FARBO regulation and is provided by the national government.

Employers' and employees' organisations can apply for subsidisation of the development of a Health and Safety catalogue for their sector. The subsidy is provided by the national government (Paltoe, 2007).

## 3.2 Spatial structure

### 3.2.1 Spatial planning policy

The legal and institutional framework for spatial structure and planning of greenhouse horticulture has undergone some important changes over the past years. Spatial organisation of greenhouse horticulture, aimed at improving the national and international position of the sector, has received much more attention than in the past. Currently, the spatial policy for greenhouse horticulture can be summarised in five objectives (NovioConsult Van Spaenendonck, 2005):

1. concentration of greenhouse horticulture; according to future visions for the greenhouse horticultural sector, spatially concentrated greenhouse development will increase sustainability of the sector;
2. offering space for the development of sustainable, future-oriented greenhouse horticulture (Agricultural Development Areas (LOG) and Satellite areas);
3. facilitation of clearing existing, outdated and dispersed greenhouse horticultural centres, by providing alternative areas for investment;
4. implementation of the national government's vision by regional governments in the development of regional spatial policies for greenhouse horticulture;
5. contributing to the objectives of Clustering, Connection, and Direction, formulated in the Visie Agrologistiek (Agrologistics Vision).

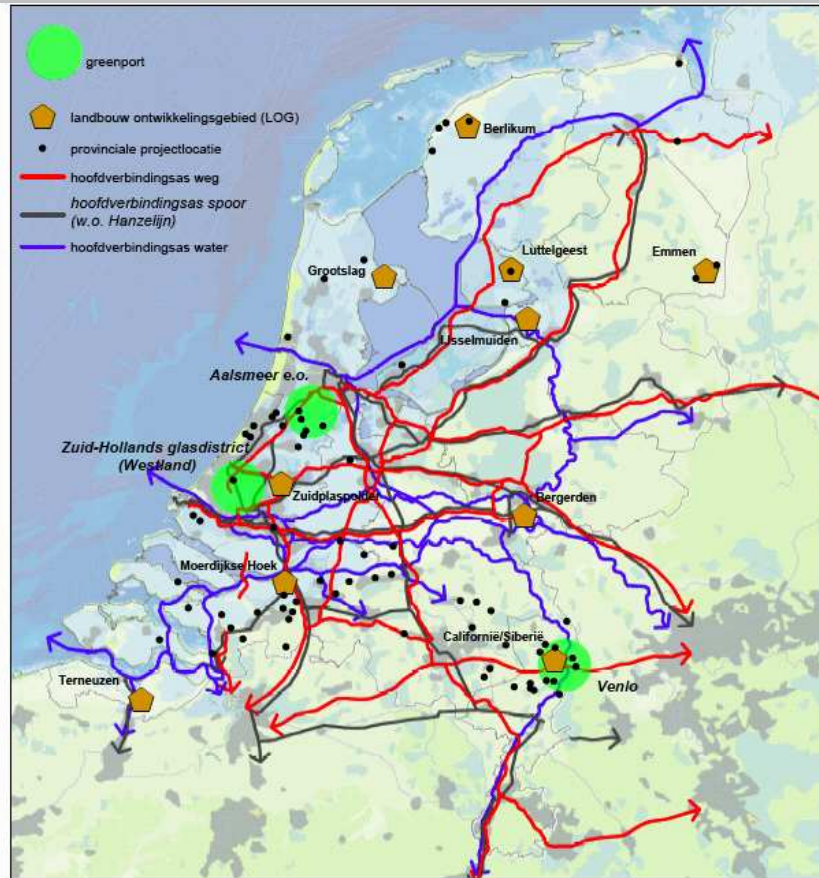
The general outline of the current spatial planning policy is described in the National Spatial Strategy (Nota Ruimte) of the Ministry of Housing, Spatial Planning and the Environment. The aim of the Dutch government is to decentralise responsibilities to regional and local levels of government. Therefore, National Spatial Strategy only provides a general outline for spatial development. Matters that are of national importance and for which the national government bears responsibility are guaranteed by the inclusion of basic quality standards. Also, regions and networks that are considered to have national significance are defined in the National Spatial Structure (Nationale Ruimtelijke Hoofdstructuur) (Summary National Spatial Strategy, 2006). With respect to greenhouse horticulture, important regional structures defined in the National Spatial Structure are the five so-called Greenports in the Netherlands.

### 3.2.2 Greenports and Agricultural Development Areas

The National Spatial Strategy designates five 'Greenports', or internationally significant horticultural areas. Greenports are concentrations of knowledge-intensive horticulture and agribusinesses with a strong, stable position in the global market. Two of these Greenports (Westland/Oostland and Venlo) comprise agglomerations of greenhouse vegetable horticulture. The basic idea behind the concentration of greenhouse horticulture and related agribusiness in the Greenports is that it can increase economies of scale and efficiency in transport and logistics. Moreover, functions and links can be coordinated. To maintain and even strengthen the international competitive position of Greenports requires reconstruction and easy accessibility. This is mainly a task for the provinces.

The National Spatial Strategy also pays attention to the reconstruction of obsolete greenhouse horticulture areas. In many cases, farms will have to relocate away from such areas. To compensate for this, the national government has designated ten local agricultural development areas ('Landbouw Ontwikkelings Gebieden', LOG), in which space is preserved for establishment and expansion. Furthermore, provinces stimulate the development of provincial project locations (provinciale projectlocaties); greenhouse horticultural areas with a regional economic importance. Examples of these regional areas are: Wieringermeer (Agriport A7, Primaviera (between Greenport Aalsmeer and Greenport Westland/Oostland)), Bommelerwaard and the eastern part of the province of North Brabant (near Greenport Venlo). Figure 3.1 shows the geographic locations of Greenports, LOGs, and provincial project locations.

**Figure 3.1** Location of Greenports and spatial development areas in the Netherlands



Source: National Spatial Strategy.

Clustering of greenhouse horticulture in Greenports contributes to more efficient transport of inputs and outputs of horticulture, which contributes to a reduction of transport streams in the Netherlands. As the national policy aims at strengthening the development of Greenports, infrastructure for agrolistics should also be improved. To achieve this, several ministries have together composed the Agrolistics Vision (Visie Agrolistiek), which includes a number of illustrative current projects. Also, the Ministry of Transport, Public Works and Water Management has composed a Mobility Policy Document (Nota Mobiliteit), in which it emphasises that priority should be given to highways that connect Greenports, mainports (airports and harbours) and brainports (knowledge-centres) with one another. Thereby, the accessibility of the Greenports will be improved.

### 3.2.3 Implementation of the National Spatial Strategy

The contents of the National Spatial Strategy are implemented in the Spatial Planning Act ('Wet op de ruimtelijke ordening'). This act prescribes how spatial plans are developed and adjusted. It defines the tasks of the government and the rights and obligations of citizens, companies and institutions. The act prescribes the realisation of spatial plans and infrastructure at different governmental levels:

- national level: Key Planning Decisions (planologische kernbeslissingen, pkb's); provide the basis for the distribution of space in the Netherlands;
- regional level: Regional Plans (streekplannen); provide more detailed information on growth potential for towns and villages and space for agriculture, nature, and recreation;
- municipality level: Destination Plans (bestemmingsplannen); prescribe the precise destination of land within a municipality, such as housing, industry, and recreation.

Realisation of the Spatial Planning Act at local level is guaranteed by a number of additional laws. Regarding greenhouse horticulture, the following statutes are the most important ones:

- Municipalities Preferential Rights Act (Wet Voorkeursrecht Gemeenten). This act provides local governments with a better position in the land market. A preferential duty can be put on land to which a new zoning plan applies, i.e. when it has been given a non-agricultural designation that differs from its actual use. In such cases, the government can claim the right to have priority in terms of the purchase of this land;



- environment permit (Omgevingsvergunning). As from 2009 onwards, this permit will replace a number of different permits and prescriptions regarding housing, space and environment. Examples of current permits that will be replaced are: building permits (for construction of new buildings and major adjustments to existing buildings), environment permits (for meeting conditions with respect to air, noise and odour pollution), and GMO permits (for companies that intend to make use of genetically modified organisms).

### 3.2.4 Subsidies and grants

Governmental support for the agricultural development areas for horticulture has been provided by means of several instruments. This section provides an overview of means of financial support at different governmental levels.

#### *National government*

- Economic Structure Processing Fund (Fonds Economische Structuurversterking, FES). This fund aims at strengthening economic structures in the Netherlands. Financial support for the reconstruction of Greenports, provided by FES, could, for instance, be used for investments in the economic structure, accessibility, energy efficiency and environmental quality.
- Regulation for Stimulation of Organisation of Sustainable Greenhouse Horticultural Areas (Stimuleringsregeling Inrichting Duurzame Glastuinbouwgebieden, STIDUG): aims at the development of new horticultural areas. This regulation stimulates the sustainable development of agricultural development areas for the greenhouse horticulture, and their strong and sustainable organisation. Only projects in the ten agricultural development areas qualify for budgets from this source. The regulation is currently temporarily inactive.
- Regulation Structural improvement of Greenhouse horticulture (Regeling Structuurverbetering Glastuinbouw). Until 2006, horticultural producers who had terminated their activities could receive financial support for the destruction of their greenhouses. The empty space thereby created could then be used for expansion by other growers. The objective of the regulation was to improve the spatial structure of existing greenhouse horticultural areas, by financing the destruction of obsolete greenhouses and the structural improvement of existing greenhouses.

### *Regional government*

- Investment Budget for Rural Areas (Investeringsbudget Landelijk Gebied, ILG). A budget provided by the national government for the organisation and management of rural areas. The budget can be used by provinces to meet the national objectives with respect to rural areas, which are specified per province. Regarding greenhouse horticulture, national objectives are clustering and reconstruction. The legal basis for the ILG has been recorded in an act (Wet Inrichting Landelijk Gebied).
- Infrastructuurregeling Glastuinbouw. This regulation supports the development and improvement of infrastructure in two Greenports (Westland and Aalsmeer). The regulation is currently inactive and there is uncertainty about whether this will be opened again in the future.
- Regular budgets which reserved by provinces for regional development.
- European structural funds. These funds are allocated by the European Union for two related purposes: support for the poorer regions of Europe and support for integrating European infrastructure, especially in the transport sector. With respect to spatial planning, the two most important structural funds are the European Regional Development Fund (ERDF) and the European Social Fund (ESF).
- Space for space regulation (Ruimte voor ruimte regeling). The objective of this regulation is to improve the spatial quality of rural areas by the destruction of company buildings and greenhouses outside areas with a concentration of greenhouse horticultural production. A horticultural producer can receive 'building rights' in return for the destruction of his greenhouse, which he can then sell to third parties. Thereby, he can finance the costs of the destruction. The regulation has been in force since 2003 in the South Holland province.

### *Municipalities*

- Outline plan housing municipality Westland (Raamplan woningen gemeente Westland): see report Herstructurering glastuinbouw Bommelerwaard, A. van der Knijff.

### *Other regulations*

- Foundation Reconstruction Westland (Stichting herstructurering Westland); see report mentioned above.
- Storage operations Greenhouse Horticulture The Netherlands (Stallingsbedrijf Glastuinbouw Nederland): see report mentioned above.

### 3.3 Energy and environment

#### 3.3.1 Agreements between the government and sector

As part of the Dutch energy policy, the government has been making Long-Term Agreements (LTA's) or covenants with various energy-intensive sectors. Within this context, the horticultural sector has signed the Greenhouse Horticulture and the Environment Covenant (Convenant Glastuinbouw en Milieu, GlaMi), which contains objectives regarding the performance of horticulture with respect to energy and environment. According to this covenant, objectives to be achieved in 2010 are:

- 65% improvement in energy efficiency compared to 1980 and 4% contribution of sustainable energy to the total energy input;
- 72% reduction in pesticide use for the cut flower sector and 88% for the greenhouse vegetable sector, compared to the average use in the period 1984-1988;
- reduction in phosphate and nitrogen emission of 95% compared to 1980.

The objectives of the Greenhouse Horticulture and the Environment Covenant have been translated into standards for individual greenhouses, which are recorded in the Greenhouse Horticulture Decree (Besluit Glastuinbouw). Also, the decree comprises all regulations that apply to greenhouse horticulture and which were formerly included in a number of more general Acts, the most important of which are:

- Environmental Management Act (including implementation of EU directive 2004/35/EG on environmental liability (EU, 2004a)), which requires certain companies to have an Environmental permit;
- Surface Water Pollution Act, which requires companies to have a permit for direct discharge of waste water into the surface water;
- Pesticides Act, which requires the application of pesticides according to legal instructions for use.

The Greenhouse Horticulture Decree includes a yearly registration commitment. To monitor the compliance with standards for energy use, crop protection products, and fertilizers, horticultural companies have to submit an environmental report to a foundation that collects, registers and analyses this data (Uitvoeringsorganisatie Integrale Milieu Taakstelling, UO). Since 2005, the reports have had to be submitted through an accredited expert (Boone et al.,

2007). The environmental reports include data on energy use, nutrients (nitrogen and phosphate), and crop protection products. They also contain a growth plan for the next year, based on which individual greenhouse norms for gigajoules of energy, kilograms of fertiliser and crop protection products are determined.

### 3.3.2 Additional legislation regarding energy and environment

Apart from the aforementioned agreements, the legal framework for the greenhouse horticultural sector includes other important legislations concerning energy and environment.

- Packaging Decree ('Besluit Verpakkingen'). This Decree results from the EU Directive 2004/12/EG on packaging and packaging waste (EU, 2004b). According to the Decree, as from January 2006 all producers and importers of packaged products and packaging are financially responsible for the collection and recycling of packaging waste. As from January 2008, these companies also have to pay a packaging tax, to finance the separated collection of packaging material.
- Light emission. Since April 2005, the Greenhouse Horticulture Decree has obliged growers to avoid horizontal light emission (through the side walls). Vertical, upward light emission should be restricted in the period between 1 September and 1 May. During these months, at least 95% of the upward light emission should be screened between 8.00 and 12.00 pm. (VROM).
- EU Directive on energy end-use efficiency and energy services. This directive aims at an improvement of 9% in energy-efficiency in 2016 compared to the average energy use in the reference period (2001-2005 for the Netherlands). The directive excludes companies to which the EU emission trade system applies, which currently include approximately 75% of the Dutch greenhouse companies.
- European Water Framework Directive. Since 2000, the responsibility of countries to ensure high water quality is internationally guaranteed by the European Water Framework Directive (EWFD). The goal of this directive is to ensure that 'the quality of the surface water and groundwater in Europe reaches a high standard ('good ecological status') by the year 2015' (EU, 2000). The expected consequences of the EFWD for companies are stricter environmental requirements with respect to the use of harmful products.
- EU Directive on CO<sub>2</sub> Emission Trade. This directive prescribes that all EU member states should set up a system for CO<sub>2</sub> emission trade as from

2005. Mostly large industrial companies are involved in this European trade system (but see next subsection).

### 3.3.3 Practical implementation

#### *Energy transition*

The current energy policy aims at realising the objectives for 2010. To obtain a sustainable energy policy in the long term, a second path was initiated in 2001, aimed at energy transition. Energy transition involves a structural change towards sustainable energy management within a 50-year period. To achieve this, seven themes have been formulated on which energy transition should focus. One of these themes is the 'Greenhouse as Energy Source', in which the Ministry of Agriculture, Nature and Food Quality collaborates with the Product Board for Horticulture and the sector. Their ambition is that, as from 2020, newly constructed greenhouses should produce crops in a climate-neutral way, have strongly reduced the use of fossil energy, and act as a supplier of sustainable heat and electricity (SenterNovem, 2007).

In January 2008, the second phase of the Emission Trading Scheme in the EU (EU-ETS) started. All combustion units with an installed heating capacity of more than 20 MW<sub>th</sub> (th = thermal) are obliged to participate in this scheme. In the Netherlands, this corresponds to almost one hundred greenhouse horticultural growers. For the greenhouses that do not have to participate in the EU-system, the government and sector are currently investigating the possibilities of a separate CO<sub>2</sub> emission system for the greenhouse horticultural sector. At the moment, Dutch greenhouse growers are rewarded for their efforts to improve energy efficiency by qualifying for lower energy tax rates.

#### *Emission trade*

There are two emissions trading programs in the Netherlands, a European system for greenhouse gas emissions (CO<sub>2</sub>) and a Dutch system for NO<sub>x</sub> emissions. These programmes are included in the Environmental Management Act (Wet milieubeheer). The CO<sub>2</sub> emissions trading program was developed to implement the European Directive on the European Emission Trading Scheme (2003/87/EC). The directive requires Member States to develop a National Allocation Plan (NAP) and to indicate how they intend to allocate the allowances to the individual installations.

#### *Green Label Greenhouse*

The government stimulates environmentally friendly horticultural producers by means of the Green Label Greenhouse certificate. Horticultural producers that have this certificate can join the Green Projects Facility and obtain fiscal advantages when investing in energy and/or environmentally friendly machinery (see below). To obtain a Green Label Greenhouse certificate, greenhouses have to meet strict requirements regarding energy use, nutrients, crop protection and water use (SMK, 2007).

#### *Research programs*

Both the national government and the greenhouse horticultural sector strive for a greenhouse horticulture that is sustainable with respect to economics, environment, and labour. To improve energy efficiency, the Ministry of Agriculture, Environment, and Food Quality and the Horticultural Product Board provide finance for research, education, communication and demonstration projects. The main objective of the financed activities is to search for opportunities for the further increase of energy efficiency for greenhouse horticultural crops and production systems and to decrease burdens for application of energy-saving techniques by entrepreneurs.

### 3.3.4 Subsidies and grants

#### *EU support*

- EU Seventh Framework Program (FP7). FP7 provides financial support for international cooperation in research and technological development. One of the thematic sub-priorities in FP7 is Energy. The objective of this theme is to adapt the current energy system into a more suitable, competitive and secure system. It should also depend less on imported fuels and use a diverse mix of energy sources, in particular renewables, energy carriers and non polluting sources.
- Intelligent Energy - Europe II (IEE-II). The IEE programme financially supports non-technological projects, the aim of which is to realise a greater share of renewable energy by removing non-technical barriers, improving market access, and increasing awareness. IEE-II is available for companies, knowledge centres, NGO's, governments and intermediaries who want to work together at European level.

#### *Development of new technologies*

- Knowledge vouchers. Agricultural (including horticultural) companies can request knowledge vouchers, which can be used to have questions regarding knowledge of products, processes, or services answered by a knowledge institute. The objective of these vouchers is the exchange of knowledge between knowledge institutes and agricultural companies.
- Energy Research Subsidy (Energie Onderzoek Subsidie, EOS). A programme that stimulates the development of new technology with the objective of realising sustainable energy management. The programme provides financial support to companies and knowledge institutes.
- New Energy Research (Nieuw Energie Onderzoek, NEO). Provides financial support for the initialisation of unconventional research projects that contribute to sustainable energy management. NEO provides support for only a short period; successful pilot projects qualify for financial support by the EOS programme.
- Research programme Product Board for Horticulture. Stimulates technological and applied research to elevate the position of the Dutch horticultural sector. Research projects can be performed by research institutes, as well as private research and consultancy companies.

#### *Introduction of new technologies*

- Technology Fund Horticulture. Provides subsidies and credit for the promotion and support of technological innovation in horticulture. The fund is available for initiatives of at least two agricultural entrepreneurs whose main activity involves greenhouse or arable crop production.
- Unique Opportunities Regulation (Unieke Kansen Regeling, UKR). This regulation facilitates the market introduction of techniques that contribute to energy transition. The regulation supports projects in which commercial and non-commercial parties work together to realise sustainable energy management.
- Innovation subsidy cooperation projects (innovatieregeling samenwerking-sprojecten): stimulates national and international technological cooperation between different companies, and between companies and public research institutes. Finance is provided for pre-competitive development, industrial research, and feasibility studies.

#### *Application of new technologies*

- Market introduction Energy-Innovations (Marktintroductie energie-innovaties, MEI) (2008). This governmental support programme subsidises investments

- in innovative energy systems in greenhouse horticulture (ca. 40%), the objective being to increase energy efficiency and reduce CO<sub>2</sub> emission.
- Energy Investment Allowance (Energie Investerings Aftrek, EIA). This tax relief programme gives a direct financial advantage to Dutch companies that invest in energy-saving equipment and sustainable energy.
  - Investment in environmentally friendly machinery. The Dutch government has established two tax relief programs, MIA and Vamil, that give a direct fiscal advantage to companies that invest in environmentally friendly machinery. Only companies with a Green Label certificate qualify for these programs.
  - Stimulation of environmentally friendly energy production. The Sustainable Energy Production Support Regulation (Stimuleringsregeling Duurzame Energieproductie, SDE) is intended for growers that invest in projects relating to renewable electricity, renewable gas, and Combined Heat and Power (CHP). The regulation will become applicable in 2008. A different, comparable, regulation had been applicable up to 2007.
  - Green Projects Facility (Regeling Groenprojecten). Stimulates environmentally friendly projects by enabling financing against a lower tax rate. Only companies with a Green Label certificate Plus qualify for this facility.

### **3.4 Product and marketing**

#### 3.4.1 Food safety

Food safety issues are governed by regulations and directives established at EU level. The general principles of the EU Food Law are recorded in EU Regulation 178/2002 (EU, 2002). At national level, this regulation is embedded in the Commodities Act (Warenwet), which includes amongst others:

- the prohibition of distribution of food products that carry a threat to the health or safety of persons and of trading raw materials that, once processed into food products, cause the product to be inferior and, thereby, threatens human health or safety;
- the prohibition of distribution of food products that are not suitable for consumption and of food products that are damaged in such a way that the utility derived from consumption is less than may reasonably be expected;
- the prohibition of using medical claims in advertising food products.



Since 1992, European regulation has placed full responsibility for the quality of consumer products with the producer. Yet, producers can hold retailers (for example, supermarkets) responsible for any damage resulting from consumption of inferior products. Consequently, retailer organisations have implemented strict quality and food safety control systems with their suppliers.

Maximum Residue Limits (MRLs) represent the concentrations of pesticides that remain in or on the marketed product despite the grower's compliance with legal requirements for the use of crop protection products. The EU has designed a Pesticide Residue Regulation (EU, 2005), on the basis of which MRLs for crop protection chemicals in agricultural products can be established only at European level. For chemicals without European authorisation, a general minimum MRL (limit of detection) will apply in most cases. The MRLs that currently apply in the Netherlands are included in the Pesticides Act.

### 3.4.2 HACCP and quality systems

Vegetable, fruit and other food product companies have the legal obligation to produce their products according to a HACCP system (Hazard Analysis Critical Control Points). Hygiene measures apply to primary producers. Hygiene and HACCP are regulated by the EU Food Hygiene Regulation (EU, 2004c). This regulation is implemented in the Netherlands by the Regulation of Hygiene of Food Products ('Warenwetregeling Hygiëne van Levensmiddelen').

HACCP systems are often part of a quality system. While a HACCP system specifically captures potential threats during production, quality systems have a broader perspective. Hygiene codes are one example of quality systems. The Product Board for Horticulture has developed a number of hygiene codes for companies at different levels of the horticultural production chain. These hygiene codes provide support in meeting the contents of the above-mentioned regulation. The hygiene codes have been approved by the Ministry of Health, Welfare and Sport. The hygiene code for primary producers are an exception, as the hygiene legislation does not (yet) apply to this level of the production chain.

At international level, a widely acknowledged food safety control system for primary producers is EurepGAP (GAP = Good Agricultural Practice), which was introduced by the Euro-Retailer Produce Working Group (Eurep). Growers who are EurepGAP certified automatically meet the requirements of the hygiene code. Since the beginning of 2008, EurepGAP has changed into GlobalGAP, as the system is being increasingly applied across the world. Another well-known international quality system is ISO 9000 (ISO = International Organisation for

Standardisation). ISO 9000 defines which elements should be part of a quality system, but should leave the interpretation of this to the company. A more specific ISO standard, ISO 22000, was developed several years ago for food safety systems based on HACCP.

### 3.4.3 EU trade policy

The EU has established trade standards for a large number of fresh vegetables and fruit. The objective of these standards is to promote international trade in vegetables and fruit by providing transparency guaranteeing free transport. The standards distinguish product quality classes that should be applied in all stages of trade (internal market, import and export). The standards also apply to retail. The global harmonisation of trading standards is accomplished by two international organisations, the UN-ECE and the Codex Alimentarius.

A number of fresh vegetable and fruit products are protected against low-priced import from third countries, by means of (fixed) import regulations. Among these are two of the three most important Dutch greenhouse horticultural products, which are tomatoes and cucumbers. In addition, export restitutions (i.e. subsidies on products that, under certain conditions, are exported outside the EU) are given to countries when certain fresh vegetable and fruit products are exported. Of these products, only tomatoes are grown in Dutch greenhouse horticulture. Export restitutions may vary per country of destination.

An EU support system is in place for producer associations that supply tomatoes, peaches, pears and citrus fruit, produced in the EU, to be processed into certain products. The supply of these products to authorised processors is based on contracts which show the amount, price, and a supply scheme.

### 3.4.4 Producer associations

The EU provides financial support to acknowledged producer (grower) associations for the foundation of action funds, by which they can become important channels for the sales of vegetables and fruit. The major objectives of producer associations are:

- assuring that production is organised and demand-driven, particularly with respect to quality, traceability and quantity;
- stimulating the concentration of supply and marketing of products produced by members;

- improving technical and economic crop management and stabilising producer prices;
- improving the use of cultivation methods, production techniques, and environmentally friendly methods for waste management, particularly to protect the quality of water, soil and landscape and to maintain or improve biodiversity.

Membership of a producer association is voluntary. However, in general, members are obliged to market their entire production through the association. In the event of a market surplus, producer associations have the right to take products that are included in the Single CMO Regulation (EU regulation 361/2008) out of the market, in order to protect the market price. The producer associations have to finance this withdrawal themselves, although a limited financial compensation is provided by the EU for certain products.

In 2007, the common market association for fruit and vegetables was reformed. In the new Common Market Organisation, producer associations will gain greater flexibility and receive additional support in regions where production that they cover is less than 20 percent. In addition, they are offered a wider range of tools for crisis management, such as circumstances that lead to large market surpluses.

#### 3.4.5 Subsidies and grants

- Joint Promotional Activities programme (Collectieve Promotie Actiteiten, CPA). The programme aims at stimulating export by supporting Dutch companies in finding suitable foreign business partners. The programme stimulates the organisation of collective promotional activities oriented towards foreign countries for Dutch companies, such as missions of Dutch companies to foreign markets and missions from foreign decision makers to the Netherlands. To qualify for a subsidy, a number of criteria have to be met. Amongst others, the CPA investment must lead to marketing of products in the intended country, and at least six Dutch companies must participate in the initiative.
- AKK Co-innovation Sustainable Agro-food Chains. This programme was active until 2006, and supported agricultural production chains with the practical implementation of sustainability. It aimed at facilitation of the transition towards sustainable production, and generation of the required knowledge. Within the programme, businesses can submit requests for the financing of projects, in which, together with knowledge institutions, they search for suit-

able and practical implementation of sustainability. The costs of acknowledged projects were shared by the companies, knowledge institutions, and government.

- Common Market Organisation Subsidies (CMO). The EU supports promotional and information activities aimed at quality and food safety of products that are produced within the EU, which stimulate marketing of these products inside or outside the EU. Requests for subsidisation of projects can be done by professional or sector organisations (growers' associations). Conditions that have to be met are amongst others: the products should be produced in the EU, activities should not favour products from a particular member state and should not be focused on trade marks. The EU finances a maximum of 50% of the costs.

## 4 Stakeholder impression

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This chapter evaluates how characteristics and developments in Dutch greenhouse horticulture and the related institutional framework are experienced by stakeholders in practice. By means of interviews with sector representatives, an inventory was made of positive and negative characteristics and developments at sector and policy level. The questionnaire that was used as a basis for these interviews can be found in appendix 1. Below, the most important outcomes of the interviews are discussed.

The interviews focused on the two most prominent production areas in the Netherlands: Greenports Westland and Venlo. Respondents represented one of the following three stakeholder groups: primary producers, traders, and policy makers. The inclusion of more regions or stakeholder groups would require more interviews in order to be able to relate observed differences in experiences to regional differences or position in the sector. In total, nine interviews were held; table 4.1 provides an overview of the organisations, regions, and stakeholder groups that were represented. In the following sections, the results of the interviews are discussed, first concerning the sector and institutional framework in general and subsequently for each of the four themes: labour, spatial structure, energy and environment, and product and market.

<b>Respondent</b>	<b>Organisation</b>	<b>Region</b>	<b>Stakeholder group</b>
1	Regional greenhouse growers organisation	Westland	production
2	Vegetable and fruit marketing association	Westland	trade
3	Marketing organisation	Westland	trade
4	Municipality	Westland	government
5	Provincial administration	Westland	government
6	National crop committee peppers	Venlo	production
7	Regional horticultural growers organisation	Venlo	production
8	Marketing organisation	Venlo	trade
9	Provincial administration	Venlo	government

## 4.1 General perception of the sector and institutional framework

### 4.1.1 Positive and negative sector characteristics

During the interviews, a number of general positive and negative characteristics of the sector were identified, which apply to the sector in general rather than to a particular theme. The most important of these are:

- innovative/progressive mentality;
- entrepreneurship;
- negative image.

According to most respondents, the Dutch greenhouse vegetable sector distinguishes itself from other sectors and countries by its innovative or progressive mentality. Entrepreneurship was also mentioned as a strong characteristic. Entrepreneurship is related to the former characteristic, in that innovation and progressivism are expressions of entrepreneurship. Other strengths that were mentioned which arise from entrepreneurship, are a lead in technologic development, high productivity, high knowledge level, and a willingness to take risks. This latter characteristic is stimulated by the positive attitude of Dutch banks, which base their decisions on financial support of entrepreneurs not only on facts, but also on their confidence in the success of the sector. A frequently mentioned weakness of the Dutch greenhouse vegetable sector is a poor image. Citizens experience greenhouses to be unattractive components of the landscape; they have little relation with traditional agriculture and cause light pollution. Moreover, the sector is still considered to be a major energy consumer, despite the improvements in this area during the past decade. One respondent ascribes the poor image to lack of communication of producers with local residents. Whereas the sector in general is prized for its involvement in social debates, individual producers often omit to inform their neighbours about intended adaptations that might affect them.

### 4.1.2 Ranking of themes

Respondents were asked to rank the four themes in order of their contribution to the success of Dutch greenhouse vegetable horticulture. Table 4.2 shows the average ranks (1 is highest, 4 is lowest rank), for all respondents in total and specified per region and per stakeholder group. All but one respondent considered product and market the strongest of all themes. In addition, with respect to

the contribution of other themes, there was quite some consistency among respondents. The difference in rankings of these three themes can be explained by the different backgrounds of respondents, both regionally and regarding their position in the sector. Greenport Westland lies in a highly urbanised area where the sector experiences strong competition for land, whereas in Greenport Venlo opportunities for spatial development are less restricted. Primary producers are more limited by scarcity of land than other stakeholders, as land is an important production factor for them. In contrast, government representatives are more likely to emphasise the positive fact that greenhouse horticulture is explicitly accounted for in spatial policy nowadays. Thus, the appreciation of spatial structure differs between regions and stakeholder groups, which also automatically affects the ranking of labour and energy and environment.

**Table 4.2** Average ranking of themes according to their contribution to the success of Dutch greenhouse vegetable horticulture

	Total	Region		Stakeholder group		
		W	V	prod.	trade	gov.
Labour	3.7	3.6	3.9	3.5	4	3.7
Spatial Structure	3.1	3.3	2.9	3.5	3	2.8
Energy and Environment	2.1	1.9	2.3	1.7	2	2.5
Product and Market	1.2	1.2	1	1.3	1	1.0

1 = high, 4 = low.

#### 4.1.3 Appreciation of government levels

We also asked the respondents how they evaluated the institutional framework at different policy levels: local (municipality), regional (province), national, and European. According to most respondents, the effect of local governments is dependent on the original position of greenhouse horticulture in a particular municipality. Local governments have to find a balance between a sector's interests and other citizens' interests. In municipalities where greenhouse horticulture has had a prominent position for some time, most citizens are used to the presence of greenhouses in the landscape and quite a few of them may have a job in this sector. In such regions, local governments are likely to have a positive attitude towards greenhouse horticulture. In other regions, citizens are less positive about greenhouse horticulture and local policy is more likely to be restrictive to the sector. At regional and national level, individual citizens play a

minor role, but interests of different sectors and interest groups (for example environmental, recreational) may conflict with each other. For stakeholders not personally involved in policy (i.e. producers and traders), the provinces appear to have a less obvious effect than national and local governments. In general, respondents do not consider national policy as being negative, and some even think that the national government stimulates sector development. The positive attitude of the national government towards the sector is expressed in the explicit definition of Greenports in the National Spatial Strategy and in policy standpoints with respect to innovation, trade, and phytosanitary policy. The perception of the EU government differs between respondents. To some respondents, the EU policy is restrictive, which is due to the fact that EU policy is based on average circumstances in the EU, and greenhouse horticulture in the Netherlands is ahead of these circumstances. However, other respondents consider this to be a potential competitive advantage.

## 4.2 Labour

Table 4.3 shows the major positive and negative characteristics of the sector and institutional framework regarding labour. Some remarkable contrasts are observed. For instance, the high labour intensity in greenhouse vegetable horticulture is considered to be both a strength and a weakness. Also, the institutional framework regarding education is perceived to be both a positive and a negative characteristic. Important issues discussed below are: labour supply and demand, education, and foreign labour.

<b>Table 4.3</b>	<b>Major positive and negative characteristics of the sector and institutional framework related to labour</b>	
	<b>Sector</b>	<b>Institutional framework</b>
<i>Positive</i>	- employment provider - quality of education	- quality of education
<i>Negative</i>	- shortage of employees - high wages	- low contribution to labour shortage - quality of education



#### 4.2.1 Labour supply and demand

The most frequently mentioned positive characteristic of the sector is the provision of employment. Particularly in urban areas, there is a relatively large supply of low-skilled employees. Large municipalities appreciate the employment offered in greenhouse vegetable horticulture. Additionally, the initialisation of new greenhouse horticultural production centres in areas with low economic activity can give a boost to the local labour market.

Unfortunately, the high labour-intensiveness in greenhouse vegetable production is more often considered to be a weakness rather than a strength. There is a structural shortage of both low- and high-skilled personnel in greenhouse horticulture. Several respondents believe this is at least partly due to a negative image of labour in greenhouse horticulture. Along with this prejudgment on labour circumstances, the high level of social care in the Netherlands does discourage unemployed persons to seek employment in this sector. Furthermore, the composition of the working population is moving towards a lower contribution of persons with a practical education.

The shortage of low-skilled employees is largely solved by hiring foreign personnel, particularly from Poland. Another way of dealing with the problem is to become less dependent on human labour by increasing the level of automation. Yet, automation only partly compensates the demand for low-skilled employees, as it also causes an increase in the demand for medium- and high-skilled employees. This demand does not necessarily have to be fulfilled by persons with a horticultural education. As greenhouse companies become more and more industrialised, most of the work can also be done by people with, for instance, a technical or administrative background. However, such people often still consider greenhouse companies to be traditional production facilities that offer little challenge and depth.

Almost half of the respondents (representing production and trade) expressed the need for more involvement of the government in matching labour demand and supply. Suggested government activities mentioned during the interviews were: improving accessibility of the Dutch labour market for foreign employees, and improving the link between education and the greenhouse horticultural sector. This latter aspect will be discussed in more detail in the next subsection. However, other respondents believed that fulfilment of labour demand is primarily the responsibility of the sector or individual companies.

#### 4.2.2 Education

During the interviews, education was a recurrent issue. Several respondents praise the high level of knowledge and skills of employers and employees in greenhouse horticulture. However, whereas some of them appreciate the stimulating role of the government in this, others believe that the government could do more. The level of education in the Netherlands is considered high (in terms of general education, as well as field-related), but the number of students that move on to a job in the greenhouse horticultural sector is decreasing.

There was disagreement amongst the respondents on whether an improvement of the link between education and employment in greenhouse horticulture is primarily the responsibility of the sector itself or the government, although most of them believed that both parties should be more or less actively involved. For instance, the sector has to work on its image in order to become more attractive to students. Also, individual companies can interest students by offering training positions. The government, in turn, could improve the admission of trainees to greenhouses, which is currently complicated by legislation. Additionally, the government can be held at least partially responsible for the shift in education towards more general skills, as a result of which students' knowledge of specific greenhouse processes and product characteristics is decreasing.

#### 4.2.3 Foreign labour

A current issue regarding foreign labour is housing. Several respondents addressed this point, although this is not particularly a positive or negative characteristic of greenhouse horticulture. Companies and employment agencies hiring Polish employees often face the difficulty of finding appropriate housing for these people. Most Polish employees are residing only temporarily in the Netherlands, and their prime objective is to earn money. They try to minimise their expenses, by, amongst other things, searching for low-cost housing. Consequently, they often become the victim of unreliable house owners, who offer housing under poor conditions (often shared by many people) for relatively high rental payments. These so-called rack-renters are particularly abundant in urban areas. Local governments try to solve this problem by offering housing of an acceptable quality and stimulating the integration of Polish employees into the Dutch society. They also have the task of reprimanding employment agencies that do not take responsibility for finding housing for foreign employees who they have recruited.

It is still a common thought that Polish and other Eastern European employees are underpaid by Dutch employers. Several respondents indicated that this is no longer a realistic assumption. Legally employed Polish and Dutch persons are covered by the same working conditions, recorded in the Collective Labour Agreements. Moreover, the growing labour market in Poland has resulted in an increase in wages in Poland, which reduces the likelihood that Polish employees would accept low wages in the Netherlands. Also the prejudice that Polish employees work harder cannot be understated in practice. However, Polish employees are generally more flexible in terms of their employability. As their main goal is to earn money while they are in the Netherlands, they are willing to work more hours. Yet, legislation regarding foreign employees will remain important in order to prevent misuse regarding their housing and labour conditions.

### 4.3 Spatial structure

The most important observations during the interviews are summarised in table 4.4. The government initiatives regarding spatial structure (more clustering and creation of space for greenhouse horticulture) are generally acknowledged and appreciated by most respondents. However, there are some differences in opinions regarding these initiatives and the approach chosen to implement them. Also, experiences regarding infrastructure vary amongst respondents. The following topics will subsequently be discussed in more detail: competition for space, clustering, the role of the government, and infrastructure.

<b>Table 4.4 Major positive and negative characteristics of the sector and institutional framework related to spatial structure</b>		
	<b>Sector</b>	<b>Institutional framework</b>
<i>Positive</i>	- Development of Greenports - Logistic position	- Support of regional development - Providing space Contribution to infrastructure
<i>Negative</i>	- Land-demanding Congestion	- Wrong focus in clustering

#### 4.3.1 Competition for space

A major negative characteristic of the greenhouse vegetable sector regarding spatial structure is its high demand for land. Traditional greenhouse vegetable

production areas are located in or close to urban areas, resulting in strong spatial competition with other functions, such as housing. This results in an exceptionally high price for land in these areas. One would expect that horticultural producers would respond by moving to less densely populated areas or even to other countries. However, this is not what happens in practice. Respondents indicated several possible explanations for this.

- Greenhouse vegetable horticulture has a relatively high production value per m<sup>2</sup>. Consequently, they can afford to pay a higher price for their production factors than other agricultural (including horticultural) sectors. Also, other agricultural sectors require even more land than greenhouse horticulture. Greenhouse horticultural companies thus have a stronger competitive position than other agricultural sectors.

- Light. Yearly averages on light intensity and availability show that the coastline absorbs the largest amount of light, with the highest intensity. The lowest light intensity is measured in the Northeast of the Netherlands. Light is an important input for greenhouse vegetable production; just a low percentage change will already have considerable consequences for the total production volume.

- Central location. Companies consider the proximity of supplying, trading, and transporting agribusiness, as well as knowledge, to be a competitive advantage.

- Social aspect. Horticultural producers often feel emotionally attached to the region in which they have grown up. Moreover, regions with low spatial competition are often less urbanised and, therefore, less attractive for family members. Also, cultural differences between urban areas and 'empty' areas can be considerable.

The high pressure on land has resulted in a dichotomy between growers in urban areas. One category of growers gives up the struggle for space and decides to sell its land at a high price. This creates space for growers in the other category, who choose to invest in expansion of their company. Competition for land has also forced producers to make more efficient use of land. This has resulted in a high production per m<sup>2</sup>, and the current trend of multi-layer use of space.

#### 4.3.2 Clustering in Greenports and other locations

Almost all respondents favour the concept of Greenports. Greenports are a positive example of joint initiatives of sector and government. Assignment of the Greenports by the national government has put the sector on the agenda of regional and local governments, which are responsible for practical implementa-

tion of the spatial planning policy. Additionally, it emphasises the economic importance of greenhouse vegetable horticulture in the designated areas, which contributes to social acceptance of land allocation to the sector. Furthermore, the concentration of all functions related to greenhouse horticulture in one area stimulates chain integration, which adds value to the whole sector.

Less unanimity among respondents was observed regarding the development of new greenhouse vegetable production centres in other regions of the Netherlands. Some respondents emphasise the amenity of clustering of greenhouse vegetable production in areas where this does not compete with housing construction. Spatial clusters allow for more efficient production, sales, and transport; they provide agglomeration advantages. One example of a growing spatial cluster is Wieringermeer; not only greenhouse companies, but also market organisations have recently established themselves here. Clustered greenhouse companies can share facilities; for instance, in the Bergschenhoek cluster, horticultural producers make use of heat buffering (the surplus of one producer is used by another). Also, greenhouse horticulture can be beneficial to its surrounding area, as a provider of energy or - in the future - heat.

In contrast, other respondents are sceptical about the development of new areas. They believe that producers have a stronger position if they are located within or in the proximity of Greenports, where agribusiness is concentrated. In this respect, the establishment of agribusiness in Wieringermeer is considered to be an exception rather than the rule. Another perceived disadvantage of new clusters is that they allow for the establishment of mega-companies; greenhouses can be sized up to 100 ha. Such companies have a considerable impact on the total supply of Dutch vegetable products, and can cause market imbalance if production incidentally stagnates. In addition, such companies take high financial risks and lean heavily on investors (for example, banks).

In line with the abovementioned considerations, respondents observe a differentiation between growers in or near to Greenports and growers in other greenhouse horticultural clusters. The former experience a strong competition for space and generally focus on product differentiation and quality. The latter have a weaker connection with other chain segments and generally aim for cost minimisation, which they realise through scale increase.

#### 4.3.3 Involvement of government

The national government has formulated general objectives for the spatial development of greenhouse horticulture. However, these objectives are not spatially specified; Greenports and other concentrations of greenhouse horticulture

are defined by their economic activities and not by explicit spatial boundaries. This allows plenty of room for interpretation and practical implementation of the objectives by regional and local governments. Whether these governments are supportive or restrictive towards the greenhouse vegetable sector is highly dependent on the region. Factors such as the traditional position of greenhouse horticulture in an area, spatial competition with other functions, and political composition of the local and regional government, play a role in this.

Several respondents consider the local and regional government as being predominantly restrictive. Intentions may be positive, but, in practice, little progress is observed regarding the creation of space for development or expansion. Municipalities still frequently give priority to housing construction. One reason for this is the, already mentioned, strong resistance among citizens to spatial development of greenhouse horticulture. The final decision is down to the local policymakers, but these persons are elected by the local population and thus run the risk of losing votes in future elections. Moreover, land designated for housing construction has a much higher value than land designated for horticulture, so there is an economic incentive to withdraw land from greenhouse horticulture. Even in Greenport Westland, the net acreage of greenhouse horticulture is decreasing. However, there are also positive developments. Provinces stimulate the development of new greenhouse horticultural clusters and are actively and financially involved in these processes. This has resulted in several projects in which local and regional governments and business cooperate. Furthermore, legislation regarding zoning plans has become more flexible in order to contribute towards scale increase in greenhouse horticulture.

Governmental representatives indicated that inconsistency between different governmental parties sometimes hinders their contribution to spatial development of greenhouse horticulture. One reason for this is the difference in interests. Provincial governments have to implement national objectives at a regional level, for which they in turn are dependent on the cooperation of municipalities. However, at national level, objectives of the separate departments may be very different and may even conflict. Also, objectives and active involvement of national government may change over time due to changing composition of the parliament. On the other hand, municipalities may have difficulties with committing themselves to regional choices as they are more emotionally involved with inhabitants.

#### 4.3.4 Infrastructure

The infrastructure was mentioned as being both a strength and a weakness of the Dutch greenhouse vegetable sector. Originally, the infrastructure provided a basis for the strong position of the sector. Greenport Westland and Venlo both have a strong position in terms of their logistics, with a site close to the main port Rotterdam and to the neighbouring countries of Belgium and Germany. In addition, good logistics are available around auctions and trading companies. However, the infrastructure is now turning into a negative characteristic as congestion increases. The designation of new production centres outside Greenports is likely to worsen this situation. Consequently, transport times increase and it becomes increasingly more challenging for traders to comply with supply times. The government is taking measures to improve the infrastructure. At the same time, however, sector representatives experience opposition as the government discourages road transport to stimulate the use of public transport.

#### 4.4 Energy and environment

Table 4.5 summarises the most frequently mentioned positive and negative developments regarding energy and environment. The general observation is that considerable improvements have been made, but much improvement is still to be made. Table 4.5 suggests that the institutional framework for energy and environment is perceived as being very positive by all respondents. This is, however, not the case; in fact, negative aspects were also mentioned, but there was too little consensus to draw any general conclusions from this feedback. However, this will be mentioned in the subsections below, which focus on energy efficiency, sustainable production, and government support.

<b>Table 4.5 Major positive and negative characteristics of the sector and institutional framework related to energy and environment</b>		
	<b>Sector</b>	<b>Institutional framework</b>
<i>positive</i>	- clean, sustainable production - increased energy efficiency	- support for innovation / knowledge - support for introduction / investment
<i>negative</i>	- no sustainable energy consumption <i>yet</i>	

#### 4.4.1 Energy efficiency

The interviews identified the sector's capability of switching from a bulk consumer to a producer of energy, as one of its major strengths regarding energy and environment. The sector has managed to achieve a great increase in the efficiency of energy consumption. An important driver for this trend is the high energy price; energy is one of the largest cost factors for greenhouse vegetable producers. Additionally, most respondents believe that the improvements have been partly enabled, or at least stimulated, by government support. As greenhouse producers introduce energy-saving innovations at different rates and scales, energy costs and thus product cost prices, show an increasing variation between companies.

The introduction of CHP installations is causing an increasing number of greenhouse companies to become suppliers of energy. Several respondents consider this to be an opportunity for the sector to fulfil other functions, besides the production of vegetables, within a region. Thereby, the greenhouse horticultural sector provides a considerable contribution to a sustainable society. A realistic near-future scenario is the development of decentralised energy webs, where greenhouse vegetable production supplies (part of) the energy to other spatial functions, such as hospitals and business parks. One respondent mentioned that the realisation of such a scenario requires a more intersectoral approach of the government.

While energy consumption has become much more efficient, improvements are still possible and desirable. According to some respondents, a majority of companies still suffer large energy leaks. Also, further innovations, such as CO<sub>2</sub> storage in the winter months, could enable a higher energy efficiency. Furthermore, most respondents admit that is not yet *sustainable*. The majority of energy is still produced using fossil fuels. The next step is to produce energy from waste products or renewable resources. In order to make innovation along these lines economically attractive, products produced by sustainable energy should have an added value that is acknowledged by consumers.

#### 4.4.2 Sustainable production

A second important positive sector characteristic regarding energy and the environment is the clean and sustainable production process of Dutch greenhouse vegetables. Greenhouse vegetable producers make very little use of crop protection chemicals. According to one respondent, Dutch conventional green-



house vegetables may even be 'cleaner' than organic vegetables from other countries. The criteria for organic production are determined at national level. In the Netherlands, standards for organic production are rather high. Organic products, amongst others, have to be produced on soil (as opposed to substrate), as a result of which few greenhouses qualify for a certificate of organic production. Another environmental aspect that has improved over the past few years is water management. However, changing legislation makes it increasingly difficult for producers to obtain good-quality water. Also, local and regional governments are expecting problems in the near future regarding water storage.

The increased sustainability of production is considered to be one of the successes of the GLAMI covenant. According to some respondents, this joint initiative of sector, government, and societal interest parties is unique and underlines the goodwill of the sector. Some respondents believe that an institutional framework regarding sustainable production is important, as growers have no economic incentive for improvement. On the other hand, other respondents note that retailers have stricter requirements than prescribed by the government. Producers find difficulties in meeting these requirements, although some consider this to be an opportunity for strengthening the competitive position of the sector. Nevertheless, there is a conflict of interest between retailers and producers on this issue, which may make governmental support desirable.

A weaker aspect regarding the environment is light emission, which is assumed to be one of the causal factors for the poor image of the sector. Technological innovations and a covenant between sector, government and environmental parties are supposed to reduce light emission. However, not all respondents are positive about the effectiveness of these measures. Light-emission-reducing innovations are implemented at a rather slow rate. In addition, compliance with the covenant hardly occurs, and individual growers generally do not let one another down.

#### 4.4.3 (Financial) government support

The improvements in energy efficiency and sustainable production are largely realised through technological and process innovations. The government tries to facilitate the development and application of these innovations through subsidies and other financial benefits.

Most respondents consider to be of particular importance the financial support of research aimed at the development of knowledge and innovation. Additionally, the introduction of innovations is thought to be stimulated by

government support. Entrepreneurs who are among the first to introduce an innovation, often take high risks, as the innovations have not proven to be profitable in practice. Subsidies or (financial) involvement of the government in such projects can cover the highest risks for these entrepreneurs. Subsidisation of development and the introduction of innovations is also desirable from the government's perspective. Greenhouse horticulture can contribute to the national objective of increasing energy sustainability and efficiency. Moreover, practical examples of well-functioning innovations stimulate their wider application.

Regarding the subsidisation of the implementation of innovations that have already been introduced at larger scale, respondents are less unanimous. Some believe that, without government support of investments in innovations, these investments would be less profitable and innovations would not have been applied at the same rate than that observed in practice. One example of this is the closed greenhouse systems, which have recently been introduced on a small scale, but which are not yet profitable. Nevertheless, they admit that once an innovation has proven to be profitable, financial support should be ceased. This is in line with the comment of other respondents that innovations are primarily driven by cost-price-reducing objectives. Other respondents consider government initiatives rather unsuccessful. An example is the Green Label Greenhouse; requirements for obtaining this certificate have become unrealistic. Other subsidies, such as those aimed at the introduction of CHP installations, have stimulated an increase in scale and are only attractive to large (groups of) greenhouse companies. Another reported disadvantage of government subsidies is that their accessibility is uncertain (subsidies are often available for a limited time) and that application procedures are time-demanding.

#### **4.5 Product and market**

The perceived positive and negative characteristics related to product and market are summarised in table 4.6. As already indicated by the empty column for institutional framework, the government plays a minor role in this theme. Developments are mainly driven by market forces. Respondents mentioned mainly positive characteristics, which is in line with the observation in section 4.1 that product and market is the highest ranked theme. Nevertheless, respondents also had some criticism about observed trends, which will be discussed below. The discussion is arranged according to the following main issues: organisational structure, market position and orientation, and product quality and safety.

Table 4.6	Major positive and negative characteristics of the sector and institutional framework related to product and market.	
	Sector	Institutional framework
<i>Positive</i>	<ul style="list-style-type: none"> <li>- Strong organisational structure</li> <li>- Strong market position /orientation</li> <li>- High product quality/safety</li> </ul>	-
<i>Negative</i>	<ul style="list-style-type: none"> <li>- Supermarket power</li> <li>- Poor market orientation</li> </ul>	-

#### 4.5.1 Organisational structure

Most respondents consider the greenhouse vegetable sector to have a strong organisational structure. In this respect, they value the changes in organisational structure that have taken place in the 90s as being positive; it has created room for individual development and differentiation. The production chain has become shorter, which has reduced production costs and the time from production to consumption. Also, primary producers and suppliers (for example of seed) can pick up market signals more easily. Auctions have shifted towards a more personal and transparent sales system. Over all, the traceability of products has increased. One respondent adds that the traceability of products in supermarkets to the level of individual growers would make producers even more critical towards their product. Yet, this incentive has to be created by market forces.

Additionally, the establishment of growers' (and sales) organisations is generally considered to be a positive development. Growers' organisations have more influence and power than individual producers. Also, certain initiatives of growers' organisations qualify for CMO subsidies, which are unavailable to individuals. However, a few respondents believe that the collapse of the auction structure has resulted in too many small parties, which have no competitive power against large retailers. Larger organisational units of suppliers may be of more interest to supermarkets, as they can offer a broader product range. In addition, large parties stimulate communication and cooperation and are thought to be more influential. A positive example in this respect is the establishment of P8, a cooperation of nine pepper growers' organisations that, together, focus on the interests of pepper producers.

#### 4.5.2 Market position and orientation

A frequently mentioned positive characteristic that is related to organisational structure is the strong international market position. This position is at least partly owed to the international importance of main port Rotterdam. Besides a large domestic production, there is a continuous flow of vegetable products in and out of the country. Consequently, the trading processes that take place in the Netherlands determine, to a large degree, the international price of vegetable products. Another reason for the strong market position of the Netherlands is the price-oriented consumer behaviour. In contrast to consumers in many other countries, Dutch consumers attach little value to the origin of vegetables. This has stimulated the international market orientation of Dutch vegetable producers. An additional advantage of the international orientation of Dutch greenhouse horticulture is that the sector traditionally has a broad logistics network, which enables a quick response to foreign demand.

Some respondents believe that the change in organisational structure has also improved market orientation of the Dutch greenhouse vegetable sector. The change in structure has improved the capacity of producers to enable them to respond quickly to specific market demands. Other respondents are less enthusiastic about the sector's market orientation. Some of them believe that the sector focuses too much on scale increase, which stimulates production volume, but not quality. CMO subsidies contribute to this trend by offering financial support for large-scale initiatives. Moreover, while product innovation may have gained more attention in the past decade, the sector is still insufficiently capable of marketing new products. Other problems that have been mentioned are that product innovation takes place without exactly knowing the type of innovation that is demanded by consumers, thus new products are adopted at too large a scale, which causes overproduction and, therefore, a low price, and new products become increasingly different to existing products.

A markedly weak aspect of the Dutch sector regarding market position is the imbalance between the power of supermarkets and suppliers (both producers and sales organisations). Supermarkets band together internationally and form a few very large retail organisations. In contrast, producers and traders have few international contacts. The supermarkets determine which product becomes available to consumers at which price. Consequently, it becomes more difficult for producers to match their supply with the demand of consumers. Moreover, strong price competition between the major supermarkets causes price margins to become smaller, of which the producers are the victims. Some

respondents suggest that the government should examine whether this form of unfair competition is still legally acceptable.

#### 4.5.3 Product quality and safety

The Dutch greenhouse vegetable sector considers itself as a leader in product quality and safety. Production under glass requires little pesticide use, enables year-round production and minimises fluctuations in product quality. Also, the central logistics position of the Netherlands allows for short transport times. Other countries often have to contend with longer transport times, as a result of which they are forced to choose varieties that have a longer storage life, but are thus often less tasty. Whilst the high quality of Dutch products is considered a strength, it is also considered a necessity; in the long run, other countries may surpass the Netherlands in terms of production volume, as any increase in production in the Netherlands is restricted by limited space.

The high product quality is stimulated by market requirements such as GlobalGAP certification. One perceived disadvantage of GlobalGAP is its relationship with national legislation, which makes its requirements country-specific. As a result, it is more difficult for Dutch producers to obtain the certificate than for other countries. On the other hand, this can be seen as a competitive advantage of Dutch products. Unfortunately, so far the sector has not yet managed to translate the difference in quality with other countries into an added value of their products. This is due to the low market emotion of Dutch consumers which was mentioned above.

#### 4.6 Differences between regions and stakeholder groups

The experiences and opinions of respondents were analysed with respect to differences between regions and stakeholder groups. Comparing interview results of respondents in different regions did not reveal any true differences. A few aspects that respondents in the two regions initially seemed to disagree on appeared to be caused by a bias in the representation of stakeholder groups per region. When looking at stakeholder groups, a few general, though weak, trends were observed.

- Contribution of the government: Respondents representing governmental organisations were more positive about the contribution of the government to the Dutch greenhouse vegetable sector than producers and traders. This makes sense, as these stakeholders are personally involved in government

activities that affect greenhouse horticulture and are less likely to be negative about these activities than others would be.

- Infrastructure: most primary producers and government representatives mentioned the strong logistic position, while trade representatives stressed the problem of congestion. Obviously, trade representatives are more directly affected by the disadvantages of congestion (long transport times) than the other two groups of stakeholders.
- Product and market: Most comments on this theme came from production and trade representatives; government representatives only had a few comments. This is in line with the observation that the government contributes little (both positively and negatively) to this theme; product and market developments are largely determined by economic (market) incentives.

The primary objective of the interviews was to collect experiences and opinions of sector representatives regarding the four major themes addressed in this report. To avoid steering respondents in particular directions and to stimulate them to talk about what they really consider to be important, the questions were kept as generic as possible and interviews were rather relaxed. While this approach results in a broad inventory of actual developments and concerns in greenhouse vegetable horticulture, it is less suitable for the analysis of correlations between particular observations and characteristics of respondents. In addition, a larger number of interviews is probably required in order to identify subgroups within the total population of respondents, based on their regional origin and position within the sector.

## 5 Synthesis: current and future perspectives of Dutch greenhouse vegetable horticulture

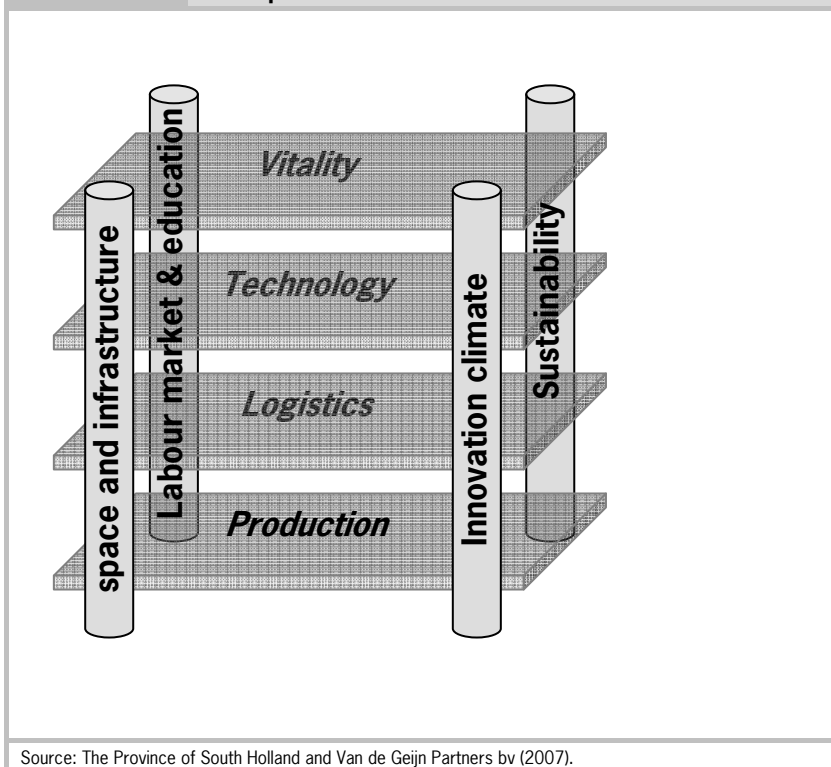
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This chapter concentrates on the evaluation of the contribution of sector and government to historic and current developments, and the position of Dutch greenhouse vegetable horticulture. The information and results from the previous chapters will be used to outline current strengths and weaknesses. Also, future perspectives and possibilities for further improvement of the Dutch greenhouse vegetable complex are discussed. The outline will be structured according to the theoretical 'Greenport building' (figure 5.1), which was developed by the Province of South Holland in cooperation with Van de Geijn Partners bv (2007). Although this concept was particularly developed in order to analyse the structure of Greenports, it also applies to the greenhouse vegetable complex in general.

The Greenport building is made up of four floors and pillars. The floors: vitality, technology, logistics, and production, are the domain of the sector (or market). For a prospective future, it is essential that all four floors remain in place and merge with the environment (i.e. other economies and society). The floors are carried by the pillars: space and infrastructure, innovation climate, sustainability, and labour market and education. The pillars are the domain of the government, which has to set the requirements for the private sector and meet the needs of the market.

In the sections below, we will first of all discuss the floors of the Greenport building, followed by the pillars. For each floor and pillar, the advantages and disadvantages will be summarised. Finally, we will conclude with a section on the current status and future perspectives of Dutch greenhouse vegetable horticulture.

**Figure 5.1** Pillars and floors of the Greenport building. The pillars are the domain of the government; the floors are the domain of the private sector



Source: The Province of South Holland and Van de Geijn Partners bv (2007).

## 5.1 Floors of the Greenport building: the private sector

### 5.1.1 Production

This floor concerns the (primary) production of greenhouse vegetables. Primary production is characterised by increasing the quality of product and production processes, increasing the scale, and the intensification of land use due to competition for space and costs of land. The following strengths and weaknesses have been identified for this floor (question marks indicate developments that have both positive and negative aspects):



- + development of Greenports: concentration of functions and cooperation in activities add value to all segments in the production chain;
- + strong entrepreneurship (market-driven) and progressiveness of Dutch growers (desire to be independent);
- ? high level of foreign labour, which cause problems if the labour markets in Eastern Europe become more attractive;
- poor image (pesticide use, light emission, disturbance of landscape), resulting in labour shortage and the aversion of citizens to greenhouse horticulture

### 5.1.2 Logistics

A production chain requires efficient logistics in order to be successful. In line with (or more likely: ahead of) primary production, market channels are increasing in scale. Vegetables produced outside the Greenports often no longer pass through the traditional logistic centres. Nevertheless, the majority of product flows still pass through the Greenports. Moreover, logistic centres in the Greenports remain important for the trade of imported vegetables. Positive and negative developments on this floor are:

- + general logistic position of the Greenports: close to main infrastructure (roads) and to main ports (Westland/Oostland) and neighbouring countries (Venlo);
- + presence of fine logistics around distribution centres;
- the congestion of roads increases time and costs of transport and contributes to fine dust issues.

### 5.1.3 Technology

Dutch greenhouse horticulture is ahead in terms of technology and innovation. This position is driven by a demanding market and society. Production processes have to become cheaper (producer-driven), more sustainable (society-driven), and more automated (labour market-driven). The Netherlands accommodates a strong cluster of (international) technological companies and institutes, which has contributed to the following aspects:

- + fast development and application rate of innovative strategies, processes and equipment;
- + technology has enabled greenhouse vegetable horticulture to fulfil additional functions, for example energy and heat supply, and water storage;

- + high level of knowledge infrastructure (research/education, extension service, and entrepreneurs).

#### 5.1.4 Vitality

Vitality of the sector requires continuous adaptation to the wishes and needs of consumers. Greenhouse vegetable production has turned from a supply-driven strategy to a demand-driven strategy. Shorter production chains have enhanced communication between producers and consumers. Profitability is, to an increasing extent, realised by creating added value: through quality, taste, nutritional aspects, or novelty. The current focus of this floor is health (life sciences), convenience, and lifestyle.

Strengths and weaknesses of the vitality floor are:

- + strong organisational structure, both vertically (short chain) and horizontally (cooperation, growers organisations);
- + leading position in product quality and safety;
- ? market orientation has improved greatly since the nineties, but improvements regarding focus of innovation and selling capacity are possible;
- ? strong international market position, but weak connection with domestic consumers (no product 'emotion') which is evident in other countries;
- supermarkets have high market power and impede supply - demand interaction.

## 5.2 Pillars of the Greenport building: the institutional framework

### 5.2.1 Space and infrastructure

Both reconstruction of greenhouse horticulture and improving infrastructure exceed the interest of the sector, as they also affect the liveability of citizens. Therefore, the government contributes to the development of the sector by providing space for the development of the production sector and by developing infrastructures to facilitate logistics. The following positive and negative aspects were identified for this pillar:

- + the designation of Greenports emphasises their economic importance and has put them on the agenda of regional and local governments;
- + the provision of space for greenhouse horticulture: specific space policy for greenhouse horticulture;

- ? the government pays attention to facilitating land development and infrastructure, but processes develop slowly and road transport appears to be discouraged;
- ? clustering of greenhouse horticulture has improved spatial quality in some regions, but is not (yet) successful in all regions that were focussed upon.

### 5.2.2 Innovation climate

To maintain the economic position of greenhouse horticulture and particularly the Greenports, a stimulating innovation climate is required. The stimulation of innovation helps the sector to maintain and improve the competitive strength in a free market. Also, a positive innovation climate avoids movement of activities towards countries with upcoming economies. Moreover, other sectors may benefit or learn from innovations in greenhouse vegetable horticulture.

Strengths and weaknesses for this pillar are:

- + innovation and knowledge development is supported and stimulated by legislation and financial instruments;
- ? certain innovations are only beneficial for greenhouses with large-scale production, while this is not necessarily the best strategy for growers;
- unattractiveness of stimulatory financial instruments due to unrealistic preconditions and uncertainty about availability.

### 5.2.3 Sustainability

Developments in this sector contribute to the national objectives regarding reduction of fossil energy use and CO<sub>2</sub> emission levels. Also, the sector is starting to fulfil other public functions related to sustainable use of resources. A high energy price encourages growers to increase energy efficiency. Other than that, there are still limited market incentives (as yet) for the sector to become more sustainable. As increased sustainability is in the interest of the society, government contribution is desired. Sustainability is a rather strong pillar, which results from the following conclusions:

- + introduction of innovations that contribute to sustainability is financially supported;
- + (regional and local) governments actively participate in initiatives that contribute to sustainability;
- + EU legislation on energy/CO<sub>2</sub>, pesticide use, and nutrient emission gives the Dutch greenhouse horticulture a lead on other countries.

#### 5.2.4 Labour market and education

Greenhouse vegetable production has shifted towards an increase in scale and professionalisation. Consequently, seasonal peaks in labour demand have flattened and the demand for highly educated labour has increased. Yet, both the labour market as well as professional education regarding greenhouse horticulture suffers from a poor image of the sector. The (regional) government can contribute to an improvement of this image. The following developments in this pillar were identified:

- ? social security in the Netherlands is relatively high, which is positive in general but may discourage unemployed persons from entering the labour market;
- ? poor connection between professional education and greenhouse horticulture (greenhouse horticulture is not 'hot'); however, this is a shared responsibility of government and sector;
- ? the wages in the Netherlands are relatively high in general, but relatively low in agriculture and horticulture.

### 5.3 Current and future perspectives for Dutch greenhouse vegetable horticulture

The Dutch greenhouse vegetable sector is a dynamic and enterprising sector. To a large degree, this can be attributed to the historic position of the sector. The sector has always operated in an open market. Knowledge and innovation, together with a cooperative mentality, have enabled the sector to maintain itself in international competition. However, another important factor is the attitude of the government. The greenhouse vegetable sector has always operated in a free market, which triggers competition and stimulates innovation. Also, government support generally focuses on moving forward, rather than helping out in crisis situations. Entrepreneurs who are willing to move forward receive encouragement, however the ones lagging behind either have to catch up or quit due to 'soft' elimination of old-fashioned farms. While the sector has a high status, public recognition in its own country is much lower. To change this, the sector will have to improve its image, by further reducing light emission, making positive developments more visible and communicating more actively with society. A better sector image may, amongst others, improve its position on the domestic market, ease the dialog with citizens regarding spatial competition, and contribute to a higher labour supply.

A major limitation that the Dutch greenhouse vegetable sector has to deal with is the scarcity of land. The government acknowledges the economic importance of the sector and has committed itself to creating space for greenhouse horticulture. However, the government also has to deal with the high public demand for housing, recreational, and environmental areas. Therefore, competition for space is likely to remain, and will probably increase in the coming years. While this can be considered to be a threat to the international position of Dutch greenhouse vegetable horticulture, it may also be seen as a chance to optimise efficiency of land use. It forces the sector to think of ways of increasing productivity per m<sup>2</sup> and to make optimal use of the available space. In the near future, multifunctional land use will become more common and productivity will further increase. Greenhouse horticulture outside urban areas will become more industrialised to reduce the dependency on existing networks. For vegetable producers in urban areas, the focus on niche products will become even more important. Consumers increasingly pay attention to the nutritional value of products. Greenhouse vegetable producers may create further added value to their products by meeting this trend.

Dutch greenhouse horticulture is an energy-intensive sector. Sustainable use of natural resources and the protection of the environment are of public and private concern. For greenhouse growers, energy is one of the major cost factors. Consequently, sector and government are jointly making efforts to increase sustainability in greenhouse vegetable horticulture. As a result, the sector has turned from a bulk consumer to a net producer of electricity. Recently introduced innovations, and innovations that are still under development, indicate that further improvements are possible. Small-scale experiments that are not yet cost-efficient will have to prove valuable in the future. Also, in the coming decades, greenhouse horticultural centres will become more integrated in the environment, with functions for heat, electricity, and water for the immediate vicinity, and services regarding tourism, recreation, and healthcare.

Greenhouse vegetable horticulture is characterised by a high demand for labour. While the sector's job supply is appreciated by urban municipalities, greenhouse vegetable producers have difficulties finding Dutch personnel to fulfil labour demand. This problem is currently solved by hiring employees from Eastern European countries. However, the domestic labour market in these countries is improving, reducing the need for Eastern Europeans to find a job in the Netherlands. Thus, efforts should be made to increase the influx of Dutch employees in the labour market for greenhouse horticulture. This starts with providing attractive education opportunities and raising interest in greenhouse horticulture among students. To achieve this, the Dutch government has re-

cently decided to increase government financing for the improvement of 'green' education. In addition, regional projects are currently being initiated, in which government, sector, and educational institutes cooperate.

The Dutch greenhouse vegetable complex is continuously developing, which is underlined by the fact that news items about the sector appear almost every day. By the time this report becomes available, part of its content may already be outdated. And it is exactly this that is the strength of Dutch greenhouse vegetable horticulture.

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# Appendix 1

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## Interview questionnaire

Themes:

1. Labour; 2. Spatial structure; 3. Energy and environment; 4. Product and market

Policy levels:

1. Local; 2. Regional; 3. National; 4. European

### *A. General questions*

1. Can you think of a major strength of the Dutch greenhouse vegetable horticulture in comparison to:
  - a. other sectors in Dutch agriculture/horticulture? and/or
  - b. greenhouse vegetable horticulture in other countries?
2. Can you think of a major weakness of the Dutch greenhouse vegetable horticulture in comparison to:
  - a. other sectors in Dutch agriculture/horticulture? and/or
  - b. greenhouse vegetable horticulture in other countries?
3. Can you rank the above-mentioned themes according to the extent to which they contribute to the strong position of the Dutch greenhouse horticultural sector?
4. To what extent do you consider the institutional framework at different policy levels to stimulate or inhibit the development of the Dutch greenhouse horticultural sector?

### *B. Questions per theme*

The following questions need to be answered for each of the four themes separately.

1. Can you think of a *positive* development in (or strong characteristic of) the Dutch greenhouse horticultural sector related to theme ...? (You may think of developments within the sector, but also at regional or individual level)
2. Has the institutional framework had (or still have) an impact on this positive development or strong characteristic? If so:
  - a. Positively or negatively?
  - b. At which level (local, regional, ...)
  - c. How? (examples of stimulation or inhibition)
3. Can you think of a *negative* development in (or weak characteristic of) the Dutch greenhouse horticultural sector related to theme ...? (You may think of developments in the sector, but also at regional or individual level)
4. Has the institutional framework had (or still have) an impact on this negative development or weak characteristic? If so:
  - a. Positively or negatively?
  - b. At which level (local, regional, ...)
  - c. How? (examples of stimulation or inhibition)

*Additional issues that may be addressed*

1. To what extent do you consider the following aspects to be strong or weak characteristics of the Dutch greenhouse horticultural sector?
2. Do you experience the position of the government regarding this issue as stimulatory, neutral, or inhibitory?

*N.B. only those issues on which the respondent has commented are addressed.*

*Labour*

- Availability of personnel (from the Netherlands or abroad)
- Flexibility of labour input
- Wage costs/working conditions (among others, collective labour agreements)
- Working circumstances/sick leave

*Spatial structure*

- Infrastructure
- Development of Greenports
- Land availability

- (Investment) costs of buildings/facilities/greenhouses

*Energy and environment*

- Energy objectives national/international
- Environmental objectives national/international
- Energy saving and sustainable innovations
- (Investment) costs of (sustainable/energy savings) machinery and equipment

*Product and market*

- Market position and (inter)national trade
- Chain integration and cooperation regional/(inter)national
- Quality and safety of products and processes
- Profitability of (segments in) greenhouse vegetable horticultural sector

## Appendix 2

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### Key figures in Dutch greenhouse vegetable production

Commissioned by the Federal Office for Agriculture, Switzerland

#### *Production-related information*

1. How large is the average vegetable-growing area per farm?
  - a. Gross area under glass – in hectares: 2.7 ha (average 2007), of which hydroponic production – in hectares: 1.5 (75-80%)
  - b. Polytunnel growing – in hectares: 0
  - c. for outdoor vegetables - in hectares: not relevant (majority of greenhouse vegetable crops are not grown outdoors)

Gross area under glass = Area including walls, heating system, energy storage, handling area

2. What percentage of the crops in the greenhouse is exposed to artificial lighting?

30-35 %

3. What is the average growing period of a crop per greenhouse and year in months?

1.5 – 11.5 months

4. What percentage of the total gross area of the greenhouse is occupied by each of the following crops, and how high is the yield of each in terms of kg per gross area?

Crop	Share of the total gross area (%)	Yield kg/gross area
Tomatoes	32% (1481 ha)	680 million kg
Cucumbers	14 % (638 ha)	440 million kg
Peppers	27 % (1214 ha)	318 million kg
Other	27 % (1228 ha)	113 million kg

5. What is the turnover of greenhouse vegetables in francs per hectare and year (including preparation)?

290,000 EURO/ha x year (€1,330 million in total in 2006)

*Workforce-related information*

6. How high is the manpower-hours requirement per gross greenhouse area and year?

16,800 MPh/ gross greenhouse area and year

- a. What are the respective percentages of permanent and temporary labour employed?

Permanent 54 %

Temporary (up to 6 months\*) 46%

\* (temporary contracts may also have a duration of more than 6 months; it is not possible to distinguish temporary contracts of different lengths).

7. What is the minimum wage for hired labour in EURO/month without employer's contribution to social insurance?

1335 EURO/month

As from April 1<sup>st</sup> 2008; Minimum age of 21; based on 40 hours / month.

8. What is the employer's social security contribution per hired worker in EURO/month?

250 EURO/month

9. How high is the difference between the wages of permanent workers (employed > 6 months) and seasonal workers (employed < 6 months) in EURO/month?

0 EURO/month. Minimum wage applies to both permanent and seasonal workers. But wages increase with the number of years a person is employed, so permanent workers will more often receive a higher wage than the required minimum.

10. What sorts of wage supplements or bonuses are paid?

- a. Holiday bonus
- b. Travel cost compensation (depending on distance between company and home)
- c. Accessibility compensation (if employer has to be accessible outside working hours)
- d. Bonus after 12.5 years employment (25% of average monthly salary)
- e. Bonus after 25 years employment (1 month-salary)

How high are the average bonuses or wage supplements in EURO/month?

Holiday bonus: 8.33 %/year (paid once per year)

11. How high are the additional accommodation and food costs for the hired workers in francs per month?

- a. Accommodation costs maximum 35 EURO/week per hired worker
- b. Food costs 0 EURO/month and hired worker

12. What is the weekly working time of the hired workers in hours per month?

- a. Average weekly working time 38 hrs/month
- b. Minimum weekly working time 0-38 hrs/month
- c. Maximum weekly working time 45 hrs/month

13. How many days of paid holidays, annual holiday entitlement, short absences and "sick" days are taken by permanent and temporary workers, respectively?

No distinction can be made between permanent and temporary workers. Data apply to greenhouse horticulture in general.

- a. Holidays: 7<sup>\*</sup> days<sup>\*</sup>
- b. Annual holiday entitlement: 9.6% of total working hours
- c. Short absences: no data available
- d. "Sick" days: 2.1 % (= number of days of sick leave relative to total working time, data from 2007)

\* This is the number of national holidays, on which employees do not have to work unless other agreements have been made or circumstances urgently require work to be done.

*Information on greenhouse investment- and maintenance costs*

14. How many months did the building-permit approval process for your latest new-build greenhouse take?

Length of building-permit approval process 6 months (average; for aquifer 9 months)

a. How high were the permit costs for the new building? no data available

15. What are the building costs in EURO per hectare greenhouse?

- a. Heated: 55 EURO/m<sup>2</sup> (2008; indication)
- b. Unheated: 35 EURO/m<sup>2</sup> (2008; indication)

N.B. The actual building costs depend on numerous factors, e.g. location, facilities, etc.

16. How high is the debt-capital share of the financing?

Debt capital share 45% (2006) of the total building costs

17. What is the interest rate of the debt capital?

variable per farm; no average data available

18. What is the expected useful life of your greenhouse?

20 years (economic life expectation)

19. What are the average repair costs for a greenhouse including facilities in francs per hectare and year?

No data available



*Information on vegetable preparation*

20. Vegetable preparation is taking place (conditioning like washing, sorting, packing and labeling)?

- a. growers (farm): 65-70%
- b. growers organizations: 25-30 %
- c. wholesalers/auctions: 5 %

If there is no vegetable preparation on farm-level, please answer the following questions for growers organizations or wholesalers/auctions.

21. What preparation processes are carried out on your farm?

- <sub>1</sub> Washing
- <sub>2</sub> Sorting
- <sub>1</sub> Packing/labelling
- <sub>2</sub> Other processes

- a. What are the costs of the packaging materials?  
ca. 3500-6500 EURO/ha x year
- b. What are the manpower requirements for the preparation?  
550 (tomato/sweet pepper), 1730 (cucumber) manpower hours per year per ha
- c. What weight of vegetables are prepared per year?  
No data available
- d. What are the investment costs for the preparation facilities (cooling, building, plant)?  
No data available

*Information on energy and water consumption*

22. What is the energy and water consumption for a greenhouse per hectare gross area and crop period?

- a. Natural gas: 7660 GJ/ha and crop period
- b. Diesel oil: 7 GJ/ha and crop period
- c. Other: 1220 GJ/ha and crop period
- d. Electricity(1) : 190 kW/ha and crop period
- e. Water: 700 m<sup>3</sup>/ha and crop period

Based on average farm size of 2.7 ha  
(1) = total electricity consumption per hectare.

23. What are your energy and water costs for a greenhouse per hectare and crop period?

- a. Natural gas: 63590 EURO/ha
- b. Diesel oil: 1000 EURO/ha
- c. Other: 700 EURO/ha
- d. Electricity: 5445 EURO/ha
- e. Water: 648 EURO/m<sup>3</sup>
- f. Sewage: No data available

24. Please rank the following areas in terms of their need for (legal) action:  
*Work, Spatial Planning, Environment/Energy, Production/Trade.*

Greatest need for action	Spatial planning
	Work
	Environment / energy
Least need for action	Production / trade