Food for the Future

Innovative capacity of the Rotterdam Food Cluster

Activities and innovation in the past, the present and the Next Economy

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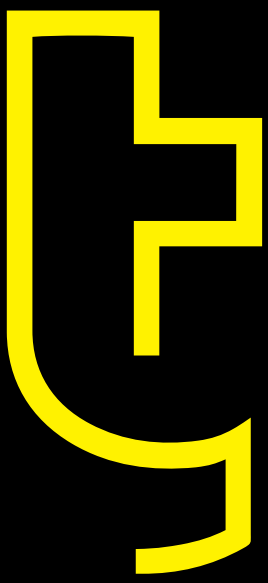
Rotterdam, September 2018



Innovative capacity of the Rotterdam Food Cluster

Activities and innovation in the past, the present and the Next Economy

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Photography by: Adam Smok

Foreword

‘Our region can justifiably be called one of the most complete and important food clusters in the world.’

Many large world cities are located in a delta, strategic positions offering access to the sea and the hinterland. Every day, over 200,000 people leave the countryside and head to the big city. It is estimated that within 15 years, over 60% of the global population will live in metropolitan areas.

When so many people live and work so closely together, more and more food must be produced. This is a huge challenge that requires innovative solutions. We see that cities are becoming an increasingly important driving force behind sustainable, radical innovation. City administrators and residents are starting to realise that outdated methods and systems pose a risk to our future and need to be renewed. Cities are promoting efficient energy and water flows, sustainable food production, green and clean districts and decentralised, short supply chains.

This may sound like an idealistic vision of the future, but in fact we are already doing it: here, in the Netherlands, in the Rotterdam Food Cluster.

In Food for the Future we demonstrate the versatility and economic power of food in our region. The Rotterdam Food Cluster was founded in 2014 to examine all that the food chain in our region has to offer. This voyage of discovery has taught us that our region is home to a major dynamic and innovative entrepreneurship with a strong international focus. We are justifiably one of the most complete and important food clusters in the world.

In and around the Rotterdam delta leading international sectors have set up business, as such as companies involved in agrilogistics, industry and seed-breeding. Not to mention knowledge institutions and specialists who know exactly how food grows and who actually develop the best products.

Almost 10% of GDP comes from the food sector, which makes it one of the most important for our economy. This shows how vital it is that we do our utmost to retain our leading global position in this sector. We need vision and decisiveness, in both the short and the long term. We have an incredible opportunity to leave outdated models and systems behind us and switch to sustainable, circular business models, which ensure we can maintain our economic position in the future. This is unquestionably achievable, with the knowledge and innovative brainpower of the entrepreneurs, researchers and developers in our region.

This book highlights the different economic sub-areas in our region and reveals their wonderful history. The cohesion and interaction between these regions is our strength. Combined with Rotterdam’s intrinsic entrepreneurship and internationally-renowned knowledge institutions, we can ensure a successful, sustainable transition for the food sector in our region – and give our international position a boost. We are the most innovative food region in the world, an international trendsetter, and that’s something we want to preserve. This demands vision, courage and the willingness to work together. To roll up our sleeves and get on with the job. And in Rotterdam, that’s something that comes naturally to us!

Enjoy!

Meiny Prins
CEO Priva

Introduction

The unique starting position of the Rotterdam Food Cluster
A study of innovative capacity, resilience and the importance of the connection to Rotterdam

Introduction

The Third Industrial Revolution will have a serious impact on the food industry. Businesses in the chain, from primary producers to the processing industry, trade and logistics, will be confronted with major challenges. These are already apparent and will be even more tangible in the near future. These 'agribusiness' companies will also have to play an important role in solving global food issues and the transition to a circular economy. The question is not whether the chain should change, but how. And who will take the lead in this endeavour?

The unique starting position of the Rotterdam Food Cluster

Virtually the entire agribusiness chain is located in the Rotterdam area, in the southern half of Zuid Holland. It ranges from horticulture in Westland and Oostland to arable farming and fishing on the ZHE (The islands south of Rotterdam); from logistic service providers and trading establishments in the port, the Spaanse Polder and Ridderkerk/Barendrecht, to the innovative start-ups in the former Tropicana swimming pool. Diverse processing, supply and services industries are also active: examples include Verstegen spices, Van Iperen fertilisers and the food designs of Foodcurators. This is unique and offers an extraordinary opportunity – an excellent chance to join forces to tackle the challenges formulated in The Next Economy Roadmap,[1] in partnerships that are forged right across the chain and with businesses outside the chain. Partnerships in which authorities and knowledge institutions contribute to a common goal. An economic transition is not a matter for individual companies, municipalities or tightly demarcated clusters of businesses, but for society as a whole. However, this imposes significant demands on companies and institutions, and on the ecosystem in which they innovate. It involves a development agenda that largely has yet to be implemented.[2]

The Municipality of Rotterdam has taken the initiative with the creation of the Rotterdam Food Cluster (www.rotterdamfoodcluster.com). This initiative produced, for example, the 'Food for the Future' consortium of educational and knowledge institutions. In 2016, the participating institutions from the higher educational institutions Inholland, Wageningen UR and Erasmus University Rotterdam compiled a research agenda and an implementation plan. An important issue addressed in the research agenda is the innovative capacity of businesses and business clusters. To what extent is the food cluster able to transform itself and play a role in the Next Economy?

A study of innovative capacity

This research report approaches this question from a variety of perspectives. A historical perspective of the dynamics of the business population shows

where the food cluster was able to innovate in the past. A historical perspective of specific clusters of businesses provides an even deeper understanding of the resilience of iconic clusters such as 'Westland' and the jenever industry in Schiedam. Another perspective focuses on the innovative capacity of individual companies. To what extent are they able to reinvent themselves? And with whom do they cooperate in order to innovate? We can also learn a lot from the businesses that are already taking the lead in the transition to the Next Economy. How are the earning business models of these innovators designed? What drives their innovative spirit?

In this publication we report on the outcomes of four sub-projects in which these diverse perspectives recur.

Part 1 Dynamics in the Rotterdam Food Cluster examines the development of the business population using existing data sources (the Zuid Holland Companies Register). It shows the clustering of businesses in and around Rotterdam and demonstrates how this has evolved over the past two decades. Special attention is dedicated to the development of the food cluster to the south of Rotterdam, a region that may not always be the first to spring to mind in discussions about the food cluster, but one which is definitely home to an established cluster. As we will reveal in Part 4, this region is also home to diverse businesses that are both literally and figuratively taking the step towards the Next Economy.

Part 2 Food cluster icons describes the emergence – and sometimes the decline – of five specific clusters in the region. The history of the Westland horticulture cluster is discussed in detail in an exceptionally valuable study. The study also highlights the history of the jenever industry in Schiedam, a cluster that was thought to have died out, as well as the third cluster we describe, the Wholesale Market in the Spaanse Polder. Both these clusters find themselves on the cusp of a potential revitalisation. This part also describes the logistics hub and trade centre around Barendrecht and Ridderkerk, and in conclusion we head off to the islands in the south. After all, Hoeksche Waard, Voorne-Putten and Goeree-Overflakkee are also home to a cluster of food companies that demonstrate a remarkable degree of vitality.

Part 3 Innovative capacity of the existing business community presents the outcomes of a survey conducted among entrepreneurs in the food cluster in the southern Randstad. In this part, we point out the (relatively limited!) attention businesses devote to renewing their business models, even though there appear to be multiple levers for doing so, both within the organisations and in the chain and the region. We devote special attention to ZHE (The islands south of Rotterdam) entrepreneurs, a part of the 'regional food cluster' that can sometimes become lost in the focus on Westland and the Rotterdam port city.

Part 4 offers, as its title suggests, **A glimpse of the future of the Rotterdam Food Cluster**. This is achieved by describing a series of frontrunners and innovators. What are the motives of the innovative businesses that characterise the food cluster? What do they have in common? We look specifically at the business models they develop and the networks (or 'ecosystems') they use to do so.

We applied a different method in each component of this study, which enabled us to construct a pyramid of insights. The broad base was constructed in Part 1, in which we were able to process a limited amount of data from many (if not all) companies. A narrower layer was laid upon this base, containing considerably more valuable information per cluster (Part 2) and per company (Part 3). Finally, the top layer is formed by a limited number of rich, qualitative descriptions of innovators and frontrunners in Part 4.

Table. Construction of a pyramid of research methods.

Level of analysis	Focus	Method	Source(s)	Number
Business population	Historic dynamics (as of 1996), current composition of the food cluster.	Quantitative analysis	Zuid Holland Companies Register (BRZ)	7,462 companies spread across six regions
Business clusters	Historic innovative capacity.	Qualitative analysis	Databases, archives, media, interviews	Five clusters
Company	Current innovative capacity, rating of regional innovation climate.	Quantitative analysis	Online survey	331 businesses
Company	Current business model, motivation and innovative strength.	Qualitative analysis	Interviews, desk research	12 x Rotterdam Food Cluster (incl. Westland) 12 x ZHE food cluster

Resilience and the importance of the connection to Rotterdam

One important task for the researchers involved ascertaining what characterises and determines the resilience of companies and clusters, so that lessons can be learned for the transition challenge currently facing the food cluster. A second focal point concerned the relationship between businesses and clusters and the city of Rotterdam. How could the Rotterdam Food Cluster contribute to the innovative capacity of individual companies and the network as a whole?

There is no unequivocal answer to these questions, because the food cluster is too diverse. Various businesses – start-ups as well as mature enterprises – demonstrate how new business models can be introduced to the market. They display a resilience and innovative capacity that can lead to inspiration. We also observe the resilience, or perhaps the determination, of the horticulture cluster in Westland, but also the decline of the Wholesale Market (with the Spaanse Polder) and the jenever cluster. This is where the future will reveal the extent to which the glimpses of revitalisation we see today will truly lead

to revival and regained glory. Neither is there a clear answer when it comes to the effect the proximity of Rotterdam has had on growth and innovation.

We summarise the most interesting findings of the study as follows:

- The resilience of Westland is proven by the dynamics we see in the business population there. The qualitative analysis of the history of Westland primarily teaches us that here resilience stems from perseverance: rolling up your sleeves, working hard and accepting that doing business inherently involves risks. Following setbacks, the sector appears to recover by taking losses and innovating. It is striking that innovation often proves to be a leap of faith, a not always equally circumspect leap into the unknown. Accordingly, the transition from beef tomatoes to cherry tomatoes did not appear to be the result of an extensive analysis of the market and the risks involved. This means that failures are sometimes costly. However, since there is a rapid diffusion of knowledge about successes in the market and new technologies, there is a net positive effect on the cluster as a whole. In this model, resilience arises from the process of 'trying and learning quickly (from someone else)'. Now that innovation increasingly demands investments in R&D, the question is whether this rapid diffusion of knowledge will continue. Companies will have to protect their inventions more effectively in order to recover their high investments, which could put the cluster's resilience at risk.
- Other clusters demonstrate a different kind of resilience. The jenever cluster in Schiedam appears to recover by actively modernising its marketing approach (aimed at a younger audience). The cluster of trading companies based around the auction in Barendrecht seems to be very capable of reinventing itself after various crises (trade boycott, physical auction closing down). These companies have an autonomous resilience.
- History has shown that the cluster of companies in the Wholesale Market and the Spaanse Polder business park will not be as quick to revitalise independently and on its own initiative. Without interventions by the government and/or private parties, the area and the market risk falling into decline. The resilience of the wholesale market is perceptible in the tenants' individual entrepreneurship: since the turn of the century, the market has changed from predominantly 'Dutch' traders to traders and customers with a non-Western background. As a result of the Municipality intensifying its policy and the recent investment by a private party, Urban Industrial, there also appear to be other conditions for a successful revival. Time will tell whether the golden era of the past will really be restored.
- The ZHE (The islands south of Rotterdam) is home to a cluster of arable farming businesses that have to deal with considerable pressure on margins. Here we see that bundling forces not only results in economies of scale, but also in innovations that enable the entrepreneurs to extricate themselves from a downward spiral. The business community on the islands is characterised by the shared value its members attach to 'stewardship'. This proves to be a powerful, intrinsic motivator for innovation. Stewardship to pass the family business (the land and farms)

on to the next generation in good condition and to manage the natural production resources (both land and fishing grounds) in a socially and economically responsible manner.

- Lastly, we observe the resilience of the cluster in the creation of new businesses, often with an idealistic motive. It is difficult to establish whether government interventions have contributed to the creation of this new industriousness. Entrepreneurs state that in general the fact of their being based in Rotterdam has more to do with coincidence than with policy. On the other hand, one cannot deny that the city does offer suitable room for start-ups – vacant business premises are eagerly snapped up – and there are diverse incubators that help new entrepreneurs on their way.
- However, the relationship with Rotterdam itself is limited when these start-ups are not taken into account. The clusters in Westland, Oostland and the ZHE (The islands south of Rotterdam) appear to have turned away from the city rather than maintaining an intensive, versatile relationship with companies in the Rotterdam food cluster. Naturally, use is often made of the Port of Rotterdam's logistics hub function. Without the port, Westland would have found it considerably more difficult to achieve international growth and the Barendrecht-Ridderkerk cluster would probably not even exist. However, this primarily concerns relationships in the primary ecosystem (the value chain). We observe far fewer relationships in the knowledge and labour ecosystems of the clusters around Rotterdam. Westland mainly attracted its personnel from The Hague, with the Schilderswijk as the major supplier of cheap labour, and the city lacks 'green' and food-related study programmes (apart from vocational catering and hospitality options in secondary schools). As far as innovation is concerned, ultimately the conclusion is even less satisfactory: Rotterdam is not at the top of the list when people are striving to develop new concepts, let alone when they are looking for new technology. The fact that it does offer serious possibilities is proven by examples such as Novifarm. In the extensive descriptions of diverse business cases, our aim was to outline the link with Rotterdam as effectively as possible, but the results were still limited in the end.

Thus we simultaneously observe autonomous resilience and the need for government interventions. In addition, we see that to date there has been little interaction between the region and the city, apart from logistics and trade flows. Nevertheless, there are also diverse examples that demonstrate that entrepreneurs are able to take advantage of the benefits of a closer relationship with the Rotterdam Food Cluster, an intensive exchange of knowledge and ideas, entrepreneurship and investment power, and of shared 'green' values could constitute a potential source of common resilience. In an era when the business community is facing a challenging transition and it is proving increasingly complex to innovate, such resilience will be vital to survive as a thriving agribusiness cluster. In an era when the business community is facing a challenging transition and it is proving increasingly complex to innovate, an intensive exchange – of knowledge and ideas, of entrepreneurship and investment power and of shared 'green' values – could constitute a potential source of common resilience. We hope that this study and all subsequent research and projects initiated by the Food for the Future consortium will contribute to this goal.

On behalf of the authors,

Dr. Niels van der Weerdt

With thanks to the two co-readers who gave us valuable feedback:
Gerry van Kouwenhoven and Sharon Janmaat-Bouw.

Part 1
Dynamics in the Rotterdam Food Cluster

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1 The Rotterdam Food Cluster as a regional entrepreneurial ecosystem

The food cluster in and around Rotterdam is pre-eminently a cluster where activities involved in the different phases of the production chain spatially converge. The composition and innovative strength of this highly diverse cluster must be properly understood during periods of transition (energy, circular economy and digitisation), so that its potential contribution to a new economic order can be optimally achieved. In the first part of this report we illustrate the activities and entrepreneurship in the cluster: what position do start-ups occupy in the links of the chain, where do they survive best and where does the most growth in employment take place? We (literally) map out the entrepreneurs and businesses, and thus start to compile an inventory of this cluster's innovative capacity.

Following an introduction related to the importance of the agribusiness sector to the Netherlands, and specifically to Rotterdam, we present various maps that reveal the dynamics in different parts of this sector. We continue with an analysis of the variation in activity levels in the region: how do Westland/Oostland and the ZHE (The islands south of Rotterdam) differ from each other and from urban Rotterdam? This first part concludes with a number of questions we try and answer elsewhere in this report or earmark for further research.

1.1 The importance of the agribusiness sector to the Netherlands

Food constitutes an important economic sector in the Dutch economy. One essential component of this sector is agribusiness, defined by Statistics Netherlands (CBS) as: 'agriculture, horticulture and fisheries, followed by the food and beverage industry, the agri-industry and suppliers of agricultural services, to wholesale and retail trade in food, beverages and tobacco, ending with consumers (in the Netherlands and abroad)'.[3] This definition indicates that the entire production column or value chain, from producer to consumer, must be taken into account when analysing the food cluster. The fact that for many types of crops this chain is almost entirely situated in the Netherlands provides location advantages and transport cost savings.[4] It is difficult to provide exact figures because a demarcation of suppliers and indirect relationships between companies is not always transparent, but the CBS estimates that 65% of the national trade surplus consists of agriculture and agriculture-related goods.[5] It is estimated that the agribusiness sector, including its related activities, accounts for around 10% of the Gross Domestic Product and provides employment for one tenth of the Dutch population.[6] The first link in the chain, agriculture, is an intensive business sector, in which high yields per square metre and quality are key.[7] This sector is important for exports. In 2017, agricultural exports, which alongside horticulture exports (such as flowers), meat, vegetables and milk have constituted important (net) export products for many years, reached a record level of €91.7 billion. Agriculture-related exports are also substantial, at €9.1 billion. The majority of these exports originate from Dutch soil and do not therefore involve long-distance transport.[8] Major export flows head to neighbouring countries (Germany, the United Kingdom, Belgium, Luxembourg, France) and to other European countries such as Italy. The importance of this sector is also demonstrated by two nationally defined policy priority areas, namely: Horticulture & Starting Materials and Agri & Food.[9] Explanations for the relative success of Dutch agriculture have traditionally been found in factors such as the flat, moist, fertile soil, the mild climate, easy access, the high degree of urbanisation and the decades of expertise acquired and innovation implemented in the subsectors.[10]

The agribusiness sector has been facing various economic challenges for some time. As early as 1994, Maas[11] differentiated a number of trends in the sector, which still play a role: the changing importance of businesses in the chain, a reduction of the bargaining power of the farmer, consolidation of businesses, an increase in technological complexity, more spatial concentration and a higher relevant scale of production and distribution, as well as growing internationalisation and supranational regulations. In 2004, this was supplemented by matters such as an increase in the importance of organically-produced food, greater demand for local food, and energy issues.[12] Other trends identified in the chain include the increase in smart devices, omni-channel distribution,[13] the use of (big) data and greater transparency, such as in the field of production and food security.

Another development concerns the continued integration of convenience products or personalised products and healthy food.[14] In addition, it is expected that the food industry will come to be characterised by more efficient chains, which will result in chain integration links that do not add significant value being abandoned. Smart industry, including the Internet of Things (IoT), robotisation and 3D printing could affect businesses in this sector. Export-oriented businesses in particular appear to be able to profit from further globalisation in the food industry, which occurs simultaneously with regional, closed chains of food produced locally. This also includes an increasing amount of organic food,[15] but for the time being this remains a niche market.

Therefore, there is a clear need to innovate in this sector. Businesses have actively responded to this need. In 2016, the CBS reported that: 'Companies in agribusiness innovate slightly more (51%) than other companies (48%). Product innovations are particularly popular among these companies'.[16] Companies in the agribusiness sector also use their own resources to make considerable investments in research and development, and are thus responsible for five percent of the total R&D expenditure in the Netherlands. Effective cluster policy fits in with this because it can prevent fragmentation, provide space for specialist facilities and suppliers to share, offer the possibility of combining and utilising waste flows, and facilitate collective innovation (whereby new forms of funding could be developed through collaboration).[17]

1.2 Innovation in agribusiness and the regional ecosystem

Innovation is particularly important in economic terms because the added value did not originate from the primary agricultural process for some time (in 2012, 13% of 48 billion); instead, it results much more from the related activities such as suppliers, a category which includes services (28%), processing (19%) and distribution (40%).[18] The Netherlands is the frontrunner in the field of improving plant starter materials, including seed-breeding. Of the global trade in seeds for horticulture and arable farming, around 35% comes from the Netherlands.[19] An analysis of companies operating in the plant starting materials sector, conducted by Food Atlas of the Netherlands, reveals that in spatial terms these businesses are highly concentrated in certain areas, including the Rotterdam area (such as Westland). The food industry comprises around 5,275 companies with a production value of €65 billion,[20] but innovation is under pressure due to intense price competition. The trade has a turnover of €100 billion and innovates in the field of services to retailers and continuous process innovation. Retail is also characterised by strong price competition, which can be felt throughout the chain since astute purchasing is required to force prices down.[21]

At the same time we also see that innovation is being applied more widely: production and quality are no longer the only key aspects involved. Energy-neutral production, precision farming, health and waste are also becoming the focus of policy and entrepreneurship. Moreover, the agribusiness chain is no longer a 'simple' linear chain; it is an interwoven network of suppliers, processors, distribution and agricultural businesses and households, playing out against a background of institutions and other businesses and households. There are also many skills-related crossovers between innovative activities in agriculture, seed-breeding, life science & health and biotechnology, precisely in the region of Zuid Holland.[22] Besides an increasing complexity in the chain, there is product expansion outside of food too, such as in the fields of biomass, biofuels, pharmaceuticals and bioplastic. Therefore we can justifiably talk of an ecosystem, with diverse actors that influence each other and that interact with adjacent ecosystems. In the chain, in addition to increasing collaboration and chain integration,[23] we also see a degree of externalisation: some of the activities take place outside the narrowly-defined agribusiness sector.

Businesses involved in the sector compete, but they also need each other to survive. Colocation of companies seems to be important in this regard, as does a certain scale. Innovation requires large companies that have the means to scale up and market inventions to work with smaller specialist companies in the vicinity. Scale thus appears to offer advantages in the form of knowledge transfer, knowledge sharing and the necessary specialist facilities, but it also leads to a locally competitive ecosystem. This is consistent with expectations for the sector, in which strong competition and collaboration are both cited as future prospects.[24]

1.3 The agribusiness sector in Rotterdam and the surrounding area: the Rotterdam Food Cluster

The size of the agribusiness sector in the region is estimated to consist of 8,000 businesses and 44,000 jobs, with an annual turnover of €27 billion.[25] The added value in the chain is estimated at €3.3 billion for the 'Rotterdam food cluster' region.[26] This makes the region a major player in agribusiness. Horticulture is represented more strongly in this region than in any other region of the Netherlands. It is also an important player at the international level. PBL[27] studied the areas that actually compete with each other, based on real trade relations, including the 'Food' and 'Agriculture' sectors. This data is available at the provincial level. In the food industry, the Province of Zuid Holland mainly competes with the regions of Lombardy (Italy), Île-de-France/Paris (France) and Catalonia (Spain). The regions related to agriculture are: Stuttgart (Germany), Vest for Storebaelt (Denmark) and Andalusia (Spain).

In the Rotterdam region we predominantly find a strong horticulture sector in the north (Westland and Oostland), in which floriculture and vegetables represent the most important products. To the south of Rotterdam we find a strong arable farming sector. The production of milk, dairy products and livestock feed are also represented, but to a far lesser degree. In most municipalities in this region, between five and ten percent of employed persons work in the agribusiness sector. One exception in the region is Westland, where 30% work in this sector.[28] Westland has formed a unique cluster in the region for decades. In the words of Maas, it is 'a place where tangible and intangible relationships converge'.[29] Together, the complex and the network jointly provide a healthy ecosystem.

Moreover, it is remarkable that in the horticulture sector, a previously cited national policy priority area, the share of the primary process is still relatively large. This may explain this sector's high degree of representation in the Metropolitan Region of Rotterdam The Hague (MRDH).[30] The labour markets of Rotterdam and The Hague have the potential to offer the necessary highly-skilled workforce for innovation and business operations, as well as the professionals, seasonal workers and the labour force needed for the primary process.[31] In spite of this, The Hague, Rotterdam and their joint spatial-economic policy memoranda barely mention the major potential for local, innovative crossovers and the implications for the labour market and education.[32]

Nevertheless, innovation is high on the agenda in the Rotterdam region. The Rotterdam Food Cluster is viewed as an important pillar of the Next Economy Roadmap.[33] In addition, nine educational institutions have united in an educational and research programme: Food for the Future. One element of the research agenda involves determining the strategic and economic value of the food cluster and identifying productive and innovative networks, entrepreneurship and dynamics in the cluster. A sound baseline measurement is still lacking.

The research programme states the following: 'The strategic value of the food cluster is unknown. How much turnover, added value, employment and food does the cluster supply, and to what extent does this contribute to the Netherlands' international competitiveness? Moreover, the area's economic climate with regard to (new) food-related activities requires further research. Only then will it be possible to clarify the added value of collaboration between the horticulture cluster (Greenport) and the port cluster (Mainport) and how the cluster's strategic value could be increased in the near future.'[34] In the next section of this chapter we present an initial analysis of the business dynamics in the Rotterdam Food Cluster, which are helping to plug this knowledge gap.

2 Business dynamics in the Rotterdam Food Cluster

With the aid of the regional Companies Register (BRZ),[35] an analysis was performed of 'food-related economic activities' – the food cluster – in the Rotterdam region. Using data from company registers, we analysed the entry and exit of businesses in the regional food cluster over the past 20 years. The result is a series of 'maps' that illustrate the course of the activities over time. To do this, the food cluster was subdivided into the following categories: Services, Trade, Storage, Production, Retail, Suppliers and Processing, in which all the different stages of the chain are represented.[36] The analyses provided reveal the dynamics in the business population between 2011 and 2015, with a breakdown of new start-ups, liquidations and growing and shrinking company branches in different phases of the sectoral value chain – from production to the retail industry.

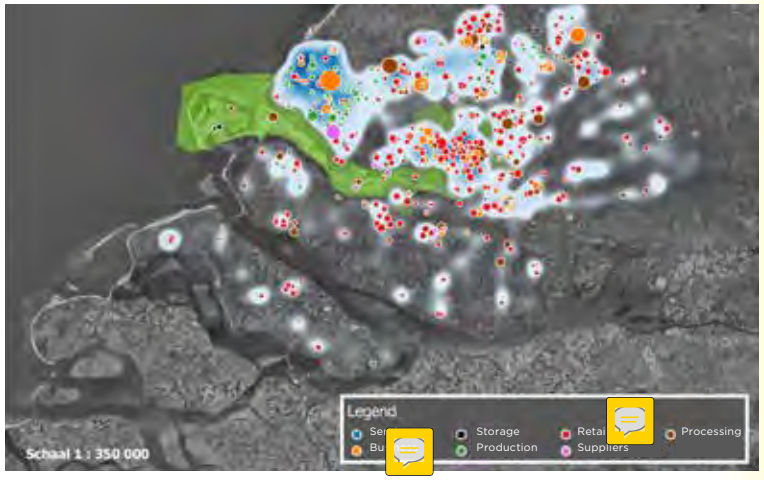

Figure 1 Businesses in the food cluster in 2014. Companies with more than 25 employees are represented by dots, with smaller companies showing up as a concentration cloud (source: BRZ, 1996-2014. Maps compiled in association with QGIS).

Figure 1 shows that in 2014 the largest companies (with over 25 employees[37]) were mainly active in retail, trade and processing. In the more urban areas we see concentrations of retail, as in the municipalities of Rotterdam and Zoetermeer and in the peripheral municipalities of Rotterdam. We also find companies that process food in the same areas. Trade in food,[38] for example in the form of wholesalers, also largely takes place on the outskirts and outside the city, with the biggest employers based in Westland.[39] Higher concentrations of smaller businesses (the blue concentration cloud) are mainly found in Westland and around the complex of The Greenery in Barendrecht, as well as in the centre of Rotterdam.

Most employment in the food cluster, scaled using the size of the dots in Figure 1, is found in Westland,[40] Rotterdam and the region to the north of Rotterdam (in Lansingerland, Pijnacker and Oostland). To the south of Rotterdam the activity is significantly smaller (with the exception of the AGF trade complex in Barendrecht and Ridderkerk).[41] Agricultural businesses, especially farming and horticulture businesses, are also included in the production category. These are spread across the region; however, the concentration cloud shows where these companies appear most frequently in relative terms.

The chain of food-related economic activities can roughly be divided into production, processing and retail.[42] We find trading businesses in the links in this chain, and all activities in the chain include services, suppliers and storage. We present the trend based on this breakdown. For the largest categories (production, processing and retail),[43] in addition to the situation in 2014 that is illustrated in Figure 1, Figure 2 maps the development of new businesses over time. We also present the extent to which there was growth in employment at business premises per year.[44] Each map also features an underlying concentration cloud. This cloud shows the existing economic activity in 2011 in the sector concerned for the maps of the start-ups and the concentration of the majority of businesses that grew annually by one job.[45]

2.1 Food production

Figure 2 reveals that in 2014 food production was highly concentrated in Westland and to the north of Rotterdam. This applies to both the large companies (with more than 25 employees) and the concentration of smaller companies. Figure 2 (the topmost figure) includes newly-registered businesses between 2011 and 2014, on top of a cloud of existing activities (companies that already existed in 2011). We see that new companies involved in production mainly set up business close to existing production. This is not surprising, since in many cases the zoning of the land encourages a certain degree of spatial clustering.

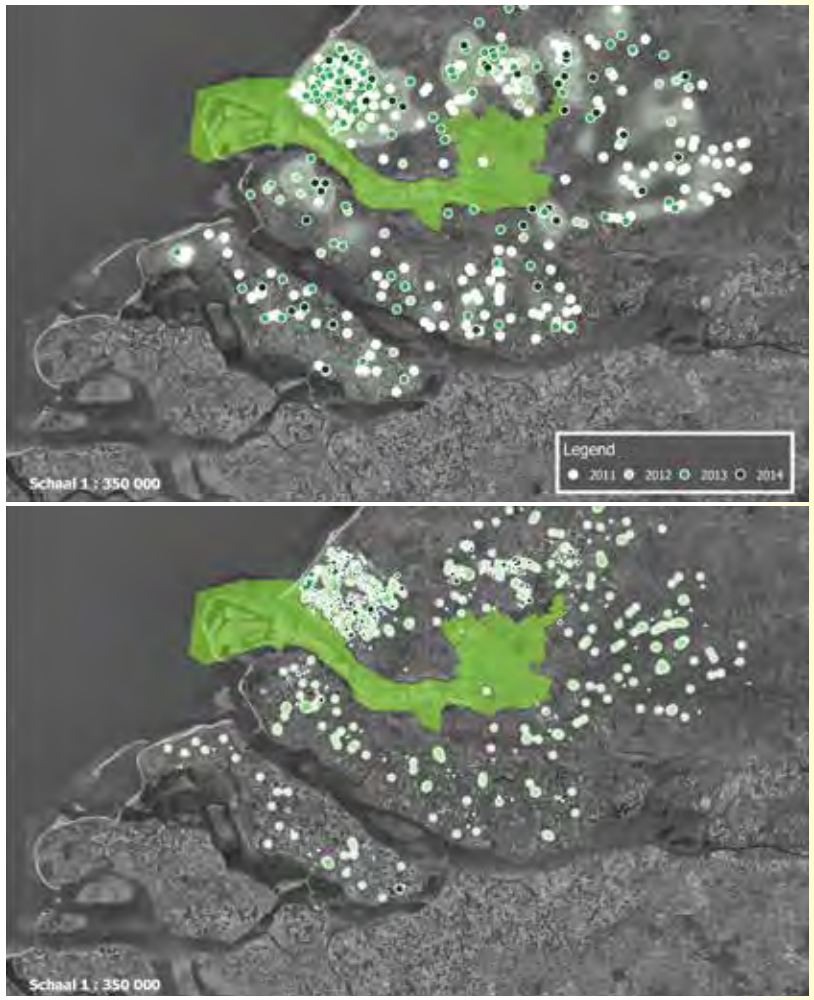

Figure 2 Start-ups (top) of production businesses between 2011 (light) and 2014 (dark) and growth (bottom) of production companies (regardless of the year they were founded) during the period 2011-2014.

Nevertheless, Westland and Lansingerland/Pijnacker clearly stand out as areas in which lots of new companies set up business. The number of new registrations was highest in 2011; that number was considerably lower in 2014. We also find many company liquidations (not shown) in the areas cited above, and they are also found more frequently to the south of Rotterdam. Start-ups survive to approximately the same degree in all areas. The vast majority of start-ups active in food production that were founded between 2011 and 2014 were still in operation in 2014. We find liquidations in all areas, and Moerkapelle stands out as an area in which there is a relatively high number of liquidated start-ups. Westland also distinguishes itself in terms of growth (Figure 2 – top) and decline (not shown) in employment. Strong growth in employment, particularly in 2014, is visible in the area below Zoetermeer (such as in Lansingerland and Pijnacker). The coexistence of start-ups and growth (as well as liquidations and decline) indicates a high degree of turbulence and flexibility in this sector: one moment employees are recruited and the next they are disposed of. If we examine the trend over a longer period, namely from 2011 up to and including 2014, the growth in employment appears to be greater than job reductions.

2.2 Food processing

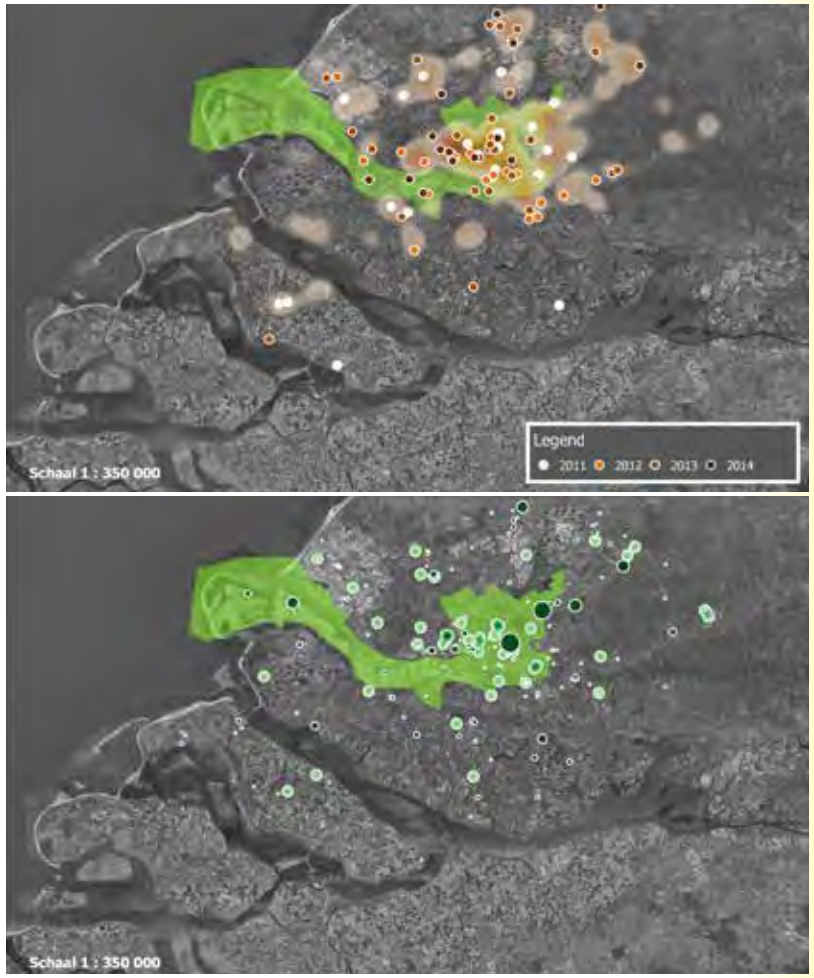

Figure 3 Start-ups (top) of food processing firms between 2011 (light) and 2014 (dark) and growth (bottom) of processing firms (regardless of the year in which they were founded) during the period 2011-2014.

In contrast to food production, food processing mainly occurs in the city, as shown in Figure 1. We find food processing taking place in locations in the city that are easily accessible from production locations. We see the highest concentration of small businesses in the city near larger companies involved in food processing, such as Unilever and Bakkersland Rotterdam, but we also find concentrations of processors near production sites, such as in Westland. New companies also set up business near the existing activity (Figure 3, top): mainly in the city of Rotterdam, as well as in Zoetermeer, between 2011 and the end of 2014. Companies that are liquidated (not shown) are found at the same locations. Start-ups in the food processing industry were generally still in operation in 2014. Growth in employment (Figure 3, bottom) is more concentrated on the outskirts of the city, especially at the 'Spaanse Polder'

and 'Alexandrium' business parks. A cluster of job reductions in South Rotterdam stands out: on closer inspection, this concerns firms involved in grain processing (including bakeries).

2.3 Food retailing

Retail is even more of an urban phenomenon than is the case for food processing, as Figure 1 shows. Retail is a typical consumption facility that goes hand in hand with urban density. We expect to see more, and possibly also larger, retail companies in places where they can reach more customers. Start-ups (Figure 4, top) and liquidations are also found in urban centres (in which Zoetermeer stands out in the negative sense). A relatively high number of start-ups cease trading in the same year; start-ups that survive the first year go on to exist for a longer period of time. Employment in retail is growing (Figure 4, bottom), with a single major peak in the west of Rotterdam. This involves 'Albert Bezorgservice' in 2011, a development that can be viewed against the background of the increasing importance of delivery services in the service package offered by supermarkets. Growth is also considerably greater than decline; retail food is a growth sector.

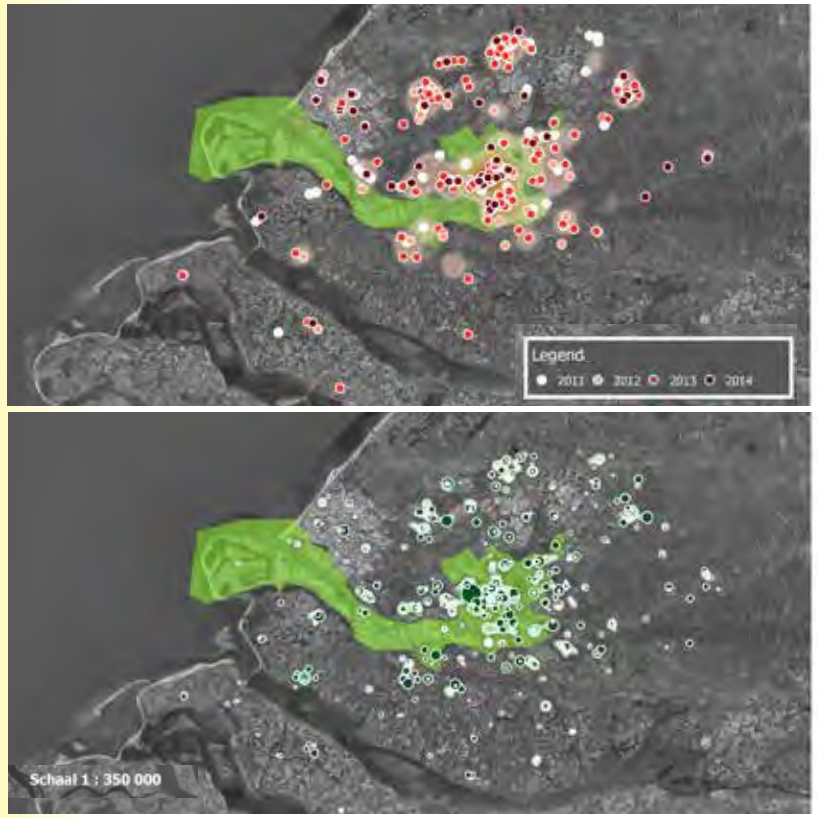

Figure 4 Start-ups (top) of food retail firms between 2011 (light) and 2014 (dark) and growth (right) of food retail firms (regardless of the year in which they were founded) during the period 2011-2014.

2.4 A regional comparison

A study of the Rotterdam Food Cluster revealed that Westland and Oostland are among the areas where most companies set up business and that they are characterised by the greatest dynamics, especially when it comes to food production.

There is also economic activity involving food to the south of the Maas, but this is not reflected in the concentration maps shown. In this follow-up to the study from 2016, we specifically examined the dynamics of the business population located on the ZHE (The islands south of Rotterdam).[46]

The original 2016 study covers the area included in the Zuid Holland Companies Register (BRZ). This is largely consistent with the postcode areas 2600 to 3300, which are used in this memorandum for practical reasons.[47] Besides the Municipality of Rotterdam, this area includes the Westland and Oostland regions, the area around Barendrecht-Ridderkerk and all of Goeree-Overflakkee, as well as Hoeksche Waard and Voorne-Putten. This coverage area is shown in Figure 5. This figure also clearly shows that the northern area is dominant in terms of the number of business premises, but also reveals that the number of businesses based to the south of Rotterdam is not insignificant.

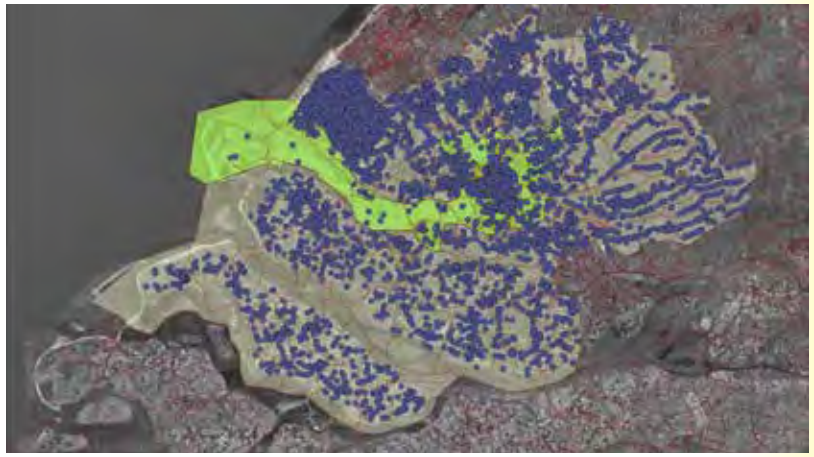

Figure 5 Area covered by the original study (with activities).

To break the activities down further into economic sectors and areas, we used a regional classification based on four-figure postcodes for the areas to the south of Rotterdam. This demarcation is illustrated in Figure 6. The demarcation used map material from the Public Services with Digital Maps (PDOK). We opted to use watercourses as the 'natural demarcation' of sub-areas when selecting postal area codes.

Figure 6 Demarcation of sub-areas for analysing business premises and employment (Source: Municipality of Rotterdam, CBS, PDOK, own production).

An analysis was conducted based on sector, business location and employment on the basis of the sub-areas described. When we categorise business premises according to year and sub-area (see Table 1), we see that the previously described dominant position of Westland and Oostland does indeed conceal around 1,800 companies in the food cluster to the south of the Municipality of Rotterdam. This accounts for almost a quarter of all businesses. The maps presented earlier do not always demonstrate this, because the businesses are spatially distributed across a large area. To the south of Rotterdam there is mainly arable farming, which involves more extensive use of the space and offers less added value.[48] This greater spatial distribution means that the number of businesses per square kilometre is considerably lower. This also concerns companies with a generally small number of employees, which means individual, large companies in this area rarely appear on the original maps. The absolute numbers of business premises in relation to Westland and Oostland and the Municipality of Rotterdam are also modest.

	Area					
Year	Rotterdam	Barendrecht-Ridderkerk	Westland-Oostland	Hoeksche Waard	Voorne-Putten	Goeree-Overflakkee
1996	1,800	298	2,541	336	304	253
1997	1,762	304	2,499	317	300	239
1998	1,729	306	2,483	321	292	234
1999	1,640	311	2,543	297	291	215
2000	1,583	304	2,507	308	269	220
2001	1,498	286	2,457	292	266	207
2002	1,444	278	2,444	294	265	204
2003	1,446	281	2,494	284	256	190
2004	1,381	270	2,595	279	261	186
2005	1,348	271	2,583	269	255	191
2006	1,316	270	2,621	271	253	184
2007	1,318	281	2,688	263	265	180
2008	1,303	282	2,695	257	252	182
	New registration system introduced					
2009	1,337	367	5,664	520	504	338
2010	1,333	367	5,531	536	506	432
2011	1,310	356	4,792	568	501	469
2012	1,269	354	4,625	546	495	454
2013	1,282	355	4,557	555	477	451
2014	1,233	344	4,446	544	450	445
	Note: the jump in the number of company registrations between 2008 and 2009 is caused by a new registration system. After 2008 companies from the primary sector are also included in the BRZ.					

Table 1 Food industry business locations by sub-area per year. Source: BRZ, Municipality of Rotterdam.

The number of business premises in the six regions has shown a steady decline over the past two decades.[49] This decline could be the result of company liquidations or of mergers and takeovers. The decline is visible in Figures 7 and 8.

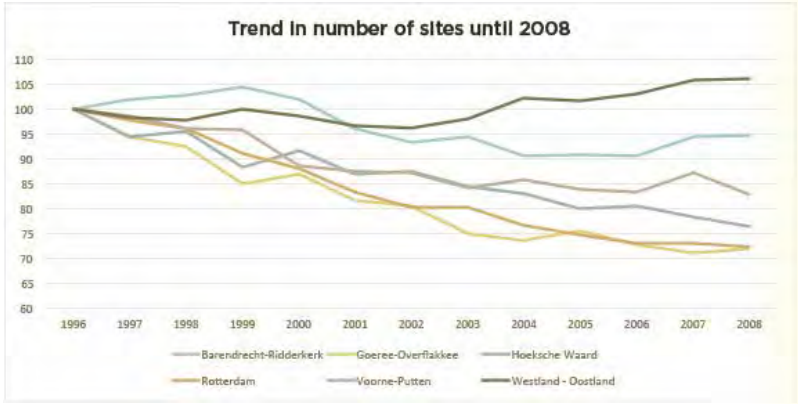

Figure 7 The number of business premises declines steadily, except in Westland-Oostland (data indexed from 1996).

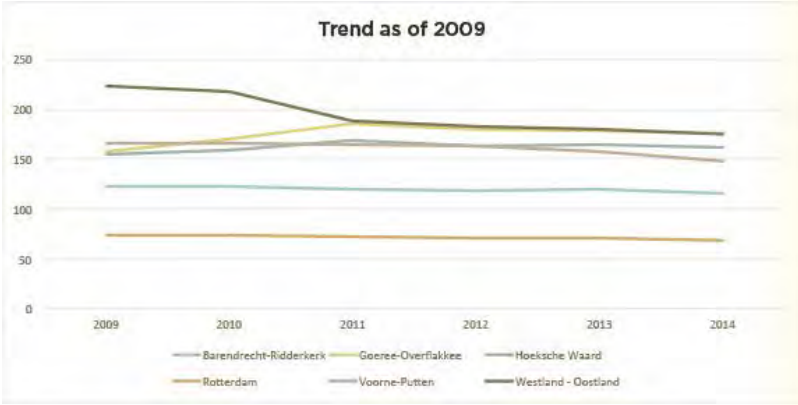

Figure 8 Following the increase in the absolute number of registrations, as a result of a different registration system, the number of companies stabilises. Only Westland-Oostland now shows a decrease.

Figure 9 (see also Table 2) reveals that the profiles of the areas differ. There is significant production in the more rural areas of Goeree-Overflakkee, Hoeksche Waard and Voorne-Putten (more than half of the food companies are active in this sector). The Barendrecht-Ridderkerk area is characterised by production, wholesale and retail; this appears to be a transitional area to the city, in which production naturally plays a smaller role and the sector is mainly dominated by processing, trade and especially retail. It is notable that the share of services in all areas is considerably lower than in Westland-Oostland.

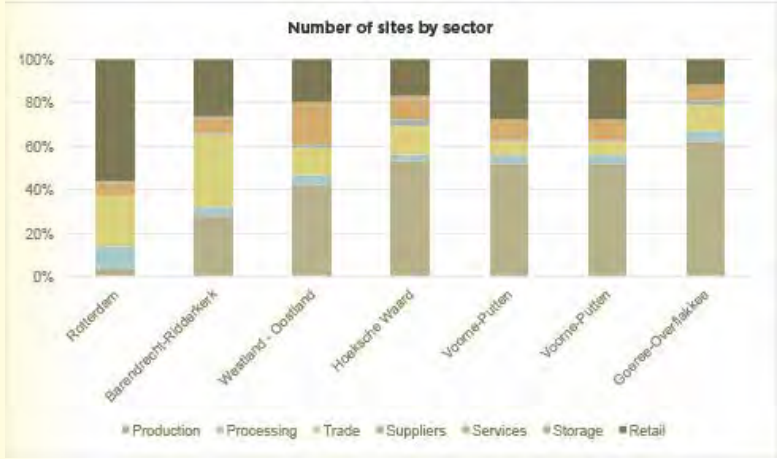

Figure 9 Production firms dominate on the ZHE (The islands south of Rotterdam).

2014	Area					
	Rotterdam	Barendrecht-Ridderkerk	Westland-Oostland	Hoeksche Waard	Voorne-Putten	Goeree-Overflakkee
Type						
Production	4%	28%	43%	53%	52%	62%
Processing	10%	4%	4%	3%	4%	5%
Trade	23%	33%	13%	13%	6%	12%
Suppliers	0%	1%	1%	3%	1%	2%
Services	6%	7%	20%	10%	9%	7%
Storage	1%	1%	0%	1%	0%	0%
Retail	56%	26%	20%	17%	28%	12%

Table 2 Distribution of business premises by sector and sub-area, 2014.

Greenport West Holland: the largest international greenhouse horticulture cluster in the Netherlands.

Rijk Zwaan: Every year, international vegetable breeding company Rijk Zwaan spends 30% of its turnover on research and development.

If we look at employment in the different areas (see Tables 3 and 4), it appears that in Westland and Oostland 56% of jobs are found in the food cluster. This percentage is 23% for the Municipality of Rotterdam. The other areas are home to the remaining 20%. It is notable that the employment figures provide a different picture than the business premises, because companies in some sectors create significantly more jobs than others. The Barendrecht-Ridderkerk area is now emerging more emphatically as a trade centre. Although in absolute numbers more people are employed in this sector in Westland-Oostland, it seems that the Barendrecht-Ridderkerk area is highly specialised in trade, with several large trading establishments and an average of 30 employees per trading company.

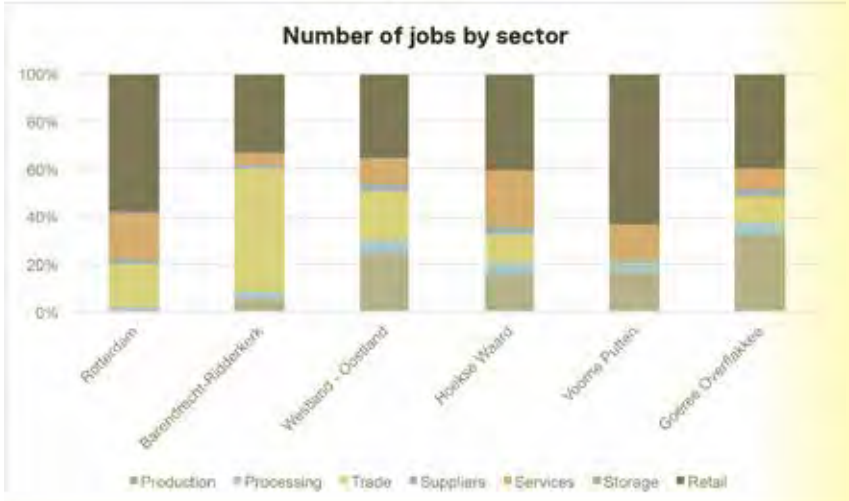

Figure 10 Employment provided by production firms (especially arable farmers) is relatively low.

2014	Area					
	Rotterdam	Barendrecht-Ridderkerk	Westland-Oostland	Hoeksche Waard	Voorne-Putten	Goeree-Overflakkee
Type						
Production	139	361	10,980	580	796	770
Processing	179	193	2,752	171	117	132
Trade	3,395	3,436	9,950	445	48	259
Suppliers	355	81	1,495	135	23	84
Services	3,716	354	4,875	884	699	228
Storage	282	24	256	3	1	2
Retail	11,149	2,151	16,396	1,518	2,877	942
Total	**19,215**	**6,600**	**46,704**	**3,736**	**4,561**	**2,417**

Table 3 Employment by sector and sub-area for 2014.

2014	Area					
	Rotterdam	Barendrecht-Ridderkerk	Westland-Oostland	Hoeksche Waard	Voorne-Putten	Goeree-Overflakkee
Type						
Production	1%	5%	24%	16%	17%	32%
Processing	1%	3%	6%	5%	3%	5%
Trade	18%	52%	21%	12%	1%	11%
Suppliers	2%	1%	3%	4%	1%	3%
Services	19%	5%	10%	24%	15%	9%
Storage	1%	0%	1%	0%	0%	0%
Retail	58%	33%	35%	41%	63%	39%

Table 4 Employment by sector and sub-area for 2014 in percentages.

3 Conclusions

In conclusion, we can say that there are major differences between the food-related economic activities in the region in and around Rotterdam. Wholesale is roughly concentrated in the city and around Barendrecht-Ridderkerk; retail is of course found everywhere, but primarily in the city. We also find the processing industry in the city, and particularly on the outskirts of the city, due to accessibility considerations. To the north of Rotterdam we find a large number of companies: the horticulture cluster of Westland and Oostland appears to be absolutely dominant. Yet we also see an interesting food cluster to the south of Rotterdam, predominantly consisting of extensive arable farming and local retail. The number of businesses is significantly lower in Westland due to the related land use. However, we consider the observation that Westland is also home to a large number of service companies to be more important. We suspect that these service companies could make a sizeable contribution to (international) growth and innovation.

The number of food-related processors, traders, suppliers and services is generally limited on the ZHE (The islands south of Rotterdam), even though these sectors are expected to be the ones that offer the most added economic value in relative terms.[50] Employment in the primary sector on the islands is also limited compared with the number of business premises, but also compared with places such as Westland. Figure 11 clearly shows the ratio between the number of business premises and employment.

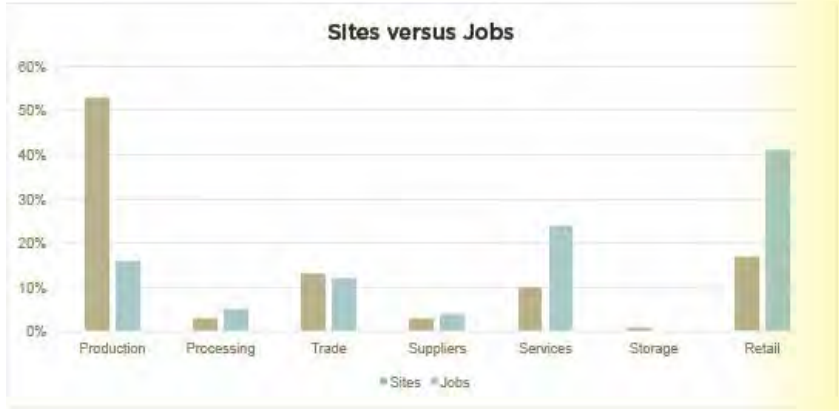

Figure 11 Where production firms dominate in the number of business premises on the ZHE (The islands south of Rotterdam), the number of jobs reveals a very different picture.

The number of companies operating in the food cluster appears to be steadily declining over time. Despite some variation, this seems to apply to all regions and sectors. In urban areas and in Westland we see the number of businesses decreasing, but employment is growing. There is a healthy dynamic: businesses come and go, and they recruit and lay off employees accordingly. The islands also show a fairly stable decline in the number of business premises over time. However, the refreshment rate is lower, which could indicate a shrinking sector (company closures) or consolidation (scaling up as existing companies move forward together or are taken over). Compared with the other regions in and around Rotterdam, it seems that the chance of new companies surviving on the islands is relatively high, possibly because their approach to doing business is slightly more conservative (less borrowed capital, more stable relationships with other companies). Nevertheless, the number of new businesses remains limited.

This chapter reveals that the area to the south of Rotterdam has a different profile compared with the area to the north of Rotterdam, and that the city also has a different profile than the more rural areas. If the aim is to develop these areas as a single food cluster, it requires further study of the complementarity of these areas and the companies that have set up business there. This study thus endorses the recommendation for further research made in the Food for the Future research agenda.[51] The sixth point in the research agenda is particularly relevant in this regard:

- The functional relationships that companies maintain, in terms of chain (input-output) relationships, as well as in terms of collaboration, family-run businesses, spin-offs, labour market distribution and joint investments in innovation and branding;

The position in the chain of the areas cited in this memorandum needs further qualitative research. One question here is whether arable farming in the area to the south of Rotterdam plays a facilitating role with regard to higher quality activities elsewhere in the chain, or whether it concerns economically outdated sectors. If the latter situation is the case, entrepreneurs will have to design new business models to remain competitive in the long term. This could manifest in diversification – the development of alternative economic activities to replace or supplement agricultural activities – or in the development of products that offer considerably more added value (product/market innovations) and the development of increasingly efficient business operations with the help of technological innovation. The latter could be an interesting joint challenge for entrepreneurs involved in horticulture. There, too, pressure on margins may accelerate the need for innovation.

3.1 Follow-up questions

The analyses provided reveal a picture of the business dynamics in the period between 2011 and 2015, with a breakdown of new start-ups, liquidations and growing and shrinking company branches in different phases of the value chain – from production to retail. The sector does appear to be dynamic: start-ups and liquidations go hand in hand, with ultimately a positive balance of job creation in virtually all parts of the chain. The integration of the chain components has a positive effect on the majority of growth indicators. However, they have not (yet) all been studied. This brings us to a more extensive research agenda, which also devotes attention to:

1. **The long-term dynamics of activities in relation to the economic climate, international competitiveness and transport flows at home and abroad (in relation to the Port of Rotterdam). How are they related?**
2. **Explanatory factors that are related to business dynamics. What spatial and (business) economic factors contribute to the cluster's dynamics, productivity and innovation?**
3. **The impact of moves, mergers and takeovers on business dynamics. Where is the cluster's strength concentrated?**
4. **The particular location-specific nature of the different parts of the value chain. Can the region (continue to) house the entire value chain? What investments are necessary to achieve this in terms of real estate, accessibility and labour potential?**
5. **The skills and competences necessary for maintaining competitiveness, but also mainly for the possibility of innovation and renewal in each of the components of the chain, and in the chain as a whole;**
6. **The functional relationships that companies maintain, in terms of chain (input-output) relationships as well as in terms of collaboration, family-run businesses, spin-offs, labour market distribution and joint investments in innovation and branding;**
7. **Last but not least: the capacity of the primary segments in the value chain – growers and arable farmers – to develop new business models that offer more added value.**

Footnotes

[1] Read more about the Next Economy Roadmap at https://roadmapnexteconomy.com/
[2] Read more about the development and research agenda at www.rotterdamfoodcluster.com
[3] https://www.cbs.nl/en-gb/publication/2016/23/internationalisation-monitor-2016-second-quarter.
[4] Raphael Hoogvliets (2014) Ruimtelijke samenhang in het Nederlandse Agro- en Foodcomplex (Spatial Cohesion between Agriculture and Agribusiness in the Dutch Agrifood Complex), Master's thesis, Faculty of Geosciences, Utrecht University.
[5] CBS (2016) Internationalisation monitor, 2016-II, Agribusiness, Statistics Netherlands: The Hague.
[6] LNV (2004) Het Nederlandse agrocluster in kaart (The Dutch agricluster), Ministry of Agriculture, Nature and Food Quality: The Hague.
[7] Maas, J.H. (1994) De Nederlandse Agrosector. Geografie en dynamiek (The Dutch Agrisector. Geography and dynamics). Van Gorcum: Assen.
[8] https://www.cbs.nl/en-gb/news/2018/03/dutch-agricultural-exports-at-record-high.
[9] https://www.topsectoren.nl/topsectoren
[10] Source: Food Atlas of the Netherlands (2014), Noordhoff Atlas Productions
[11] Maas, J.H. (1994), see above.
[12] LNV (2004), see above.
[13] This refers to distribution channels, including physical and virtual channels, becoming completely interwoven.
[14] https://www.rabobank.com/nl/raboworld/articles/healthy-eating-what-you-know-and-what-you-believe.html (2017)
[15] https://www.rabobankcijfersentrends.nl/index.cfm?action=branche&branche=Voedingsmiddelenindustrie (2018)
[16] https://www.rabobankcijfersentrends.nl/index.cfm?action=branche&branche=Voedingsmiddelenindustrie (2018)
[17] Greenport Westland-Oostland (2015) Visie 2030, Mondiale tuinbouwkern voor voedselvoorziening, gezondheid en welbevinden (Vision 2030, Global horticulture hub for food supply, health and well-being).
[18] Greenport Westland-Oostland (2015) Visie 2030, Mondiale tuinbouwkern voor voedselvoorziening, gezondheid en welbevinden (Vision 2030, Global horticulture hub for food supply, health and well-being).
[19] Food Atlas of the Netherlands (2014), Noordhoff Atlas Productions.
[20] https://www.rabobank.nl/bedrijven/cijfers-en-trends/food/voedingsmiddelenindustrie#economie (update January 2018)
[21] ING (2012), see above.
[22] F. van Oort (2012), De weerbare regio. Ruimtelijk-economisch beleid in de Zuid-Hollandse kenniseconomie (The resilient region. Spatial-economic policy in the Zuid Holland knowledge economy). Province of Zuid Holland;
S. van der Laan (2014), Versterking van het cluster life & health in regio Zuidwest Nederland (Strengthening the life & health cluster in the Zuidwest region of the Netherlands). Doctoral thesis, University of Utrecht;
D. van der Hoorn (2013), Kruisbestuiving in de praktijk: onderzoek naar de ontwikkeling van innovatienetwerken in de Zuid-Hollandse plantenveredeling (Cross pollination in practice: a study of the development of innovation networks in the Zuid Holland plant-breeding sector). Doctoral thesis, University of Utrecht.
[23] https://www.rabobankcijfersentrends.nl/index.cfm?action=sector&sector=Food
[24] ING (2012), see above.
[25] https://www.rotterdamfoodcluster.com/facts-figures/ (2017).
[26] Agricola, H. and Kuhlman, T. (2015) Benchmark Agrofood, De positie van regio FoodValley in Nederland (Agrifood benchmark, The position of the FoodValley region in the Netherlands), Alterra: Wageningen.
[27] M. Thissen, A. Ruijs, F. van Oort & D. Diodato (2011), De concurrentiepositie van Nederlandse regio's. Regionaal-economische samenhang in Europa (The competitiveness of the Netherlands' regions. Regional-economic cohesion in Europe). The Hague: PBL.
[28] CBS (2016) Internationalisation monitor, 2016-II, Agribusiness, Statistics Netherlands: The Hague, p. 20.
[29] Maas, J.H. (1994), see above.
[30] Hoogvliets (2013), see above.
[31] Van Oort (2012), see above.
[32] The economic agenda of the Municipality of The Hague (2015: Knowledge Economy Agenda) entirely excludes the agrifood sector and crossovers to bioscience, R&D and seed-breeding as a whole, and the Economische Verkenningen Rotterdam (Rotterdam Economic Forecasts) (2015-2017) barely devote any attention to the potential offered by this cluster apart from the link to distribution and the circular economy (residual heat use in the port – Westland). Strategy papers by MRDH (2015), Rotterdam (2011) and the Next Economy Roadmap (2016) make explicit use of agribusiness, but mainly embedded in a life science & health focus.
[33.] MRDH (2016), The Next Economy Roadmap.
[34.] Food for the Future (2016), The transition of education in the food sector in the Rotterdam Region (p. 13).
[35] Made available for this study by the Municipality of Rotterdam.
[36] Based on the standard business classification SBI 2008, a selection was made of business categories that are part of the food cluster.
This selection was compiled with care in consultation between clients and authors, but does not cover all food-related activities.
This is unavoidable, because one disadvantage of working with SBI codes is generic classification. For example, on the basis of this =classification it is not possible to differentiate logistics activities that are related to food distribution. A conservative selection was made to arrive at an analysis that is as objective as possible. Only the SBI codes that could be directly linked to food were included.36
This selection also includes beverages and tobacco.
[37] The number 25 was selected because companies with between one and roughly ten employees repeatedly crop up in the database.
For the sake of clarity, it was decided to separate out companies that distinguish themselves in terms of their size.
[38] The food and beverages industry is substantial in national terms, with a turnover of around €80 billion, of which roughly a third consists of exports.
[39] Horticulture in the region mainly consists of tomatoes and bell peppers. In Westland, slightly less than two thirds of growers are involved in tomato growing, and one fifth are active in bell pepper cultivation. In the Groot Rijnmond area this ratio is reversed, with around 40% involved in bell pepper cultivation and 30% in growing tomatoes.
[40] Greenport Westland-Oostland is the largest greenport in the Netherlands. Total production value amounts to €2.4 billion and mainly consists of ornamental products (almost 80%), with the remainder consisting almost entirely of fruiting vegetables (almost 20%).
[41] The region to the south of Rotterdam is mainly home to arable farming, especially wheat cultivation (in most municipalities 30-60% of arable farmland is used to grow wheat). Farmers hardly make any profit on the cultivation: of the €1.21 that an average loaf of bread costs, there is a profit of 7 cents in the chain, of which 1 cent goes to the miller, 3 cents to the bread industry and 3 cents to the retailer (Food Atlas of The Netherlands, 2014). There is also substantial potato cultivation to the south of Rotterdam.
[42] Trade (both urban pattern and nearby production) and services (strong urban pattern) are not shown in this chapter. They can be found at www.zoekjeplaatje.mrdh.
[43] Suppliers and storage related to the food industry were not elaborated further. Both categories are distributed across the region, with no clear concentrations outside of densely populated or production areas. They also involve an extremely limited number of businesses, which makes it difficult to identify patterns. For the sake of completeness, both categories are included in the overview map presented earlier. An initial study reveals that storage and suppliers are mainly concentrated in places where production and services are found.
[44] Maps illustrating company liquidations and business shrinkage were also produced, but are not presented here (although they are briefly discussed). These maps can be consulted at www.zoekjeplaatje.mrdh.
[45] We can also use these ingredients of business dynamics to analyse where growth is persistent over time, where start-ups survive for longer or even expand, and where the balance of start-ups and closures, expansions and shrinkage is most positive (see www.zoekjeplaatje.mrdh).
[46] The Barendrecht-Ridderkerk area was also included in this analysis, mainly to provide material for comparison.
[47] This memorandum uses postcode areas because this makes a demarcation of sub-areas possible. As a result, area totals may differ slightly from the 2016 figures. The authors assessed these deviations and there appears to be a deviation of <1%.
[48] The region to the south of Rotterdam is mainly home to arable farming, especially wheat cultivation (in most municipalities 30-60% of arable farmland is used to grow wheat). Farmers hardly make any profit on the cultivation: of the €1.21 that an average loaf of bread costs, there is a profit of 7 cents in the chain, of which 1 cent goes to the miller, 3 cents to the bread industry and 3 cents to the retailer (Food Atlas of the Netherlands, 2014). There is also substantial potato cultivation to the south of Rotterdam.
[49] The sudden increase in 2009 is the result of a different registration system: the agricultural sector has also been included in the Zuid Holland Companies Register since that year.
[50] It may be more accurate to say that the economic value is 'absorbed' by other parts of the value chain. The primary sector might create considerable value with its production, but does not always appear able to earn high margins.
[51] The research agenda was developed in 2016, commissioned by the Food for the Future consortium. An electronic copy is available at https://www.rotterdamfoodcluster.com/project/food-for-the-future/.

Photography: Pieter Musterd

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4 The Westland as a dynamic and resilient horticulture cluster: an evolutionary study of the Glass City (Glazen Stad)

Westland, situated on the North Sea coast between Hook of Holland, Rotterdam and The Hague, is one of the most well-known horticulture regions in Europe. Due to the proximity of the North Sea, Westland benefits from a gentle maritime climate with mild winters and temperate summers. Besides the favourable climate, the fertile soil and man-made protection have ensured that Westland inhabitants were able to produce and protect their fruit, vegetables and flowers early on. The favourable location, close to the urban sales area of The Hague, Rotterdam, Leiden and Amsterdam, and via the Port of Rotterdam to England and later by train to Germany, undoubtedly contributed to the fact that Westland soon forged ahead. The economic geographer Blink already had an eye for the (potential) industrial aspects of this ever-expanding horticulture complex in the 1920s: 'Due to this endless surface of glass covering the greenhouses, glinting in the sun, due to the mass of tall chimneys of the heating systems, Westland has virtually become a contiguous factory district, where horticulture products are grown on a large scale, where every foot of ground is used, and where the finest products can be cultivated'.[52] When it comes to greenhouse horticulture, this area has become one of the largest contiguous glass acreages in the world. It is no wonder the area acquired the name of the 'glass city'.[53]

Today, Westland is one of the world's leading horticulture clusters. This region comprises approximately half of the total glass acreage in the Netherlands, as well as half of the top 100 innovative primary horticultural businesses, and approximately three quarters of traders in fruit, vegetables, flowers and plants are based here.[54] All links in the horticulture value chains are represented here in various degrees, from breeding to primary production, the supply of knowledge and technology, wholesale and commercial services and consumer marketing. The importance of the Westland to our economy has been recognised for decades. It also acts as a magnet, attracting interested companies, researchers, trade delegations and journalists who come from all over the world in search of the unique and distinctive practices of this extremely successful horticulture cluster.

Since Westland's success has been accomplished by trial and error, the question is how people in Westland have so far managed to prevent the cluster from falling into decline, as happened in the Ruhr Area in Germany, the automotive industry around Detroit and, closer to home, shipbuilding in the Rotterdam region. The spatial concentration of innovative primary and secondary horticulture businesses, together with support facilities from financial bodies, national and regional governmental organisations and educational and research institutions, has ensured not only unparalleled export success and the special status of horticulture as a top sector in our Dutch economy, but also for an accelerator of innovation and (new) activities.[55]

A study conducted several years ago[56] cited the high degree of work ethos and business acumen/entrepreneurship, the international focus, proximity of large urban markets (the London-Paris-Berlin triangle) and the location close to Rotterdam Mainport and Schiphol airport as Westland's assets. However, weaknesses were also highlighted, such as a relatively low level of education among the working population, scarcity on the labour market, limited possibilities for expansion due to the area's encapsulation by large cities, unilateral economic structure, and congestion, and outdated infrastructure.

While the number of policy reports on different aspects of Westland's development in the broad sense, and the Westland horticulture cluster in particular, could occasionally run to triple figures, more comprehensive (academic) studies are limited in both scope and length. The results are limited to three theses published a relatively long time ago (by Verbraeck in 1933[57], Oudshoorn in 1957[58] and Groot in 1992[59]), a dated popular-scientific discourse by Barendse[60] and a recent appealing monograph about the (early) spatial and geographic development of Westland by IJsselstein and Van Mill in 2016.[61] This literature study describes and analyses Westland as a dynamic and resilient horticulture region, which has developed over a period of around 150 years to become one of the most well-known horticulture clusters in the world. The question that occupied us was which factors and potential tipping and pivotal points have played a role in this successful development and the transformations. In view of these transformations, which scenarios could be anticipated and what are the appropriate decisions for achieving success in the future?

This chapter is structured as follows. First and foremost, we will focus on the spatial and geological aspects of the Westland region. We then zoom in on the specific horticulture products that Westland has grown in the past and still grows today, the technologies and technical systems involved and the emergence and (almost) demise of the auction mechanism in the market which, at the time, was highly efficient and effective. The major players in the Westland horticulture cluster are the entrepreneurs and their new or mature businesses; a select group of the latter will be discussed in a little more detail. Lastly, Westland's macro-environment and its historical developments are addressed; in addition to Westland's sensitivity to the economic climate over time, we will discuss the expansion of sector-wide education and applied research and the relevant government policy at the local, regional and national levels. Following a summary overview called 'Looking back to look ahead', this study concludes with possible future configurations and scenarios for the Westland horticulture cluster.

4.1 Westland's spatial and geological development

When we talk about Westland, we roughly mean the geographic triangle of The Hague – Rotterdam (specifically Vlaardingen) – Hook of Holland, which in the past encompassed the northern Maasmond area (also referred to as the western part of the Delfland water authority area). With regard to public law, Westland encompasses the municipalities of Westland and Midden-Delfland, created as a result of several municipalities that consolidated in 2004.

In the past, this area at the funnel-shaped estuary of the Maas was alternately flooded and inhabited. The coastal side already featured a dune area early on, while a little less than half the area, roughly south-west of the Monster-Naaldwijk-Vlaardingen line, consisted mainly of mudflats and salt marshes.[62] River water from the Rhine and the tides resulted in deposits of thick layers of clay and sand on top of a layer of basic peat in the areas of the Gantel and the Gaag, via broad channels. North-easterly, from the line mentioned above, there were farms on elevations in the landscape, such as at Hoogeland in Naaldwijk, from early on in our era. Excavated ditches that drained the water into natural creeks and several long roads from this period indicate reclamation, which made arable fields and meadows possible. From the fifth to the eleventh century, the area was characterised by the formation of peat, woodlands and dunes, flooding and a modest settlement. In the twelfth century, tides deposited around one and a half metres of sandy clay soil in the area.[63] The main components of the soil type in Westland are sand, clay and peat, supplemented with sludge and natural fertiliser, in which the balance between water and land alternated, now tipping towards land (with the growth of woodland, dunes and peat formation) and then heading back towards water (with flooding and withdrawal from the coast). This land has been used for small-scale agriculture and livestock farming since early times. Dunes formed on the southern side of Westland, after which the area could be reclaimed by means of an organised water board: along the Maas estuary and the Gantel dikes (such as Poeldijk, Zanddijk, and Maasdijk) and drainage canals (such as Oostgaag and Gravenzandsevaart) were constructed and wind-water mills were gradually introduced. To the south-west of Westland the villages of 's Gravenzande and Ter Heijde grew up.

From 1300, the land was in the hands of the clergy, the nobility (Van Wassenaar, Van der Woert, the Lords of Naaldwijk, Countess Machteld) and wealthy city dwellers (Hodenpijl, Uter Liere, Honderdland). In exchange for land reclamation, the Count of Holland permitted people to build fortified houses. The groundwater level fell as a result of settling peat, although the surface layer of clay limited soil subsidence. The required further drainage of the peat areas resulted in the formation of almost 50 polders in the area.

During the period between 1500 and 1850, the stadholders and wealthy families, the administrators of the land and merchants from the cities (especially The Hague and Delft) constructed pleasure gardens and country estates, along with the corresponding kitchen gardens and orchards, such as Huis Honselersdijk, Vluchtenburch, Cruysbroek, Endeldijk, Ockenburgh, Patijnenburch and Sion. In the eighteenth century, Naaldwijk and Honselersdijk flourished as Arcadian places, where urban patricians and

the Family of Orange could devote themselves to country life, sometimes combined with commercial leases of farms and gardens. The fiefdom of Polanen was acquired by the Family of Orange as long ago as 1589. By 1612, Prince Frederick Henry was feudal lord of Naaldwijk (including Honselersdijk) as well as of Wateringen and Zand-Ambacht. In 1621, construction began on the prestigious castle of Honselersdijk, a worthy rival to the famousVersailles and only completed in 1647.[64] This country estate was surrounded by a lush park with vast gardens spanning 85 hectares. During this period the stadholder received permission from the States of Holland to create something to create to its south the 'Oranjepolder', an acreage of approximately 460 hectares of fertile farmland.

Not only the mild maritime climate and fertile soil, but also the supply from ornamental and kitchen gardens to the owners of monasteries and country houses promoted the development of horticulture in Westland. Substantial knowledge of horticulture was gained in monastery gardens and country estates with their own orchards, kitchen gardens and nurseries. Horticulture in Westland received a boost in the thirteenth century when monks from Loosduinen abbey (and later other monasteries in the surrounding area) began to establish their own herb gardens and orchards. Distinctive cultivation methods were developed as a result.[65] The early development of horticulture was further stimulated by the construction of the previously mentioned country estates such as Huis Honselersdijk, Ockenburgh farmstead in Loosduinen, Endeldijck and Zuidwind ('s Gravenzande). Their ornamental and kitchen gardens undeniably had an impact on emerging horticulture in Westland.[66] At Huis Honselersdijk, Prince Frederick Henry employed trained French and later Dutch head gardeners who focused professionally on ornamentals and fruit growing and who supplied fruit, vegetables and flowers to the Court in The Hague. He had grapevines brought from Germany to breed and improve them here. Pieter Westerbaen was an important catalyst of horticultural knowledge, involved in crop breeding at his farmstead Ockenburgh. The Rotterdam trader Willem van der Pot, who owned the Endeldijk country estate, leased his land to fruit growers in the eighteenth century. Fruit was often grown at the country estates: not only apples and pears, but also apricots, melons and asparagus. They also constructed grape walls, specially designed to protect the grapes against the salty sea wind.

In 1798, the fiefdoms of Naaldwijk, Honselersdijk and Honderdland-Oranjepolders were merged to form the Municipality of Naaldwijk. Naaldwijk became the administrative centre of Westland, which sealed the fall of the feudal system; the pleasure gardens had lost their allure. Honselersdijk Castle became neglected and was sold by King Willem I after it had served as a prison, hospital and military academy. The Patijnenburg country estate was demolished in 1799, soon followed by the other pleasure gardens. The beautifully landscaped parks with their clipped hedges, orangeries and water features disappeared, and growers and farmers transformed lawns and thickets into fertile agricultural land.

In the nineteenth century, extensive tillage was carried out in Westland. Excavated sand from high-lying sandy ground was transported by barge to low-lying wet, heavy or clay ground. Up until 1950 over 1,000 hectares were raised (sometimes up to a metre) and improved using ‘Schiedammer manure’. Before artificial fertiliser and compost were invented, the Westlanders had high regard for cow dung, which they used extensively to fertilise the land. At the time, the manure was collected from the ‘swill district’ in Schiedam, where the cows were fed with waste products from the many jenever distilleries there.[67]

Around the turn of the twentieth century, the best grounds were the ‘geest’ grounds at Loosduinen in the north of the area, where the harvests were better and began earlier than elsewhere. Horticulturists there invented flat glass and introduced warehouses. They made a decent living. Horticulture in this area produced lots of early potatoes, grapes, cucumbers and cabbages. After the Second World War, the growers wanted to be at least self-sufficient by growing diverse types of fruit, vegetables and some flowers, and even keeping small livestock.

Last spatial item to discuss is the improvement of transport and trade as an underlying cause of the positive development in horticulture in Westland. The construction of canals provided regular transport for produce and people. The opening of the Nieuwe Waterweg from Rotterdam to the North Sea in 1872 meant that transport to England, the main export country at the time, became much faster. Cooperative banks were founded around 1900, a subject to which we will return later. The establishment of auctions (as of 1888) and tramlines gave the sector a boost, while the obligation to supply to auction in 1916 made trade and pricing more transparent and reduced dubious export practices. The central trade itself promoted the introduction of railway lines. Locks and canals were used until after 1960 to transport produce by barge to the auctions, and long afterwards to extract surface water to spray the crops. Around 1960, 40% of the greenhouses were still only accessible on foot or by barge.[68] Many canals were filled in to construct roads.

In around 1925, three quarters of horticulture in the Netherlands took place under glass in Westland. In 1930, Westland’s horticulture spanned over 3,800 hectares, mainly in Loosduinen, Monster, ‘s Gravenzande and Naaldwijk. The growth of horticulture stagnated a few years later due to the crisis and damage caused during the Second World War. Starting in 1930, countries began to restrict imports to protect their own companies: Germany set foreign exchanges for imports, Britain devalued the pound sterling and introduced import duties, and the Netherlands introduced a variety of measures including fruit import duties, as well as a Horticulture Support Act (1932) with price surcharges and minimum prices. Due to the war, hundreds of hectares along the coast and the Waterweg were closed to cultivation and habitation. They were fitted with tank moats and bunkers to stave off an invasion by sea. In 1945, horticulture in the region covered 4,400 hectares in Westland, especially outdoor cultivation: there were 1,800 hectares of

extremely good sand and geest soil in the northern part of Westland, while a little further to the south lay 1,000 hectares of 'geest' grounds and 1,600 hectares of clay soil.[69]

Vegetable cultivation only reached previous production volumes again in around 1950. Flower cultivation took even longer to recover fully. We will focus specifically on these macro-economic and political forces later in this document. Exports to fast-growing Germany were key to the subsequent rapid growth in sales territory and turnover. Although horticulture was initially concentrated in the west of the area, the expansion of the village centres and the success of greenhouse horticulture enabled ‘bought out’ - growers to the remaining vacant land with greenhouses, and Westland horticulture expanded to the south and the east. With the creation of the Municipality of Westland in 2004, the territory was relatively built up. This concludes this very brief spatial description and we will now move on to other topics, such as products and the economic climate.

Figure 12 Topography of the Municipality of Westland, 2016.

4.1.1 Products

When we zoom in on the horticultural products of Westland in previous centuries, we see that they mainly concerned the open-field production of fruit and vegetables. Westland grape growing is mentioned as early as 1828, in the 'State of Agriculture in the Kingdom of Holland', which contains an explicit reference to the successful export of grapes to England. Around 1850, hay and pasture dominate, in addition to (arable) farming, in terms of surface area. Horticulture thus covered up to max 22% of a village, according to IJsselstein and Van Mil.[70] For the purpose of illustration: in the village of Poeldijk, many kinds of 'wares' were grown such as grapes, lettuce, cucumbers, endives, carrots, cabbages, turnips and beetroot.

Westland changed dramatically between 1850 and 1950. The market gardens, greenhouses built against walls, and fruit trees were successively replaced by wall greenhouses, 'flat glass', and warehouses with coal-powered heating systems. Fruit walls were built several metres high to provide protection against the salty sea wind and to retain the heat of the sun. Around 1880, Westland had no less than 180 kilometres of fruit walls. Later, individual windows were placed against the walls, quickly followed by wall greenhouses such as the lean-to greenhouse, the pent-roof greenhouse and the 'kopkas', a lean-to style greenhouse with the apex of the roof extending higher than the support wall; each new version provided more space between the glass and wall. These were followed by greenhouses that did not require a supporting wall. Until the Second World War, grape growing was a major economic factor in the Westland economy. 1936 was a record year during which 22 million kilograms of grapes were produced, resulting in a huge increase in the acreage covered by glass in Westland.

Vegetables experienced a similar development to grapes, from flat glass to warehouse, so called because lots of 'wares' could be grown in them. People had already started using greenhouses in the second half of the nineteenth century, to increase the production of vegetables. In addition to the 'wares' grown in the greenhouses, a lot of potatoes, cabbages, fruit trees and chrysanthemums were cultivated in the open field.

Flower cultivation began in Westland in the 1920s. What started as a secondary crop to keep staff in work became an independent crop, with the establishment of its own auction, now the FloraHolland auction. In addition to the autumn chrysanthemums, people began growing tulips and cut foliage. During the 1930s, the supply of carnations, freesias and a number of pot plants increased considerably. However, the development of the flower sector was thwarted during the crisis due to the introduction of growing permits. Under the claim that expanding this luxury product could soon result in overproduction, this growing restriction endured until 1966. In 1963, the acreage used to grow flowers covered 230 hectares, of which 140 hectares were under glass.[71] Once the acreage was released, expansion of the supply could be easily accommodated.

Meanwhile there was huge growth in greenhouse horticulture after the Second World War. The emergence of industry, with the corresponding population growth in the Ruhr Area in Germany in particular, resulted in an almost insatiable demand for common foods. The demand for grapes steadily declined, but the demand for vegetables outside the normal season, which could be accommodated with heated greenhouses, provided an almost untouchable competitive position on the Dutch and German market. Growers began investing in process innovation, which triggered growth in the supply industry. This success was observed by the breeding businesses, which had traditionally focused on open-field cultivated vegetables; who they turned their attention to breeding greenhouse vegetables and flowers. Continuously stimulated by plant breeders' rights, which allowed the improvement of what others had already introduced to market without having to pay expensive licences, Dutch horticultural breeding firms became the largest and the most innovative in the world (see also the Rijk Zwaan business case later in this text). The effect of the diverse innovations was that production per square metre increased significantly. For example, in the 50 years from 1955 to 2005, the production of tomatoes increased tenfold, from an average of 7 kg/m² to 70 kg/m². Specialisation of professional knowledge meant that 'mixed cultivation' disappeared: for efficiency reasons, growers became specialists in a single product which, according to the economic rules of the market, they also began producing on an increasingly large scale so the cost of a unit product could be kept as low as possible.

The formula for success resulting from continuous process and product innovation kept international competition for the horticulture cluster at a clear distance, as long as demand from the international markets continued to grow. In the 1960s, three-quarters of Westland's auction sales were already achieved through exports.[72] Unfortunately, with Spain's accession to the European Union in 1986 that country slowly but surely became a major competitor for Westland's greenhouse horticulture, especially in the winter months. Dutch tomato production collapsed after 1990, partly as a result of a boycott of Dutch beef tomatoes (the 'Wasserbomben') by German consumers. Nevertheless, the tomato acreage recovered around 1996 as a result of product innovations (such as vine tomatoes and the tasty cherry tomato) and cost reductions achieved by scaling up. When we examine the vegetable sector in the long term, the range decreases to mainly tomatoes, bell peppers and cucumbers for international trade, with secondary roles for courgettes and aubergines.

Between 1970 and 1990, the flower trade grew faster than the vegetable trade: sales increased at the Westland vegetable auctions by almost 50%, to 1.1 billion guilders; sales at the flower auction increased by around 450%, to 1.6 billion guilders. Unlike with vegetables, the capacity to sell a wide assortment of flowers (and later plants) gave the Dutch flower sector a labour-intensive but crucial competitive advantage. The varied range of flowers on offer made the Dutch auction clocks world famous, although exports of carnations and freesias to Germany dominated. In terms of plants, seasonal products, such

as bedding plants and poinsettias, together with the traditions of competitors in Belgium and Denmark as early as the 1970s, resulted in the emergence of mediation for large batches of pot plants at competitive prices.

After the turn of the century, the demand from the market diversified and a number of producers were easily able to respond to this demand. Besides scaling up, searching for the right market niche was shown to be a major factor for success. This resulted in the reintroduction of 'forgotten vegetables', organic greenhouse cultivation and a vast, diverse market for speciality tomatoes and vegetable sprouts. However, the main pillar of Westland's economy remains the mass and large-scale production of the tomato, cucumber and bell pepper, mainly for export. In 2014, the Netherlands may not have been the largest producer, but it was the largest exporter of tomatoes worldwide. In the flower sector, the large-scale, capital-intensive production of orchids, especially the Phalaenopsis, represents the horticultural success story in recent decades, not only in Westland. Once more, process innovation enabled the sector to achieve competitive advantages; uniform production with extremely low failure rates was possible due to the perfection of the meristem culture in plant-breeding and to maximised mechanisation and automation in growing these pot plants. Together with the creative marketing approach (see the Sion business case), this enabled the Netherlands to catch up with and surpass its orchid competitor, Taiwan.

4.1.2 Technology/engineering and systems

Due to the relatively high cost of land, energy and labour, process innovation to increase productivity has proven crucial for continued success in greenhouse horticulture.[73] The transition to vegetable cultivation in greenhouses progressed relatively naturally after the Second World War, because of the experience already acquired with growing grapes in greenhouses in Westland (see Figure 13). As a result, certain vegetables, such as lettuce and spinach, could be grown on a large scale outside the open-air harvesting season. This delivered such good prices that the additional costs involved in heating a greenhouse could easily be covered. Heating greenhouses with coal stoves using water in a pipe system was expensive and heavy work. In the 1960s, there was a switch from coal to using oil to heat the greenhouses. The number of boilers and chimneys required decreased dramatically, but air pollution worsened. This soon improved when all horticulture firms were connected to the natural gas network in the 1970s. So-called 'cold growers', who left their greenhouses empty in the winter due to heating costs, disappeared.

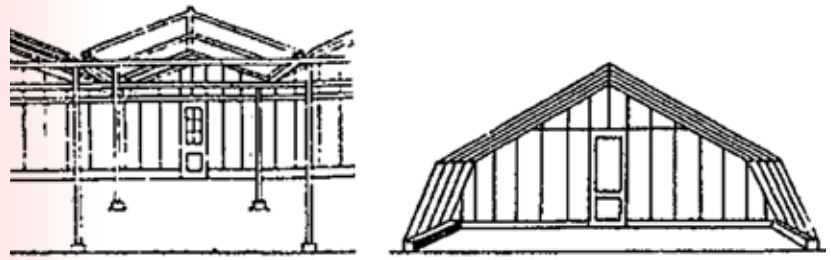


Figure 13 Warehouse (left) and greenhouse (right).[74 75]

The introduction around 1959 of air-heating 'plofkachels' (literally translated as 'exploding stoves', so called because of the detonation heard when the round, oil-powered stove was ignited) in the greenhouses resulted in the extra production of leafy crops (see the Priva business case). Later on, people discovered that the production of CO^2 was mainly responsible for this, and not the hot air. CO^2 is needed for photosynthesis and thus for plant growth. This was discovered around 1970, during the transition to cheap natural gas. This very reliable heating method, compared with coal and heating oil, meant that the 'plofkachels' were superfluous. The 'ploffers' disappeared from the greenhouses, and with them the extra CO^2 in the greenhouses. Research revealed when and how CO^2 could best be added. This led to a targeted use of CO^2 in greenhouses as a form of fertiliser, by extracting and supplying CO^2 from the combustion gases from the boilers and more recently from energy-intensive sectors in the nearby ports of Rotterdam.

Greenhouse construction developed simultaneously with the slogan 'one percent more light produces one percent more yield'. Much earlier, as long ago as the eighteenth century, windows were placed against walls at an angle, where grapes could be grown in sheltered conditions. The example was apparently taken from the grape greenhouses constructed from iron and glass panes in Belgium after 1880.[76] Around 1900-1915, growers began experimenting with growing fruit and vegetables in containers covered by glass in a frame containing flat glass with Dutch light. In the former horticultural village of Loosduinen, a grower apparently placed the flat glass on poles and called the complex a warehouse, after a four-storey consumer shop with a large glass dome in The Hague.[77]

Researchers soon advocated a fixed greenhouse with windows and intermediate rods, and iron gutters for water drainage and support. This is cheaper, produces less shadow and results in less heat loss. This greenhouse was built in Venlo, hence the name 'Venlo greenhouse'. In Westland in the 1950s the grape greenhouse was still more generally known than the Venlo greenhouse. From then on, the pace picked up and the Venlo greenhouse, 3.2 metres wide and constructed of glass, steel and aluminium, became the standard greenhouse all over the world (see the Duijnisveld and KUBO business cases). In the search for better growing conditions, lattice girders and span greenhouses emerged as alternatives. The glass windows also got larger and the glass became more translucent.[78]

Growers pumped up ever more groundwater to use as rainwater in the greenhouses. The Gist and Spiritus factories in nearby Delft (later Gist-Brocades, now DSM) also pumped water on a large scale to use in the factories. Since Westland was located on the North Sea, this massive groundwater extraction slowly but surely resulted in salinisation of the water. To combat salinisation in the cultivation ground and to prevent the spread of germs, the ground was rinsed for long periods as needed using spraying systems. The quality of the surface water in the area decreased as a result of drainage into the ditches, causing fish, frogs and plants to suffer as a result. Lakes were constructed, such as the Plas van alle Winden and Prinsenbos lake, to improve water storage and quality. The ban on groundwater extraction, due to salinisation, meant that growers no longer drained the rainwater that fell on to the glass of the greenhouses, but channelled it into rainwater basins to use as needed. They administered fertiliser to the plants through the water system, which meant that the fertile ground could be used more and more intensively until the 1980s. One effective innovation involved combating germs and pests in the soil after a crop had been harvested, by applying vapam and methyl-bromide. Once the latter was discovered in drinking water it was banned in 1983 due to health and environmental risks, and growers had to return to soil steaming. Disease-sensitive crops such as carnations suffered badly as a result. However, the heavily contested ban proved to be a blessing in disguise, which accelerated the introduction of a major process innovation considerably: cultivation on substrate.

Research conducted in Wageningen into cultivating on substrate (rock wool) clearly revealed that it could increase production substantially.[79] The first growers to experiment with it in the 1980s were regarded with suspicion by their colleagues but, when it appeared that production rocketed and the disease burden fell, Dutch greenhouse vegetable cultivation switched completely to growing on rock wool within three years. It was also possible to switch to rock wool or a different substrate to grow plants and some flowers. This process innovation subsequently provided improvements to the production process and increased productivity for many years. The climate and cultivation computers that had emerged made it possible to increase production per unit of energy, water, CO^2 and fertiliser. Lighting with incandescent bulbs was used more widely to extend the number of growing hours per day, although this production steering mechanism got out of hand when tomatoes and cucumbers lost their flavour due to an excessively high water percentage, as mentioned previously. Growers soon drew lessons from this and went on to cultivate ever fewer vegetables, flowers and plants in the field.

Around 2010, greenhouse horticulture in Westland comprised 250 vegetable companies, 300 plant companies and fewer than 400 flower companies, which in terms of acreage amounts to 1,000, 600 and 800 hectares, respectively (see Table 5).[80]

Total hectares									
Year	1947	1955	1960	1970	1980	1990	2000	2010	2015
Westland (conform 2004 classification)	1,096	1,481	1,797		2,791	2,987	2,723	2,423	2,399

Table 5 Surface area of greenhouse horticulture, Westland.

Existing innovation in the greenhouses was mainly driven by two major cost items for production: labour and energy. Mechanisation and specialisation aimed to minimise labour pressure by using picking, spraying, sorting and packing robots, greenhouse climate automation, walking plant systems and the introduction of various crop growth prediction modules. By using energy screens, underground heat storage, geothermal heat and heat from cogeneration, the aim was to minimise fossil fuel input. On the other hand, (assimilation) lighting made it possible for product quality to be steered more effectively, independently from the relatively high number of sunlight hours in the region. All this made greenhouse horticulture capital intensive, which meant that scaling up was the only option to make such investments possible. Meanwhile, the technical supply companies exported just as much in terms of euros as the entire greenhouse vegetable sector put together, yet many supply companies were still located in Westland.

As production was increasingly improved, the varieties also had to continuously adapt to these new production methods. Some vegetable-breeding companies specialised in greenhouse-grown vegetables. In the 1950s, the Moneymaker tomato variety was considered to be an extremely productive variety. However, the current Merlice variety by De Ruiter Seeds produces around five times as much per season per plant. This made these family-run businesses the largest and most innovative vegetable breeders in the world, and thus prey for multinationals such as Monsanto and Syngenta. With the introduction of substrates, gutters, pots and cultivation tables, the horticultural sector has become largely soil-independent. Beginning in the 1960s, a series of innovations in techniques and systems, as well as in varieties, had resulted in the modernisation and expansion of crops, gardens, transport and auctions.

4.2 Industry in Westland

We discuss the greenhouse horticulture region of Westland, the Glass City,[81] but this is largely limited to 2,385 hectares of greenhouse horticulture in the Municipality of Westland (in the strict sense). The neighbouring municipality of Midden-Delfland, also formed in 2004, is part of the Westland region (in the broad sense), but there, besides 187 hectares of greenhouse horticulture, livestock farming and recreation dominate. The economy of the Westland region (in the strict sense) mainly consists of a lot of horticultural firms, a significant number of medium-sized companies and a few large companies. These businesses form the core of the Dutch horticulture cluster: in 2017, of the 100 pioneering horticultural businesses in the Netherlands, 48 come

from the Westland region, compared with 12 from Oostland, 8 from the Aalsmeer region and 8 from West Friesland.[82] With influential companies such as Nature's Pride, Harvest House, Agrocare, Priva, Certhon, FloraHolland, Rijk Zwaan, Koppert Cress, Royal Brinkman, Greenco, Beekenkamp, Kubo, Dümmen Orange, Ter Laak Orchids etc., the region is important in all segments of greenhouse horticulture in the Netherlands.

However, the services sector is small in Westland compared with the rest of the Netherlands. The recreational, healthcare and educational sectors are also relatively small-scale and regionally-oriented. Westland has sufficient business space, which means businesses can expand and/or settle there. The surface area covered by industrial estates has increased in recent years, from 400 hectares in 1996 to 650 hectares in 2007. In contrast, Westland has limited office premises, which slows down the growth of the services sector. Lastly, the price of land is high compared with the surrounding municipalities. This means that it is expensive for new businesses to settle there and the need to focus on activities offering the highest added value is self-evident.

In contrast to the growth of industrial estates, the surface area occupied by greenhouse horticulture businesses in Westland is decreasing. Whereas in 1996 it still occupied 3,250 hectares, this fell to approximately 2,750 hectares in 2007 and is now at most 2,572 hectares (depending on the calculation method used). Due to the shortage of affordable horticultural land, growers and other firms in the cluster are starting extra firms outside Westland; just one of the many examples is Looije Kwekers, which has branches near Schiphol airport and in Murcia (Spain) (see the Looije business case). These firms are often run from Westland.

4.2.1 The origin of Westland's horticulture business

Horticulture in Westland emerged from the mixed business, in which small-scale horticulture was carried out alongside livestock and arable farming. Since it was easier for a horticulture (and arable farming) firm to set up a new company than it was for a livestock farmer (less land and capital was needed for horticulture to be profitable), livestock farming disappeared from Westland in the nineteenth century, with the exception of Midden-Delfland. In terms of surface area, arable farming, especially potato growing, lasted much longer. In 1880, potato growing was still dominant in Westland; around 750 hectares were devoted to growing potatoes.

The large number of children in the growers' families can be attributed to the influence of two religious denominations with strong generational pressure (the Reformed Church and Catholicism) and the specific business structure of horticulture (Oudshoorn, 1957). The intensive horticulture business was a good fit for families with many children: it provided additional workers for the growing business of the head of the family, which may have cost him board and care, but did not cost him wages. Given the yields per hectare, the transfer of arable farming acreage to the next generation and the division of that acreage between the children was expected to result in a downward spiral. In contrast, the presence of large families in Westland, in which the growers' sons could start a new horticulture business relatively easily, ensured that this horticulture area could flourish quickly.

The religious pleas in favour of large families were welcomed by both Reformed and Catholic growers. A large brood meant a reserve of young labourers and was as such an incentive, instead of a stumbling block, to modernise horticulture. As the children grew up, the need and possibility to increase production in the business grew most strongly. After all, the father would have to either split his business between his sons or double the yield of the same amount of land by building greenhouses and warehouses. When it was no longer possible to establish new businesses by dividing them up, growers looked around for land for their sons in the immediate vicinity in order to increase turnover and capital by purchasing new acreage. Once growers had first set up new businesses elsewhere in Westland, a lack of land later resulted in migration to other horticulture areas outside Westland (such as in the direction of Vleuten, near Utrecht, or Eelde in Drenthe).

With regard to their status in the social echelons, growers formed an intermediate link; on the one hand a few individuals could compete with the wealthiest in the village, but some led a meagre existence, differing little from that of the workers. The majority found themselves somewhere in between. The horticulture sector was a halfway house or final destination for climbers and fallers on the social ladder. The limited land use made it possible for workers, as well as farmers' sons, to launch their horticulture business on a small scale and gradually expand.

The original, versatile nineteenth-century Westland agriculture steadily evolved to become a monoculture dominated by horticulture in which grapes, tomatoes and vegetables were the main products. As already mentioned, in the first instance horticulture involved cultivation in the open field and orchards with a crop of berries below, followed by wall greenhouses for grapes, then actual grape greenhouses, to finally end up with the current product assortment that comes from Westland's warehouses: tomatoes, bell peppers, cucumbers, diverse pot plants and ornamentals. Intensification of the horticulture business may have extended the harvesting season, but this required greater investments in terms of money, labour and time.

In the nineteenth and first half of the twentieth century, horticulture was mainly practised as a traditional family-run business. Besides horticulture, Westland offered virtually no other educational or employment options. In the dominant business type at the beginning of the twentieth century, in addition to the cheap labour of his wife and children, the grower relied on an average of two non-permanent paid labourers. After the Second World War, many horticulture labourers from Westland's gardens left to work in the factories, a trend that is also referred to as urban migration or rural depopulation. When the growers' children also had to attend school for longer as a result of the introduction of compulsory education, labour became a scarce commodity in Westland's horticulture sector. Besides the typical family-run business,

in which during peak periods casual and/or temporary workers were recruited to supplement family members, there were businesses that hired their workforce from specialist contractors, which meant the growers were supervisors rather than employers of the labourers. On the one hand, smaller horticulture business were, on average, in a less favourable position to keep up and be able to innovate, but on the other hand, they often had a buffer (whether occasional or not) of family members who worked in the business, which meant they had more room for manoeuvre to cope with setbacks, because they had lower fixed wage costs.

From 1920 to 1960, approximately half of horticulture labourers came from Westland itself, with the other half hailing from elsewhere. First, migrants were recruited from Zeeland and the ZHE (The islands south of Rotterdam), followed by workers from Noord Nederland (Friesland and Groningen) or Zuid Nederland (Noord Brabant and Limburg). Since wages and working conditions in the horticulture sector lagged behind those in industry, working hours were considerably longer and the prospect of career development was poorer, an increasing number of workers switched to an industrial firm or technical profession. In the prosperous 1960s, the competitiveness of the horticulture sector on the labour market was not good, and especially as a result of the impressive growth of the Westland horticulture sector there was a shortage of workers, in terms of both quantity (high numbers were involved) and quality (skills and motivation). Local alternatives were simply unavailable.

When employees were unsuccessfully recruited from the Drenthe countryside, at the end of the 1960s Westland businesses turned to Turkey and Morocco to recruit large numbers of unskilled workers to work in the greenhouses here. It has been said that the growth and survival of Westland horticulture was, and still is, dependent on foreign workers. From the 1990s, these two groups of labour migrants were supplemented with a fast-growing population of Polish and other Eastern European workers. Given the structural shortage on the labour market it is almost impossible for the Dutch horticultural sector to do without illegal workers, and for over thirty years Illegals have made a substantial contribution to greenhouse horticulture in Westland. Their share was estimated to be around 10-20% of the labour factor per year.[83] Most horticultural businesses now use intermediaries and choose the one who can supply the desired quality of labour at the best price. There is a combination of permanent workers and casual temporary workers, as well as school-age workers, students, housewives and migrants, hired through specialist employment agencies.

At the end of the twentieth century, horticulture further transformed from a labour-intensive business activity to a capital-intensive one, in which it was necessary to wait and see whether the major investments in building greenhouses, installation engineering and ICT would pay off. As a result of increasing international competition and problems with the distribution system in the 1990s, the operating results of most horticulture businesses came under serious pressure. Most growers (apart from pot and bedding plant growers) had reacted inadequately to structural changes in the market

from a supply-based model to a more demand-based one. Traditionally, the specialist group of pot and bedding plant growers were more involved in the market and were able to respond more effectively to customer demand due to their wide assortment, compared with the more traditional growers. Whether or not they were forced to do so, an increasing number of growers delivered their products directly to traders instead of via the auction as a central location for supply and demand, resulting in fragmented sales and considerable price decreases in horticulture products. Due to a combination of lower profit margins and high energy bills it became difficult for some growers to meet their obligations to pay interest and repay loans.

4.2.2 The new innovative horticulture businesses

In the twenty-first century, Westland growers and the Municipality of Westland proceeded with land acquisition to facilitate the expansion of companies and residential acreage, respectively. The banks financed modernisation and scaling-up; land prices shot up. The situation changed dramatically when in 2008, with the banking crisis, the housing and real estate market collapsed and horticultural land and buildings had to be depreciated. Land prices lost half their value and the financier Rabobank ended up in dire straits. Out of necessity, many growers ceased their business activities; those with a small, outdated business converted to a less intensive crop such as flower bulbs and some pot plants. A number of growers also opted for non-agricultural activities such as storing caravans or a recreational activity. Other innovative growers invested in new market approaches and techniques to adopt a more profitable and more environmentally-friendly growing method, such as using cogeneration, underground water storage (water basements), geothermal heat and geothermal storage. The family-run business endured, even among pioneering horticulture firms. Three top horticulture firms that distinguish themselves in their business operations are briefly discussed below: Looije Kwekers, Sion and Koppert Cress.

Looije Kwekers

Looije Kwekers is a family-run business that was founded in 1946 by J.M. Looije, the father of the current director Jos Looije. The company started out as a vegetable growing business in Naaldwijk. The oldest son, Jos Looije, joined the company in the 1970s and it began specialising in growing tomatoes. The second son, Vincent Looije, later also joined the business. The company began to focus on growing cherry tomatoes as early as 1992, when the regular and beef tomato were dominant. Since 2000, the assortment has grown to include vine cherry tomatoes. Besides growing tomatoes, Looije is also involved in further links in the chain, such as attractively packaging the product. In 2003, Looije began handling its own product sales. Before then, product sales first went via the auction and later via cooperation partnerships.

Looije combines large-scale cultivation with a customer-oriented approach. Since 2006, Looije in Naaldwijk has a total of 6.6 hectares of tomato greenhouses, in which their tomatoes can grow under light 365 days a year.

This means the company can satisfy demand for tomatoes all year round. Looije generates its own heat and electricity using a combined heat and power (CHP) system. Water from the CHP is used to heat the greenhouses; in the winter power is used to supply light for the tomatoes, while in summer the electricity is sold via the power grid. In 2017 Looije participated in a geothermal project to extract geothermal heat at a depth of four kilometres. Since 2014, Looije has had its own packaging facility in Naaldwijk, to which the tomatoes are transported as quickly as possible after being harvested. Dozens of people work every day in the new packaging facility to pack the tomatoes and make them ready to be shipped. Within 24 hours after being harvested, the tomatoes are sorted, packaged and sent on their way to the supermarket and the consumer.

The company now has large branches in Burgerveen (near Schiphol) and in Murcia. Just like the greenhouses in Naaldwijk and Burgerveen, the Mediterranean climate enables high-quality cherry tomatoes to be produced all year round. This product is packed at the company's own facilities and shipped directly to Looije's customers throughout Europe.

Jos Looije views independent sales as a key component of the business. It means that the company has direct contact with consumers, supermarkets and other important stakeholders in the business environment. As a teenager he worked for years on a street market, where he acquired his sales acumen. After studying horticulture and social educational science, Jos Looije conducted his own research by visiting supermarkets here and in Britain. He also spent some time in telesales.[84] In 2005 the company began to focus exclusively on tasty tomatoes and later on honey tomatoes. In contrast to many growers, Looije readily accepts that production per surface area is around 25% lower and is more labour-intensive, in exchange for a much higher-quality and greater yield per unit of honey tomatoes. The company brand (name, logo and corporate identity) is strictly applied and utilised, for example as ketchup from residual tomatoes. The firm has recently recruited people with experience in the perfume and food industries.

Sion

In 1988, Eric Moor founded Sion in the hamlet of the same name, between Rijswijk and Delft, with one hectare of greenhouses. The business originally focused on producing cut flowers that were sold through the auction. Sion was still a small-scale firm at the time, with three employees, and did not concern itself much with marketing. Over the years, Sion has grown to join the group of high-profile breeders of the fashionable Phalaenopsis pot orchid.

The activities were expanded to breeding and cultivation, selection, production and imports/exports of young plant material, with which Sion became active throughout the entire chain, in some cases in association with other players ('from seed to windowsill'). In a time when sales and pricing of the Phalaenopsis product was stagnating, Sion demonstrated huge growth by being a supplier of young plants who actively involved customers in the

choice of varieties, by working new markets (with a substantial marketing budget), and by effectively spreading out the risks involved in international sales and purchases.

In 2004, the company moved to its hyper-modern headquarters in De Lier in Westland. The unconventional grand opening was embellished with life-size posters and a fashion show featuring orchids. Moor proved to be a pioneer, bringing fashion, lifestyle and marketing to horticulture and the Phalaenopsis to interior designers. Almost thirty years after its beginnings, the company now cultivates at two production sites in Westland and in Brazil, using the most advanced methods and techniques. Through exporters, flowering plants from Sion Orchids are sold all over the world.

In 2008, Sion began to specialise in breeding and propagating its own varieties. To perfect the meristem culture for propagation, Sion Young Plants collaborates with laboratories in Belgium, Germany and Taiwan. The propagation of the young plants from the laboratories takes place at Sion Young Plants and at a German partner. After around 20 weeks, the young plants are sold to growers in the Netherlands and other countries, where they flower and are made ready for market. In the meantime, serious steps have been taken with exports of plant material outside Europe, mainly to Canada, America and Brazil. Sion is now a well-known and successful floriculture company with around 60 employees and €30 million in turnover, and the firm is known for its market-oriented approach and innovations.

As a result of the many cooperation partnerships in the area of promotion (Orchidee Nederland), ICT software (Plantform), brand development (Decorum), and education/knowledge/cultivation (various study clubs and with Wageningen UR), the company presents a positive image for the horticultural sector as a whole. Partly due to Sion, the turnover related to Phalaenopsis in the Netherlands is growing by no less than 21% a year (2000-2015), to 150 million young plants and half a billion euros in revenues.[85 86]

Eric Moor is also the co-founder and former president of Decorum Company, a cooperation partnership of 45 leading pot plant growers set up in 1996. The aim of this company, which was originally a pot plant growers' association and which currently comprises around 60 flower and plant growers, is to manage the chain more effectively with the 'Decorum' brand product, in cooperation with all the value chain links. Under their recognisable flag, Decorum Plants & flowers offers a range of 3,000 pot plants and flowers, which are available in dozens of countries. The next ambitious goal, which is already showing promise, is large-scale category management: running plant shelfs in supermarkets.[87]

Koppert Cress

The history of Koppert Cress dates back to 1988, when the firm was set up by Mr Koppert to develop and produce micro-vegetables, such as radishes. As part of his job with seed-breeder Syngenta, Rob Baan travelled all around the world from 1979 onwards and put Koppert in touch with new products from elsewhere. After working with Koppert as an account manager, Rob Baan took over the company by means of a management buy-out in 2002, with the help of two investors. Baan not only changed the name to Koppert Cress, but also repositioned it as a customer-oriented business with marketing and innovation as its primary driving forces. Koppert Cress specialises in 'cresses', seedlings of unique plants, each with their distinctive effect on the senses. Depending on the taste, scent, touch or presentation, there is a suitable cress for every occasion. Koppert Cress produces 65 different plants, and every year at least one new product is added to the range of micro-vegetables, a collection that is pitched as 'Architecture Aromatique'. Partly as a result of his previous work experience at Syngenta and relationships with chefs in Europe, Baan has succeeded in combining his knowledge of the seed industry with culinary delights. Koppert Cress has created its own niche.

In 2006, the site in Monster, in Westland, was expanded to 1.7 hectares and 'Cressperience' was opened, intended as a meeting centre for co-creation cooking workshops and 'venue for mouth-watering horticulture and flavour-seeking gourmets'. Cressperience consists of a hyper-modern kitchen where Koppert Cress joins forces with chefs and traders to seek innovative applications for gastronomy. Koppert also entices gourmets and chefs with the renowned Molteni Podium IV stove, to create, serve and taste their dishes with cresses. A visit to Cressperience is combined with a guided tour of the company, where the entire production process can be viewed, from sowing to the products' use in the demonstration kitchen.

The opening of Cressperience provides considerable growth and increasing interest in the product. The active approach with regard to end users – mainly chefs, restaurants, caterers and hotels – guarantees increased awareness and creates demand for the innovative range. Every day the 200 employees at Koppert Cress supply Dutch traders, who in turn distribute the micro-vegetables across Europe and beyond.

Since January 2007, Koppert Cress has also supplied its products to the American market. In October 2006, the construction of special greenhouses began on Long Island, near New York, where the fresh products originate. An effective collaboration with the fruit and vegetable wholesale industry guarantees distribution throughout North America. At the moment there are four branches and licence holders in North America, Japan, Turkey and Australia.[88]

Koppert Cress and its director Rob Baan have picked up an impressive number of awards from the Dutch vegetable industry as well as the international gastronomic community, in recognition of the innovative approach of the product and market. Baan aspires to improve the health of

the Netherlands with tasty, healthy food. Recent recognition of his vision, innovation and professionalism took the form of an invitation to participate in an exhibition of non-urban developments by the architect Koolhaas in the Guggenheim Museum in New York.

4.2.3 Supply companies: suppliers of greenhouses, climate control and seeds

Influenced by specific horticulture subsidy regulations and fuelled by a strong urge to expand among the Westland growers, in the late 1970s and early 1980s there was explosive growth in new varieties, greenhouses and installations. Local supply companies such as the seed-breeder Rijk Zwaan, KUBO and Duijnisveld greenhouse construction and Priva climate control benefited enormously from this round of investment. They have now almost outgrown Westland or greenhouse horticulture.

Duijnisveld and KUBO

One of the pioneers of Westland greenhouse construction is Cees Duijnisveld and the business he founded: Duijnisveld Kasconstructies. Around 1900-1915, when the first innovative growers were starting to experiment with growing fruit and vegetables in wooden greenhouses and under flat glass, Duijnisveld came up with the idea of producing a steel greenhouse. Together with three associates he founded a company in 1919, and two years later Cees Duijnisveld continued alone with his firm Duijnisveld & Son. Besides his greenhouse construction business in Poeldijk, he also had his own nursery, but the success of his construction firm resulted in him closing the nursery in 1934. At the end of the 1940s, father Cees was succeeded by his sons Jan and Aad, who were succeeded in turn in the 1980s by the new generation: Hans and Cor Duijnisveld. A shift in emphasis in the direction of mass production resulted in the company, now called Duijnisveld Kasconstructies, expanding significantly and evolving to become a professional and successful supplier of greenhouses both at home and abroad.

The history of another successful greenhouse constructor from Westland, KUBO, dates back to the years after the Second World War, when Arie Kuiper, a former heating engineer who had a lot of experience working in flower greenhouses, set up the firm Kuiper en Boers in Monster along with his associate Rien Boers (Kuiper, 2015). One important innovation Kuiper en Boers introduced to the market was the KUBO greenhouse, characterised by the fact that it was maintenance-free and required virtually no welding work. The company subsequently expanded to become a major business involved in warehouse construction, heating systems and air vent material. In 1963 the company simply adopted the product name KUBO as its company name (Kuiper 2015: 13). The second generation also gradually took over the reins of the company from the founders and it was decentralised with specialist units, such as KUBO production, KUBO horticulture projects and the toolmaker Kustema.

In 2002, the third generation joined the family-run business, and Wouter Kuiper became director. Along with Verkade Klimaat and the technical installers Nic Sosef and Peter Dekker Installaties, Kubo designs the greenhouse concept of the future: their Ultra-Clima greenhouse transforms greenhouse horticulture from an energy-guzzling to an energy-efficient sector. In 2005, the greenhouse was successfully trialled at Houweling Nurseries in California. The Ultra-Clima greenhouse and the Solar greenhouse, also designed by KUBO, are export successes and generate large orders for the company from Japan, Kazakhstan, Oman, Kuwait and Canada, among others. Over 350 hectares of Ultra-Clima greenhouses have been built in 16 countries (Hillenraad100, 2017). KUBO has recently continued its highly innovative and successful approach, by the construction of the medicinal marijuana greenhouses in North America, and a solar power project in Oman.[89]

Rijk Zwaan

One of the iconic enterprises in Westland, Rijk Zwaan, does not actually come from Westland, but the founder and individual who gave his name to the company eventually came to De Lier from Enkhuizen, via Rotterdam and Bergschenhoek (Van Paassen, 2016). Rijk Zwaan came from a family of seed-breeders and traders in Enkhuizen, which has been a national and international centre for seed-breeding and production since the end of the nineteenth century. In addition to the theoretical knowledge he acquired at the RijksTuinbouwSchool in Hoorn, he gained practical experience in his father and uncle's family-run business in Enkhuizen and started out as a representative in the company's Rotterdam branch.

In 1924, after briefly trying his luck in America, Zwaan founded his own company in Rotterdam: he opened a shop selling seeds near the former horticulture area of Kralingen. He also started breeding plants. Several years later, the company had multiple small experimental gardens to facilitate the selection of the vegetable crops. He also used a lot of seeds he obtained from his brother Hendrik, who had established himself as a breeder in Enkhuizen. This meant that vegetable seed was not only grown in-house but was also selected by Rijk Zwaan himself. Rijk Zwaan found new customers in the area around Delft and Loosduinen. After buying a piece of pastureland in Bergschenhoek in 1929, he built his own facilities there for seed production and breeding so he could select plants and thus control the seed quality. When, in 1941, the Breeders' Decree was introduced, the breeding profession acquired a more permanent and financially interesting base.

After the Second World War, greenhouse horticulture development exploded and Westland became Rijk Zwaan's main sales market for greenhouse vegetable seed. In 1964, nine hectares of land was purchased in De Lier to conduct breeding tests. The process to make Rijk Zwaan more international also began, first in Germany where a subsidiary was founded, and then in Belgium and the Scandinavian countries. In 1970, a new storage and office complex was opened in De Lier, including the Rijk Zwaan headquarters. In

1971, Rijk Zwaan was succeeded by a trio: son Jaap Zwaan, son-in-law Willem Tintel and Herman Beeftink. Succession issues in the family-run business caused that in 1986, the Zwaan family decided to sell the company shares to BP Nutrition, which became the majority shareholder. The sellers stipulated that Rijk Zwaan would not be merged with other European seed firms.

In 1987, it was decided to move all activities from Bergschenhoek to De Lier, where the Seed Technology Centre was established: a modern complex which was not only used to store products, but which was also where the seeds underwent various processes. At that time there were around 750 employees working at Rijk Zwaan in De Lier. BP Nutrition did invest in Rijk Zwaan the first two years, but after this the multinational changed its strategic course and in 1989 it put the business in De Lier up for sale. Management, employees and even customers vehemently opposed a sale to parties that wanted to dismantle or merge the breeding company. They wanted the business to remain intact and independent. With financial efforts by the management and employees, and strategic input from national horticulture cooperative Cebeco-Handelsraad, the management managed to buy back Rijk Zwaan from BP Nutrition.

Internationalisation and new technology began to characterise the company in the 1990s. After 1980, the international market became more and more important to the company and the number of branches outside the Netherlands increased. Second generation member Jaap Zwaan took his leave of the company in 1989 and Maarten Zwaan, the son of Rijk's brother Hendrik, took over the breeding company. In 1989, co-founder Rijk Zwaan, along with four other seed companies, was involved in setting up the new biotech company KeyGene in Wageningen, on the development of fundamental research and marker technology. Beginning in 1989, Rijk Zwaan opened an average of one new branch outside the Netherlands every year. In 2004, the breeding company opened a second research site in the Netherlands, in Fijnaart (Noord Brabant). Finally, Rijk Zwaan took the initiative of integrated chain care through closer cooperation between the partners in the whole chain, such as growers, exporters and supermarkets. The Rijk Zwaan assortment mainly consisted of fruiting vegetables, leafy crops, root crops and cabbage varieties.

In 2015, Rijk Zwaan, number five in the world in the field of vegetable seeds, was an international family-run business with around 30 subsidiaries and 2,500 employees, of which 1,100 are based in the Netherlands. Rijk Zwaan is a very knowledge-intensive business, where approximately 15% of the total annual turnover of almost €400 million is spent on research, development and breeding. Due to worldwide competition, in 2016 Rijk Zwaan announced it would accelerate its investment of €250 million, of which €150 million would be invested in the Netherlands, in greenhouses, laboratories and research centres.[90]

Priva

Another interesting supply company, located a stone's throw from Rijk Zwaan, is Priva, a family-run business that supplies systems for climate and process automation for greenhouse horticulture. The company also installs building management systems for regular office and/or factory buildings.[91] Founded in 1959 by Jan Prins and his uncle Cor Valk in De Lier as Valk & Prins, it expanded with the sale of convection heaters and fans in the 1960s and 1970s.

In 1956, Jan Prins started experimenting with Hylo Salamander heaters for the horticultural sector, also called 'ploffers' (exploders). These heaters, powered by oil and ignited using a detonator, were placed in greenhouses as auxiliary heating. The heaters did not even have a flue system leading outside the greenhouse. Entrepreneur Jan Prins discovered more or less by accident that the fumes released into the warehouse stimulated the growth and the quality of the lettuce and (later) tomatoes, and that the lettuce growing season could be extended. When it became clear that the positive growth effect was a result of the combustion product CO2, the heaters were used more often as the driver for productivity improvements. After this initial success, Jan Prins began developing and selling fully-automatic CO2 burners, featuring a timer, that could be hung in the greenhouses. In 1965, the company name was changed to Priva, from the names of the founders: Prins and Valk. The company quickly grew to around 300 employees.

The company encountered difficulties in the late 1960s. Growth had come to an end, costs had risen dramatically and a reorganisation was needed. Around 1973, at the time of the first oil crisis that caused a lot of problems for the horticulture sector, Valk & Prins were saved by the investment vehicle VEEM of the Bank Mees & Hope. For Jan Prins, this meant that he had lost his job as well as his company. Two years later Prins was asked to once more take leadership of the now much leaner Priva: Jan Prins and 29 employees started transforming the heating company into a control technology firm. In 1977, Priva was one of the first companies on the market to use a climate computer, supported by user-friendly software written specially for the horticulture sector. This computer combined control of the climate, energy and irrigation in the greenhouse. In competition with Royal Brinkman and later Hoogendoorn, these computers brought Priva strong growth and development.

Through a small project at the RAI in Amsterdam in the early 1980s, the company also entered the market for building management systems and automation. Based on the knowledge and products gained from the horticulture sector, Priva's activities on the Dutch building market grew to account for approximately half of the company's current turnover. In less than 60 years, Priva has evolved into a global company with premises, training centres and partners on every continent. The 120 employees in the company's Product Development department work on innovative solutions for climate control and process management in horticulture and in the built environment. This is guided by the vision that we need to reduce our reliance on scarce

natural resources such as water and (fossil) fuel, and that the food production per square metre must be further increased. Daughter Meiny Prins, a business engineer herself, not only took over the company in 2003, but also expanded it considerably, and was elected Businesswoman of the Year in 2009. Since then she has been an inspirational member of many committees and platforms. Priva won the World Wildlife Fund's first Cleantech Star.

According to Priva itself, the firm is a market leader in climate control and process management for greenhouse horticulture and large buildings. Its current product range features hardware, software and services, including online services. All things considered, Priva is perfectly placed to implement innovations at the intersection where horticulture meets the built environment, such as residual heat supply from a greenhouse to a residential district in Naaldwijk, growth cells, energy-efficient workplaces or systems for fully-conditioned indoor (vertical) farming. Priva is now a bona fide high-tech firm with a turnover of around €75 million, of which 15-18% is allocated to R&D, achieved by 460 employees whose work is centralised at the Priva campus in De Lier, but who also work in branches elsewhere in Europe, North America and Asia.

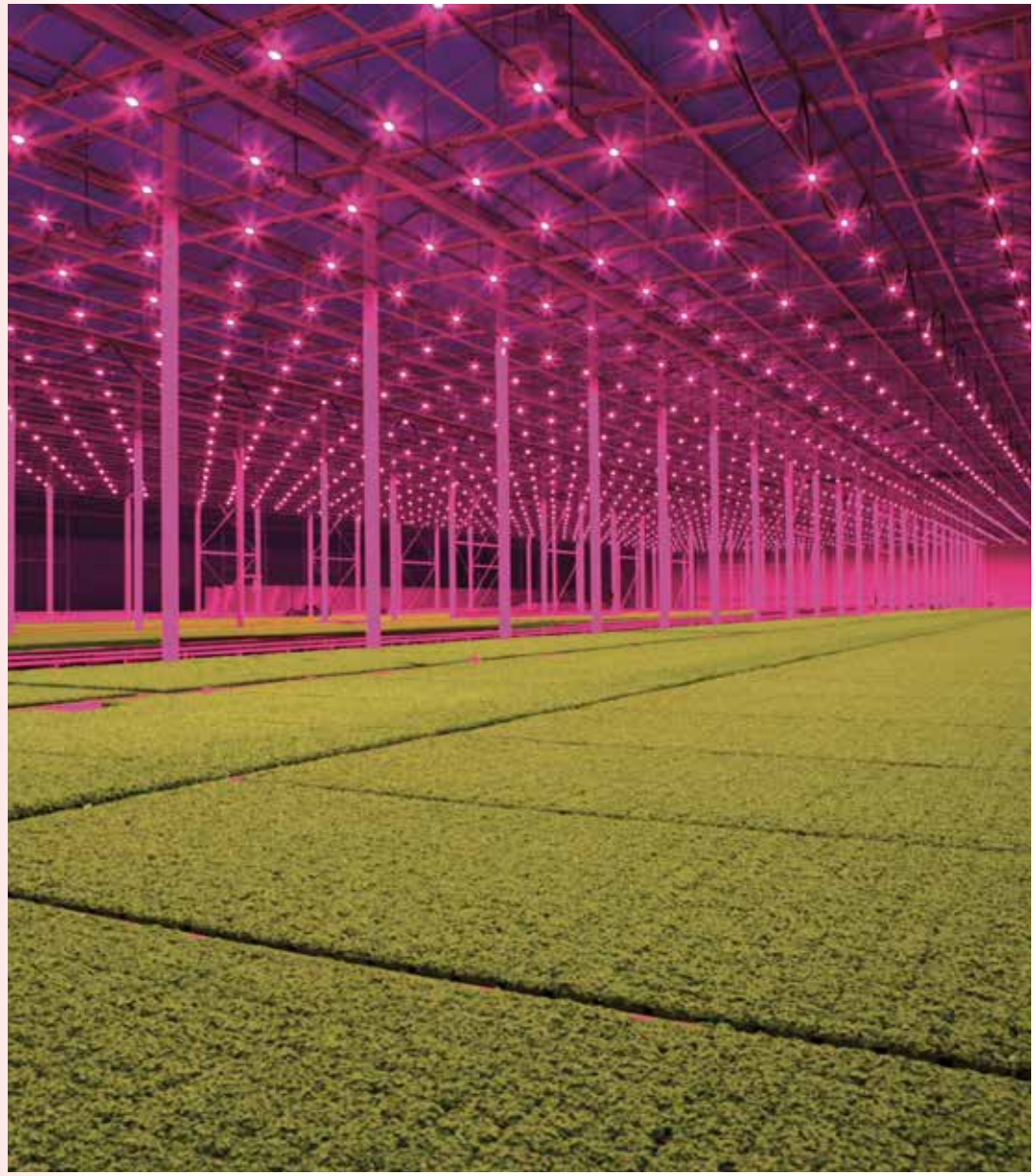
4.2.4 The emergence of the auction in Westland

Westland is known for its horticulture-related activities. The growth of the auction houses constituted an important development in this cluster.

Westland may not have been the pioneer with regard to the auction houses, but it was a fast learner. De Broeker Veiling, founded in Broek op Langedijk in 1887, was a pioneer in reverse auctions of horticulture products. Their auction building (constructed later) offered the distinct advantage that growers could move through the bidding hall with their barges laden with vegetables.

In contrast to our expectations, when the first auction houses were founded in Westland it was not so much the pricing process that was key to the auction success, but the fact that people viewed the auction as an ideal way of combating the evils of the consignment trade: the high dependence on harvest advances and tampering with quality, weight and payments.[92] Following the boom of the potato trade during the period 1850-1880, the dramatic decline and emerging agricultural crises created a shock effect that resulted in a number of new initiatives, mainly intended to correct market thinking, such as cooperatives, auction houses and farmers' credit/advance payment banks. One important catalyst of these new forms of organisation was the Committee set up by the Westland division of the Hollandse Maatschappij van Landbouw (Holland Agricultural Society), which included mayors of several Westland municipalities, independent experts and growers from the region and which developed a proposal for improving trade in potatoes and fruit. The Committee wanted to organise the monitoring of quality, quantity and packing of the products to be shipped.[93]

Sion Young Plants: Phalaenopsis breeder always takes ‘the next step in orchids’ together with its customers.



Koppert Cress: strives for continuous innovation of its assortment of micro-vegetables.

Tuinderij Vers: is a modern vegetable processing firm specialised in cutting, mixing and packaging fruit and vegetables to produce ready-made and ready-to-cook products.

Priva: leads the field in the development and production of technology (software, hardware and services) to optimise environmental conditions and process management for the horticulture sector, building automation and everything in between.

On 25 April 1889, this Westland division decided to strive for an auction with a reverse auction system per municipality, for which, despite protests, the Vereeniging Westland was set up. The Vereeniging Westland would introduce a quality label, mainly for trade in and exports of potatoes, to make this market more transparent. Approved potatoes would be permitted to carry the Vereeniging Westland trademark. However, specific growers and traders had built up a good reputation and did not want to relinquish it. The idea of an auction was consistent with the plans of Vereeniging Westland: as a result of the auction, growers would receive higher returns and for merchants the Westland quality label would serve as a guarantee of the good quality of the fruit and vegetable products on offer. Before that time, growers had to visit cities to obtain knowledge of the market or rely on travelling merchants, who acted as intermediaries and took products in consignment, only paying for them once they had been sold on. With a reverse auction, all traders had to buy in open competition and pay immediately in cash. Not only the growers, but also the traders had to do their best to get a good deal. The Honselersdijk auction was founded in 1889, followed by that of Naaldwijk a year later, after which the spread of new auctions picked up pace in Westland. Almost every village had its own auction. At one point there were twelve fruit and vegetable auctions, in Poeldijk, Honselersdijk, Naaldwijk, Naaldwijk-Zwartendijk, Westerlee, Maasland, 's Gravenzande, 's Gravenzande-Woutersweg, Monster, Wateringen, Rijswijk-Sammersbrug, Kwintsheul, and two flower auctions, the Coöperatieve Centrale Westlandse Snijbloemenveiling (CCWS) and Westland.

Despite opposition and scepticism, this auction system slowly but surely became a huge success. The bidding system, the predecessor of the famous clock with a declining price indicator, was introduced in 1905. The auctions assumed the risk of payment and the inspectors examined the contents and weight. In 1915, the local divisions of the Vereeniging Westland became an association of independent auction houses: Bond Westland. Small auctions mainly handled smaller quantities of fruit and vegetables for nearby towns. Large auctions were aimed more at exports and conducted pre-sales for delivery to traders the following day. Industrialisation, urbanisation and prosperity increased, so they constructed auction houses, dug out ports for the supply and transport of the harvest by the growers' barges and constructed railway lines for distribution by train. The Vereeniging Westland was also active in promoting sales, especially to Germany. As of 1917, sales promotion was organised at the national level, after the auction obligation entered into force in 1916 to safeguard the supply of vegetables for the domestic market. During the First World War the price level remained very high for a long time. It was only in 1920 that all products could be traded freely again.[94]

Westland's horticulture sector grew steadily until the 1930s (see Table 6). In 1900, total sales from Westland's vegetable auctions amounted to half a million guilders (1 guilder = €0.45); this rose to 1.5 million (1910) and then 10.6 million (1920), reaching 20.4 million in 1930, although the currency

during this period was worth 40% less.[95] Import duties and phytosanitary measures were regularly discussed at the international level, but in the 1920s the competitiveness of Dutch vegetable cultivation always prevailed. Trucks and trains began to replace domestic transport by boat. Liners and charter shipping kept each other on their toes when it came to cheap transport to Britain. At a regional level, exporters were concentrated in Rotterdam.[96]

Westland vegetable auctions													
Year	1910	1920	1930	1940	1950	1955	1960	1970	1980	1990	2000	2010	2015
Nom. sales, mln guilders	1.5	10.6	20		53	87	140	298	742	1,148			
Westland flowers and plant auctions													
Year			1930	1940	1950	1955	1960	1970	1980	1990	2000	2010	2015
Nom. sales, mln guilders			0.5	1	4	8	16	113	683	1,678			
Nom. sales, mln euro												796	703

Table 6 Auction sales figures in Westland.

As mentioned elsewhere, Westland entered a long period of decline as a result of the international economic crisis of the 1930s. The Netherlands suffered badly during the crisis, after which national price supplements, minimum prices, set-aside measures and cultivation permits were introduced. During the 1930s and the Second World War (1940-1945) the auction system was eroded, first by long periods of unsold products and then by maximum prices during the war.[97] Free pricing was reintroduced in 1946.

Flower cultivation and auctions appeared relatively late and encountered major obstacles as a result of the economic crisis. People began by growing chrysanthemums and produced tulips and cut greenery. The CCWS, founded in 1923, already had a turnover of 0.85 million guilders in 1931.[98] In 1931, this centralised and now cooperative Westland cut flower auction moved to the current Westland location occupied by FloraHolland. Also in 1931, Poeldijk became home to a second flower auction, called Westland, which was dissolved in 1969. There was a flower bulb auction in 's Gravenzande for a short period.[99] During the 1930s, the supply of carnations, freesias and a number of pot plants increased.

After the Second World War the large-scale, efficient auctioning led to the sale of vegetables according to standardised formats, called block auctioning. Products were separated by variety, size, weight, and/or quality and traded via the auction clock in front of the buyers' gallery. Any sales made outside the clock were also settled financially through the auction. Until the 1970s, the force of the growth in prosperity, acreage expansions, mechanisation, international competition and the concentration of supermarkets and wholesale resulted in good and bad years. For example, Westland auction revenues for tomatoes increased considerably after the war, to 75 million kilos in 1950 and 100 million kilos in 1960, yielding a turnover of 73 million guilders, going on to achieve 350 million kilos around 1970.[100] After 1960, revenues

from flowers, especially freesias and carnations, soon exceeded 24 million guilders.[101]

Until the 1960s, the development of the flower auction was limited as a result of heating bans and production limitations. The cultivation permit for flowers and thus the acreage remained in force for 34 years, until 1966. In 1963, the acreage for flowers amounted to 230 hectares, of which 140 hectares were under glass.[102] Export auction CCWS held a clock auction with products featuring the supplier's name, instead of an anonymous auction per block of the same products, as in the vegetable auctions. Being able to purchase a wide assortment at the flower auction was a labour-intensive but crucial competitive advantage, in contrast to the vegetable auctions, where large quantities of homogeneous tomatoes, cucumbers and bell peppers dominated. This encouraged specialisation and a focus on quality among flower and plant breeders. Consequently, the flower auction had to devote a relatively high degree of attention to the variety of supply and demand in terms of the ripeness, length, quality and packaging. In the 1970s, it was mainly the cultivation and auction supply of pot plants that grew in Westland. With regard to flowers, exports of carnations and freesias to Germany dominated. In the 1960s, three-quarters of Westland auction revenues already came from exports.[103]

The trend of consolidation was already in progress in 1970, by the foundation and construction of the Westland-Noord vegetable auction through a merger of seven Westland auctions. For years the profitability of vegetable production was lower than flower production, resulting in a shift in priorities and cost control. The concentration of supply, cost control and logistical modernisation were also important objectives of the new merged auction.[104] This meant, for example, better packaging, dock boards and temporary stock formation in centralised cold stores. Tomatoes, cucumbers and lettuce had become the largest product groups. Specialist buyers, called auction commissioners, sold to exporters or wholesalers, who in turn sold to importers and/or retailers and supermarkets. The arrival of concentrated purchasing from supermarkets came at the expense of importers and small retailers, and resulted in the streamlining of standardised, uniform products. At the time this benefited Dutch auctions, which were also able to promote sales to new export countries.

As mentioned previously, the flower auction grew faster than vegetable auctions between the 1970s and 1990s (see also Table 6). During this period, phytosanitary issues occurred on a regular basis with specific products and/or countries, and there was more standardisation in packaging and trolleys. The mediation of large quantities of pot plants at quotation prices began in 1973. The sale of flowers from abroad at, and later outside, the auction really took off to supplement low domestic supply in the winter. At first this involved carnations from Israel, and later roses from Africa. In the Netherlands the production acreage for carnations and roses was overtaken by chrysanthemums and later pot plants.

Two large vegetable auctions remained in Westland during the turbulent 1990s: the aforementioned Westland Noord and the Westerlee auction. They consolidated their revenues under the name of Veiling Westland, after which the Westerlee site became a supply point. The auction clock continued to run at Westland Noord. The requirements of the retail market changed with the arrival of the computer, the tomato crisis and the continued bundling of purchasing power by supermarket chains. The lines from grower to supermarket had to be shorter, to save money, and the quality had to improve. The auction statutes were modified so that people no longer had voting rights per grower but according to turnover, which meant that large growers acquired more power. In order to become more market-oriented, the later Minister Cees Veerman presented a plan on 13 December 1995 to merge all vegetable auctions in the Netherlands to continue under the name of Voeding Tuinbouw Nederland. Members of the Westland auction voted with a small majority in favour of the merger plan on 31 May 1996. Eight national fruit and vegetable auctions consolidated through a merger and the commercial name became Voeding Tuinbouw Nederland (which gave rise to The Greenery auction house).

In 1997, The Greenery, one of the largest international sales cooperatives in fruit and vegetables, decided to close the Poeldijk site. The activities were moved to the Westerlee location, because it was more central and offered a better connection to the Port of Rotterdam. The Greenery aimed to save 11 million guilders with this action. The site was closed in 1999. The Poeldijk site was sold for 152.5 million guilders to the CCWS flower auction and a number of trading houses, and since then has served as the ABC Westland industrial estate.

Further scaling up in terms of production and sales meant that the auction remained under pressure afterwards as a trading location. People wanted to set up direct trade relations outside the auction. For example, the supermarket chain Albert Heijn concluded contracts with a group of growers (united as Holland Crop), including specific supply conditions, through its vegetable firm Bakker Barendrecht (now part of Greenyard; see also Chapter 7 on Ridderkerk-Barendrecht). The consolidation, starting mainly with the dominant vegetable sales in Europe, and the increase in scale among growers weighed particularly heavily on the intermediate links. The Greenery had to build up long-term customer relations, including customer-specific contracts. To this end, multiple trading companies were purchased. The clock auctions at diverse locations were systematically replaced by a single marketing and sales organisation, and the vegetable auction withdrew from Westland.

Leading growers stayed outside The Greenery merger and charted their own course. They made the new organisational form widely known: the growers' association. The Prominent growers' association was established in 1993, founded by Westland tomato growers who were trying to sell their own products in the sales chain, using their own sellers as much as possible. Multiple market-oriented growers' associations were set up. Growers often

set up their own flexible sales organisations and packaging locations with European (so-called GMO) subsidies. Diverse innovative, mainly Westland-based growers' associations united under the umbrella cooperative FresQ. Nevertheless, innovative growers also appeared to misjudge the sale of their own wares. During the 2002-2004 period, after the dot.com bubble, and later with the long-lasting economic crisis that began in 2008, suppliers were played off against each other: sales proved to be too fragmented. Competition rules prohibited cooperation between several large suppliers to acquire market power. However sales were organised, half of the vegetable firms were left with insufficient returns for years. Legal complications led to the dissolution of FresQ in 2014 and ultimately the founding of Harvest House and DOOR Partners.

In the flower sector it had been possible to agree on product specifications between growers and retailers for a long time, via the mediation agency. The continued emergence of pot plants that were brokered, such as the pot orchid, resulted in an acceleration of the clock auction's decline. If sales were already relatively international, it was their scaling up and the increase in international sourcing that ultimately resulted in the merger of the large flower auctions in the Netherlands that created FloraHolland, in 2007. Trading companies were becoming increasingly important in the rise of the import, processing and re-exportation of flowers they handled themselves. Growers became increasingly aware of the importance of their own initiative and capacity regarding sales of their products. The wish to organise assortments for customers on the one hand, together with the risk of rapid saturation of a product group on the other, ensured that the flower auction clock continued to play a role.

The previously dominant vegetable and flower auctions, absorbed in The Greenery and FloraHolland, respectively, had to fight for their right to exist – for their market share. Many growers decided (or were forced) to cease their activities due to inadequate solvency and profitability, especially during the economic crisis. For all greenhouse horticulture areas, but especially in Westland, serious work began within the HOT Coalition (Restructuring and Development of the Horticultural Sector) to restructure and develop greenhouse horticulture: larger plots with, for example, a sustainable energy supply, better agrilogistics and infrastructure and improved competition rules and joint market operations. A sustainable CO_2 network and a heat grid were organised via several routes, together with the Port of Rotterdam and other surrounding cities. Players who appear to have emerged stronger from the economic downturn include large-scale growers' associations managed from Westland (DOOR Partners, Harvest House, Decorum Plants, Zentoo) and trading companies (Van Vliet Flower, FleuraMetz, Dutch Flower Group, Greenyard), usually with their head office elsewhere, as well as some specialists in production, supply and breeding. New spatial pressure is building up once more due to housing construction, as well as due to spatial claims from suppliers (such as cuttings/seed companies, installation companies and greenhouse construction firms) of the greenhouse horticulture sector, and from processors (refrigeration, packing stations, cutting, transport and trade) of the produce, partly originating from large horticultural plots

outside Westland, and partly from far beyond the Netherlands. Westland primarily appeared to have become a base for diverse enterprising businesses involved in the greenhouse horticulture cluster.

4.3 Funding for enterprise

Until the cooperative banks were established in the late nineteenth and early twentieth centuries, it was difficult for growers and farmers to obtain money for investments. They were dependent on loans or advances, often issued by lenders at high interest rates. These advances were often provided by traders who had purchased their agricultural and horticultural products the previous season and were able to sell them at high profits. This dependence meant that every year, growers and farmers had insufficient funds to invest in propagating material, tools, expanding their herd and other resources needed for effective business operations. This situation was resolved by organising mutual financial support from the farmers and growers themselves, with help from the cooperative banks established for this purpose. These farmers' credit cooperatives provided farmers and growers with cheap business loans.

In 1894, the Voorschotbank, a forerunner of the Raiffeisen en Boerenleenbank, or the Rabobank, was locally realised in Naaldwijk. The catalyst for the foundation of this cooperative Voorschotbank was Mr A.I. Verhagen, an important advocate for Westland horticulture and also a successful international trader of grain, fruit and vegetables, as well as a dairy and pig farmer. Together with other dignitaries he was the driving force behind the aforementioned auction association Vereeniging Westland and, along with several liberal leaders, he set up the Voorschotbank for members of this auction. Verhagen was inspired by Friedrich Wilhelm Raiffeisen, who set up the first farmers' credit and savings bank in Heddesdorf, Germany, with the motto: 'What is possible in Heddesdorf will surely work in Naaldwijk too'.[105] The Voorschotbank was not originally a true farmers' credit or Raiffeisenbank. The objectives may have been similar, but the Voorschotbank was more commercial and more expensive and, as such, was not a member of either of the two central organisations in Utrecht and Eindhoven. In 1910, the Voorschotbank became a genuine cooperative bank: it was converted into a standard Raiffeisenbank and linked up with the Raiffeisenbank office in Utrecht.

In 1902, in addition to the neutral Voorschotbank, a second cooperative bank was founded in Naaldwijk, for Catholic farmers and growers, with Eindhoven as the location of their central Boerenleenbank. Father Van Lijnschooten fulfilled an important role as the catalyst. Later on a cooperative bank was set up for growers in every Westland village. At first, membership of the bank was limited to farmers and growers, but it was later opened up to non-agricultural firms and private individuals. When, in 1971, the decision was taken to merge the two large central cooperative banks to create the Raiffeisen-Boerenleenbank, a bundling of the local cooperative banks also soon followed in Westland. In 1973, the Raiffeisen Voorschotbank and the Boerenleenbank merged in Naaldwijk. The merger of the Naaldwijk, Poeldijk, Watering and Kwintsheul cooperative banks was finalised in 1975, resulting in the creation of

Rabobank Midden-Westland. In 2004, this merged with Rabobank Westland Zuidwest and Rabobank De Maaslanden to form Rabobank Westland. Rabobank Westland is the largest local bank of all the Rabobanks in the Netherlands. 2016 heralded the end of the legal independence of the local Rabobanks and all local banks became branches of the Rabobank in Utrecht, the head office.

Rabobank has traditionally been the largest provider of capital to the Dutch greenhouse horticulture sector; it is the main external credit provider for the vast majority of horticulture firms. As such, the Rabobank, like its two legal predecessors, constitutes a major driver of growth in Westland's horticulture cluster. As in the rest of the Netherlands, Rabobank Westland also proudly reported that 2008 was another great year, with 15% growth in loans provided to businesses.[106] Meanwhile, 300 employees from the independent Rabobanks that merged in 2004 moved to a stunning new office building in the centre of Westland.

However, the financial and economic crisis meant that the optimistic years of scaling up, easy money and capacity expansion quickly turned into disappointing revenues, rising costs including energy bills, falling land prices and deteriorating competitive positions. Due to scant reserves and the reins of credit being tightened, 30-40% of growers soon experienced serious problems and ended up in receivership in the Rabobank's Special Management Department. Substantial write-offs, forced company closures and a great deal of personal suffering was the tragic result. Between 2005 and 2010, the added value of the total agri-cluster in Westland hovered around €1.2 billion and 23,500 jobs (note: converted into guilders in Chapter 1). In this period the number of horticulture businesses fell by around 8.5% a year (see Figure 14).[107] For glass-grown vegetables the number of firms decreased by 50%, but for plants the number fell less than the national average. However, over the longer period between 2000 and 2015, the number of closures still amounted to 7.7% annually. It is striking that the share of added value of the agri-cluster of the total of Westland economic activities fell six percentage points to 34% in five years, mainly due to a decline in producers; the importance of suppliers increased because they were able to achieve new sales elsewhere, primarily abroad.

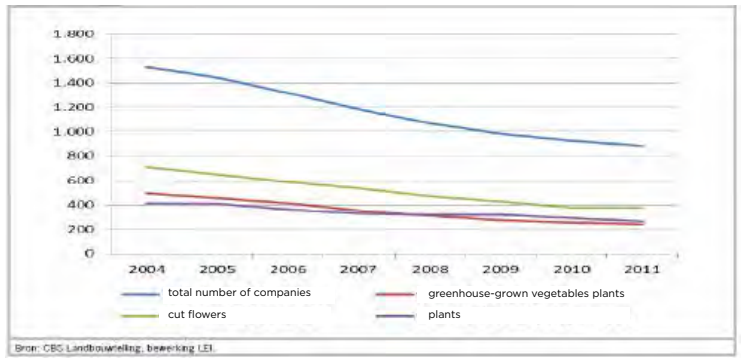


Figure 14 Number of greenhouse horticulture businesses, Westland.

Since growth of the Westland horticulture cluster lagged behind for a long time, also compared with other horticulture regions, the people held Rabobank responsible for this. The position of other banks was relatively weak and the supply of alternative forms of funding, such as private equity, was limited. Since the account managers are trained by the bank to pass on business funding and be able to estimate the risks, they focus on the one company with which they are in discussions. The 'sale and lease back' constructions are a good example of this. Where the effects of large-scale financing are concerned, such as over €100 million for expansion in Wieringermeer, the effects of such decisions spread like an oil slick through the entire agricultural sector. The Rabobank is clearly now starting to see that, due to its dominant position in the sector, its responsibility goes further than the sum of individual businesses: Rabobank Westland has a systemic risk.

At the beginning of 2017, The Greenery and a number of capital providers were working on an investment fund, which is expected to be worth between €150 million and €300 million. This fund should contribute to the long-awaited restructuring of fruit and vegetable cultivation in the Netherlands, as well as making expansion projects, innovation and increased sustainability possible in the sector. The fund is intended for growers who want to fund larger projects, for start-ups that have minimal financial resources, or for entrepreneurs who would otherwise be unable to modernise or make their business more sustainable due to a lack of successors. We have already discussed the restructuring and development of greenhouse horticulture within the HOT Coalition. How robust is Westland with regard to changes in the economic climate and structure?

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4.3.1 Westland's sensitivity to the economic climate

The question about the Westland horticulture sector's sensitivity to the economic climate is a difficult one: is the horticultural sector or this region characterised by its own periods of booms and slumps, or does it follow general trends? As previously mentioned, the Westland horticulture sector began to develop in the mid-nineteenth century. The Industrial Revolution brought urbanisation, a certain degree of prosperity, better transport and exports to Britain – the new world power – and the Commonwealth. In 1845, Britain was hit by a grape disease and by the potato disease phytophthora infestans, which caused famine and mass emigration. Exports from Westland mainly consisted of the stronger, early potatoes, supplemented by grapes, various vegetables and orchard fruit. Sulphur and copper were used to combat the diseases, grape walls were constructed, clay soil was improved with sand and initially-expensive protective glass appeared. The economic downturn in the years after 1870 was hardly noticeable in Westland exports (Van Duijn, 2010). The Nieuwe Waterweg opened in 1872, providing direct access from Rotterdam and Maassluis to the North Sea, which considerably shortened the export route to Britain. The acreage devoted to Westland horticulture in 1875 (including Loosduinen, Rijswijk, etc.) already covered 3,000 hectares. This consisted almost exclusively of open field cultivation.

During this Golden Age, highly productive varieties offering moderate quality were popular, and buyers who paid harvest advances (the consignment trade) dominated. Growers and traders alike tampered with and cheated each other; they acquired a bad reputation. During the years after 1880 there was a major agricultural crisis, with an increase in meat and grain imports to Europe. Westland suffered several wet, cold summers, weakening exports of potatoes, and competition from Belgium and the islands of Guernsey and Jersey. Roughly 70% of fruit and vegetable exports to different countries went through nearby Rotterdam. Already in the 1880s, more than half of imported onions, potatoes, greenhouse-grown cucumbers, citrus fruits and suchlike were intended for re-export.[108] During these trying times the lack of knowledge about the supply and consumer demand weakened the already dubious position of the people of Westland. Nevertheless, it is clear that there was resilience because various innovations and imitations emerged, such as the introduction of the grape greenhouse from Belgium; flower bulb cultivation in 1892; the first tomato cultivation, adopted from Britain, also in 1892; and the foundation of the Voorschotbank in Naaldwijk in 1895, the predecessor of the cooperative banks. In 1890, the first Westland reverse auction opened in Honselersdijk. This centralisation of demand was organised amid serious opposition from traders and scepticism from growers.[109] However, as a result quality and price transparency quickly improved, as did the position of the growers in relation to the traders. Short cyclical waves

appeared not to have had any effect on Westland's horticulture sector, unlike the longer economic wave between 1845 and 1895.[110]

From the end of the nineteenth century, broad technological innovations such as the car, the train, electricity, coal and petrochemicals had a fundamental impact on Europe. The tramline was extended to Westland,[111] and canals were dug for water transport. Westland tried out the innovation of the warehouse, the greenhouse for multiple products. The farmers' credit bank took shape, the publicly-funded experimental garden was established and labourers were brought in from other agricultural areas. Growers produced a wide range of products such as asparagus, strawberries, lettuce, spinach and cucumbers. Around 1900, Westland almost exclusively featured open field cultivation, with a surface area of around 2.5 hectares per business, amounting to a total of 2,600 hectares. Just 50 hectares were under glass.[112]

The First World War had an effect on the neutral Netherlands in the years from 1914 to 1918, but no long-lasting impact. The war resulted in the temporary emphasis on 'war vegetables'. Exports were extremely lucrative. In 1916, the obligation entered into force to safeguard the supply of vegetables for the domestic market. Whereas the turnover of the vegetable auctions amounted to a total of half a million guilders in 1900, this rose to 1.5 million (1910) then 10.6 million (1920) and again to 20.4 million in 1930, even though the currency depreciated 40% during this period.[113] The 1920s were years of great prosperity. In 1928, exports to Germany in guilders were already worth twice as much as those to Britain. By 1930, the turnover of the flower auction founded in 1923 had already reached half a million. The number of horticulture businesses doubled to 2,261 between 1910 and 1930. By the 1930s, 800 hectares of greenhouses had been built, partly including coal-powered boilers, on a total of 4,224 hectares of horticultural land.[114] The grape and the tomato, grown under glass, were major products, accounting for respectively 80,000 tons and 7,500 tons of exports in 1930. There were warnings about overproduction.

Between 1930 and 1950, Westland experienced a period of severe decline, as a result of international obstacles during the crisis in the 1930s and damage from the Second World War. During the 1930s and 1940s, there was virtually no greenhouse expansion.[115] In 1931, Germany imposed foreign exchange quotas on individual import products: the consequence was an increased volume of exports at a lower price. In September 1931, Britain allowed the pound sterling to devalue, and introduced import duties in March 1932. All these obstacles resulted in sales of Westland vegetables and tomato exports decreasing by half between 1930 and 1935.[116] The Netherlands imposed import duties on fruit, as well as passing a Horticulture Support Act (1932) with price surcharges and minimum prices, followed by the Agricultural Crisis Act (1933) with set-aside measures and cultivation permits. The crisis clearly had a macro-economic impact on Westland, with wages falling by as much as 40%.

Due to the Second World War, both people and horticulture businesses had to move away from a wide strip along the coast and along the Waterweg as the occupying forces were preparing for a landing of Allied troops in this area. Various bombs had also caused damage. The horticulture sector was affected by the consequences of the lack of glass, wood, iron and manure, even though there was money to pay for them. Product volumes of vegetable cultivation only returned to their previous levels around 1950, and in 1953 exports of fruit and vegetables to Germany were fully released. This took longer for flower cultivation, partly due the fact that the cultivation permit system was only abandoned at the end of 1966.

Between 1950 and 1970, Europe experienced a major increase in prosperity. Westland expanded considerably in terms of the glass acreage, significant improvements of cultivation methods, varieties, soil decontamination, disease control, fertilisation, watering, heating, greenhouse construction and equipment and exports, particularly to up-and-coming West Germany.[117] The production of grapes slumped, partly due to increasing liberalisation of imports.[118] In 1960, grape sales still amounted to 7.4 million kilos with a turnover worth 12.6 million guilders (one guilder equals €0.45). Tomato cultivation increased dramatically, after recovering, to 75 million kilos in 1950 and 350 kilos by the early 1970s. In 1960, tomato sales from the auctions amounted to 100 million kilos with a turnover of 73 million guilders.[119] Around 1960, products cultivated in open fields accounted for just 6% of auction revenues. It is interesting to note that, while the number of businesses continued to increase, the average size of a business shrank to just over one hectare, half of which was covered by greenhouses.

In 1960, still only half of the greenhouses were heated.[120] With the increase of heating in greenhouses, annual production of greenhouse-grown lettuce soared to 130 million heads of lettuce with a turnover of 22.5 million guilders by the early 1960s.[121] The greenhouses had been heated with coal for a long time; during this period it was replaced by fuel oil and petroleum and finally, around 1970, by natural gas. All growers were connected to the new gas grid, which was supplied with gas from the sizeable gas bubble in Groningen. This reduced heavy labour and air pollution. The benefits of the increased prosperity and reduced trade barriers in Western Europe predominantly manifested in the emergence of flower cultivation.

Around 1960, sales of flowers, mainly freesias and carnations, already exceeded 24 million guilders.[122] The cucumber became fashionable during the 1960s.

The 1970s were characterised by the oil crises of 1973 and 1978 which caused years of stagnation in the 1980s, with low growth and high inflation. While vegetable horticulture encountered several bad years during this period, with lots of bankruptcies and personal suffering, the flower sector enjoyed steady growth. As mentioned previously, turnover increased in Westland's vegetable auctions by almost 50% to 1.1 billion guilders (1970-1990), and revenues from flower auctions by no less than 450% to 1.6 billion guilders. The shortage of labour was absorbed by foreign workers, mainly from Morocco and Turkey.

Greenhouse-grown lettuce disappeared and bell peppers emerged. In the flower sector, the share of plants increased. With the emergence of artificial lighting, and especially substrates as a replacement for open field cultivation, plus the required climate and cultivation computers, tomato productivity quadrupled over this 20-year period. Researchers (from the experimental garden) had warned for some time about the risks of cultivating beef tomatoes on rock wool substrate. During the prosporous 1990s, the emphasis on green, water-rich, tasteless tomatoes resulted in German consumers shifting from Dutch to Spanish tomatoes. This so-called Wasserbomben-boycott by German consumers resulted in a sector-specific, deep, but brief crisis. The enterprising and seemingly growers soon shifted to cucumbers, bell peppers, flowers or other varieties of tomato, such as vine tomatoes, plum tomatoes and cherry tomatoes.

After 2000, growers focused primarily on developing distinctive brands (see the Looije and Koppert Cress business cases), or on cost-reducing scale-ups in vegetables, or extremely capital-intensive, highly-automated cuttings and plant cultivation, especially orchids (see the Sion business case). Energy generation was optimised using combined heat and power (CHP), but the optimisation of production encouraged monocultures and vegetable production on a huge scale. For a long time CHP provided substantial amounts of money from sales of electricity via the Amsterdam Power Exchange (APX). Growers increasingly approached the sales market themselves through growers' associations instead of auctions. Due to the cost of land, use of space and labour shortages, major expansions were increasingly carried out outside Westland, and even abroad. People issued warnings about expanding supply too quickly given the absorption capacity of final markets, but the individual growers were mainly concerned with their personal reasons for expanding quickly in good years: otherwise the profit only goes to the tax man, and if you don't invest, your neighbour will. Individual, rational decisions produced suboptimal results.

The radical reversal with the economic crisis that began in 2008 caused the price of land in the area to decrease by 50%, and construction virtually ground to a halt. The Municipality of Westland was left with a substantial loss-making land holding, for homes that would not be built. In the meantime, the previously dominant vegetable and flower auctions which were absorbed in The Greenery and FloraHolland, respectively, had to fight for their right to exist. The crisis lasted between five and seven years, and was particularly severe for vegetable growers. The EHEC bacteria discovered in Germany in 2011 and Russian import restrictions imposed in 2014 exacerbated the problems. Many of the now-specialist growers were not able to bridge the bad years and were forced to give up. In contrast, specific suppliers, such as some greenhouse constructors and seed breeders, achieved good sales figures abroad. In Westland, growers continue to optimise the use of energy and labour, but their focus is also shifting to less operations-related activities such as packaging, marketing and trade. Production is increasingly beginning after upfront sales of the expected products through annual contracts, mainly with retailers.

Already-flourishing growers' associations (DOOR, Harvest House, Decorum) and trading establishments (Van Vliet Flower, FleuraMetz, Dutch Flower Group, Greenyard) appear to have recovered in good condition, with a keen eye for opportunities and developments beyond Westland and abroad.

In conclusion, we can say that the horticulture cluster in Westland was – and is – not overly sensitive to economic fluctuations. People do not quickly alter their eating patterns, and for many decades entrepreneurship has ensured that urgent problems are faced head-on. However, some fundamental innovations are not utilised or are slow to be adopted, such as organic pesticides, (LED) lighting, brand building, plant-based crop management, energy grids and fundamental new products (such as tasty tomatoes, micro-vegetables, food components and vertical farming). These require a long inception phase. Sensitivity to the economic climate in recent decades probably increased with the growing importance of flowers and plants in Westland, both luxury products to a certain extent. On the other hand, Westland appears to be more sensitive to long waves of process and product innovations. The crisis of the 1930s, which lasted until the 1950s, and the recent economic crisis exerted a real fundamental impact (various sources). We may be too close to the situation to see how fundamental the impact of the recent crisis is (or has been) on the structure of the Westland horticulture cluster.

4.3.2 The importance of sector-wide education and (applied) research

The agriculture crisis of 1870-1880 together with the international agriculture exhibition in Amsterdam resulted in a radical turnaround in the State's intervention in agriculture and horticulture. From then on, the government took an active interest in training and education in agriculture and horticulture. The first agriculture teacher was appointed in 1890, followed in 1892 by the first inspector of agricultural education, and the first State Horticulture Teacher was appointed in 1896. These State agriculture or horticulture teachers would focus on education, applied research through use of the experimental fields and experimental stations subsidised by the State, and they would act as the directors of new or existing agricultural or horticultural schools.

Having effective and differentiated educational institutions was by no means the highest priority in Westland. The area lacked higher and academic educational institutions; these could be found outside the regional borders: Inholland Delft has an agribusiness/horticulture department and Wageningen UR is represented by a site at nearby Oostland (Bleiswijk) focusing on applied research. The basic knowledge of most upcoming growers in Westland was far too low or not effectively practice to follow secondary vocational education. Until the early 1970s, Westland was seriously lagging behind in the area of horticulture education. Most growers in the Zuid Holland Glass District had had little or no secondary education, especially compared with other horticultural areas. However, the importance of good horticultural education was increasingly being recognised by the younger generations of Westland

growers.[123] School discipline was often poor: if there was a lot of work to do on the farm, such as harvesting potatoes or berries, the children were simply kept at home.[124] Training and education were mainly acquired on the job and the exchange of information was passed down through the generations, from father to son.

The first achievement of education specifically aimed at the horticulture sector in Westland began in 1896 with the founding in Naaldwijk of the Rijks Tuinbouw Winterschool, which existed until 1938. This was a two-year secondary horticultural school where all the lessons were taught during the six months of winter. Despite the fact that the school functioned for over 40 years, it was not popular in Westland: people complained that the programme contained too much theoretical ballast and offered too little practical experience.[125] Interest in the two-year study programme largely came from outside Westland, and often consisted of youngsters who did not want to attend secondary or higher education or who were not capable of doing so. When the Roman Catholic lower horticulture school was founded in Poeldijk in 1918, it proved to be a great success, as did the Christian horticulture school founded in Naaldwijk ten years later; the Rijks Tuinbouw Winterschool closed in 1938 due to lack of interest.

The second horticulture secondary school existed for just 12 years, from 1951 to 1963. In fact, people in Westland now wanted to establish a Higher Horticultural School under the slogan 'intellect must be retained by the region (Kruyk, 1975: 43)'. This would have been linked to the Agricultural College of Higher Education in Wageningen, but ultimately the government did not grant permission for the school.[126] This second initiative did not have enough support in Westland, where some organisations preferred horticultural colleges of lower rather than higher education in the region, or a school of a Christian or Catholic persuasion, which meant that the second public horticultural school was abandoned in 1963. The third horticulture secondary school, the Rijks Middelbare Tuinbouwschool, which was founded in 1965 in Naaldwijk but later moved to De Lier, did catch on. Lower horticulture education got off the ground fast and effectively in Westland, including practical education and horticulture evening courses; in the 1970s there were seven agriculture and horticulture schools in Westland. Whether these institutions were abandoned by pupils or disappeared as a result of mergers, just one organisation remained in 1991 for lower and secondary horticulture education, the Holland College, with branches in Maasland, Naaldwijk, Delft and De Lier.

The second achievement consisted of the foundation of the Zuid Holland Glass District Experimental Garden in Naaldwijk in 1901, originally planned by the State, but expeditiously picked up by horticulture dignitaries in Westland who believed that, in addition to the recently established Rijks Tuinbouw Winterschool, there should be an experimental garden-annex school garden.[127] [128] For the first three decades, the school, the experimental garden and the local horticultural education service fell under a single leadership.

In 1948, the name Experimental Garden was changed to Experimental Station for Fruit and Vegetable Greenhouse Cultivation. The experimental garden was extremely influential and relevant to Westland's horticulture sector, with its applied research and knowledge and publications about plant disease, fertilisation, variety tests, new cultivation methods and other technical problems and potential solutions (such as for weed control and soil decontamination). Besides the research publications by the Experimental Garden/Station, the study clubs and crop committees set up by the growers, as well as the district assistant of the State horticultural education department and his fellow educators, were important for disseminating new ideas, practices and techniques. In the 1960s, the experimental station employed 140 staff, including an education department consisting of between five and ten employees.[129] The experimental station was an association comprising around 600 members in its heyday who all paid a membership fee; the station also received subsidies from the State, the Province and the Central Agency for Horticulture Auctions.

Applied research and advice to growers were closely linked at the Naaldwijk experimental station. However, neither the experimental stations for Dutch horticulture, in Naaldwijk, Aalsmeer, Horst and Klazienaveen nor the supporting information for growers from the Agricultural Advisory Service (DLV) still exist. The latter agency was privatised and the experimental stations were reorganised (closed, or merged or continued as an independent commercial research station). In the specific case of the Naaldwijk experimental station, along with the Aalsmeer experimental station, it evolved to become a new experimental station for greenhouse horticulture as part of the process to bundle forces in Westland with Oostland in GreenPort, at the location of Wageningen UR in Bleiswijk.

In 2001, under the inspiring leadership of Peet van Adrichem, the Demo Nursery Westland in Honselersdijk was established with the aim of putting technical horticultural suppliers directly in touch with growers, to thus develop rapid and practical innovations. There was space available (a large greenhouse) to demonstrate new innovations. It was also possible to test new innovations on a small scale in practice before they were introduced. The various innovation projects involved collaboration with WUR Glastuinbouw and TNO Fieldlab. Remarkably, the Demo Nursery became a subsidiary of the privatised Zwaagdijk experimental station from the seed area of Noord Holland. In 2017, the Westland Demo Nursery moved to the much larger World Horti Centre; along with the Lentiz education group and the Greenport Food & Flower Experience (GFFX), the Demo Nursery is one of the initiators for creating a knowledge hotspot for businesses, educational institutions (Opleidingsinstituut MBO Westland) (Westland secondary Educational Institute) and the authorities for promoting the Westland (and Dutch) horticulture cluster. In 2016, nine educational institutions providing VMBO (pre-vocational secondary education), HBO (higher professional education) and WO (academic university education) joined forces with the Municipality

of Rotterdam in the Food for the Future knowledge consortium.[130] The consortium compiled a research agenda[131] whose results include this report. The consortium has set itself the goal of actively contributing to the transition of the food cluster by more effectively aligning education and research with the future needs and challenges of businesses in the food cluster.

4.3.3 Relevant government policy at the local, regional and national levels

As early as 1933, Verbraeck advocated in his thesis for abandoning the seven existing autonomous municipalities and shifting to the formation of a Municipality of Westland: '... there is perhaps no group of municipalities anywhere in the country that form such an economically complete whole than this horticulture region. .... The formation of a large Municipality of Westland could offer the following advantages: savings related to municipal services by uniting several companies, establishing a regional plan for roads and canals, better means of transport, uniform building regulations, unity of police regulations, larger educational institutions, hospitals, clinics, public slaughterhouses, more economical distribution of electricity grids, etc., and especially the feeling of being united...' Seventy years later, in 2004, partly on the basis of the arguments put forward by Verbraeck, the new Municipality of Westland was formed, in which previously independent municipalities were absorbed. Maasland and Schipluiden jointly formed the neighbouring municipality of Midden-Delfland.

Over time, the cultural and legal boundaries of Westland were subject to change. The substantial expansion of the cities in and around Westland had gobbled up a lot of the horticultural land as well as pastureland. In 1914, after the Nieuwe Waterweg was dug out, Hook of Holland was added to Rotterdam, at the expense of the municipalities of 's Gravenzande and Naaldwijk. The Hague was responsible for horticulture disappearing entirely in Loosduinen and Rijswijk and partially in Wateringen. The Delft agglomeration spared little of the horticulture in Den Hoorn; Schiedam, Maassluis and Vlaardingen also expanded considerably. As a result of this annexation and shrinkage in the region, autonomous growth of the individual Westland villages was limited. In Westland the surface area occupied by greenhouses decreased due to expansion: the expansion of cities, the villages themselves, industrial estates and auction sites and recreational facilities.

We will zoom in on Loosduinen as an example. As of 1812, the Municipality of Loosduinen, an independent municipality, had to develop districts for expansion and became part of the Municipality of The Hague in 1923.[132] As of the 1950s, Loosduinen growers were bought out for housing construction required by the city of The Hague. 570 hectares of valuable ground thus disappeared; it was said that it was impossible to find such good soil anywhere else. In Westland, Loosduinen horticulture had always served as a model for the development of items like new greenhouses (such as the Dutch light ('eenruiters') and the warehouse). At the turn of the twentieth century Loosduinen was by far the most important glass municipality in Westland (with greenhouse-grown cucumbers being the main product).[133] Along with

horticulture, the culture of ‘doers’, of ‘hard work for little remuneration’, ‘going to work so you could take care of your girl’ and the focus on fully utilising every inch of your land disappeared in Loosduinen.

After the war, the Province of Zuid Holland developed a Regional Plan for Westland in an attempt to alleviate the tension between the need for housing in The Hague and Rijswijk and the wish of horticultural communities to be able to retain enough suitable land and to have a plan in which the zoning of the land would be established in detail for years to come.[134] While the cities were eager to expand, with new space for housing, industry, roads and recreation, the growers could potentially continue with fewer hectares of glass on their increasingly intensive greenhouse complexes, since the productivity and added value of these business had increased considerably as a result of process and cultivation innovations.

The initial drafts of the Regional Plan were predominantly conservative in nature: where greenhouse complexes stood, they would be allowed to remain, but there was virtually no space for expansion. In contrast, the final Regional Plan (Streekplan) for Westland, established in 1965, placed protection of the horticultural areas at its centre. Westland had to be preserved as a horticultural area, and an attempt had to be made to establish a clear border with regard to expansion of the cities. The establishment of both settlements of commuters from the surrounding cities and activities unrelated to horticulture in Westland had to be prevented as far as possible. The construction of housing near the villages would only be permitted on a small scale, and only industry related to horticulture would be tolerated. Access to horticulture firms for transport by road had to be addressed, as did sewage treatment and the electricity supply. Retaining pastureland in Midden-Delfland as open space between all the urban areas also became a priority. Another recommendation of the Regional Plan of 1965 was to create an administrative district that would encompass all Westland municipalities.[135] This only happened 40 years later.

In the 1970s, The Hague wanted to expand further in the direction of Wateringen and Monster. This ended in a conflict between housing construction and horticulture. In 1994, part of Wateringen (the Wateringseveldse Polder and the Wippolder) was annexed by the Municipality of The Hague to create the new Vinex district. Around the turn of the century, a strip of Monster, the Madestein-Uithofslaan area, was offered to The Hague for the construction of luxury housing for expats and embassy staff. The Municipality of Rotterdam also wanted a piece of the action.

At the end of the 1960s, the Naaldwijk municipal council was surprised by the plans of the Municipality of Rotterdam related to the construction of the Rijnpoorthaven on the north side of the Nieuwe Waterweg on Naaldwijk’s territory, without taking into account the interests of the horticultural area. The Municipality of Naaldwijk (1968) feared that the construction of the Rijnpoorthaven would result in a considerable acceleration of urbanisation between Maassluis and Hook of Holland; moreover, people were also

concerned about salinisation of the surrounding Westland horticultural area and about the effects of this precedent if Rotterdam later returned with greater demands with regard to the valuable horticultural land. The plans for the Rijnpoorthaven were only withdrawn at the end of the 1970s, and alternative port sites at the coast of Hook of Holland and Oostvoorne were considered. In other words, the danger for Westland from Rotterdam was averted with new plans for the Maasvlakte.

However, that era was not only dominated by annexation and decline; alternatives were also developed in which area and land expansion were key, such as the Waterman Plan (named after its creator, Provincial Council Member Waterman). This plan anticipated the creation of new land by developing 4,000 hectares in the sea along the Westland coast between Kijkduin and Hook of Holland to allow for both the urban expansion of The Hague and horticulture in Westland. In the end, the Waterman Plan for a new large coastal location in Zuid Holland was not implemented. Another interesting idea was the plan by the Municipality of Rotterdam involving an Agri Distribution Centre (ADC) in the Oranjepolder (in the South of Westland); this involved cooperation between the Westland region and the Port of Rotterdam in a bold project. Furthermore, it made an attempt to establish a clear boundary for the expansion of the cities of The Hague, Rijswijk and Delft. The administrators of Rotterdam, the port and Westland were keen, but the horticulture businesses and the auctions were not. This revealed that closed communities, such as the auctions at the time, obstructed important, promising developments.

In 2000, Minister De Vries of the Interior and Kingdom Relations presented the Restructuring Plan for The Hague and the surrounding area: it proposed that Wateringen would lose a large area to The Hague – in fact, Wateringen itself was to be absorbed by The Hague. This evoked a storm of protest. A large share of the Wateringen and Westland population opposed the annexation. People not only wanted to remain in Westland, but also insisted on the formation of a Municipality of Westland so it could stand stronger against its large neighbour The Hague. The position of the seven Westland municipalities was extremely vulnerable and insufficiently specialised to cope with the municipal development challenges.

A stronger position based on far-reaching integration of these municipalities compared with the larger neighbouring municipalities, the province and the State was deemed necessary. Thinking from the perspective of a single Westland, across former municipal borders, was becoming more common as a result of similar scale increases among companies, banks, police, Catholic churches and secondary schools. LTO-Glaskracht, VNO-NCW and FloraHolland also supported the merger. The former municipalities needed more expertise and were no longer functioning at top efficiency, while municipal tasks remained unaddressed.

Finally, as a consequence of a large, voluntary reorganisation of the seven Westland municipalities, two new municipalities were formed: Midden-

Delfland (comprising the municipalities of Maasland and Schipluiden) with the emphasis on the open pasture area, and Westland, comprising the former municipalities of Monster, 's Gravenzande, Naaldwijk, De Lier and Wateringen, with the emphasis on greenhouse horticulture. The aim of this separation of grass and glass was to boost the position of the greenhouse horticulture area as well as the pasture area. Afterwards, an important dilemma faced by the Municipality of Westland concerned whether or not to sacrifice greenhouse horticulture for local housing or infrastructure. Especially with the current scarcity on the housing market, guaranteeing the surface area for horticulture acreage, let alone its possible expansion, was not an easy feat.

A new, significant element of government policy related to the economic stimulation of Dutch horticulture involved the development of so-called Greenports, each one of national and international importance. In these pioneering horticultural areas or Greenports, the business community (breeders, other suppliers, banks, growers, auction and trading companies) work to strengthen horticulture together with research organisations, schools and the authorities (municipalities, provinces and the State). In 2004, six of these Greenports were designated in the Spatial Planning Policy Document, including Greenport Westland-Oostland, now called Greenport West-Holland. The Greenports focus on five themes: i) increasing earning capacity; ii) helping entrepreneurs to innovate; iii) improving logistics, spatial planning and accessibility; iv) increasing sustainable developments; and v) improving collaboration between the labour market and education.[136] Several other relevant organisations naturally include the Province of Zuid Holland, the Metropolitan Region of Rotterdam The Hague (MRDH) and the Rotterdam Food Cluster. In the 2017 national elections, conscious efforts were made to promote Westland's interests in the new House of Representatives.

4.4 Looking back to look ahead

Westland is located in a large and prosperous sales market close to three major cities: The Hague, Rotterdam and Delft. However, Amsterdam and Utrecht, which are slightly further away, have also been supplied with fruit, vegetables and potatoes by Westlanders since the nineteenth century. Already in the mid-nineteenth century Great Britain emerged as a large customer of the potatoes, grapes, cabbage varieties, cherries and berries produced in Westland. These were shipped very frequently from Rotterdam to London in steamships and sailing vessels. At that time, the Port of Rotterdam was becoming an increasingly important market and handling location for agricultural products and was a major hub for export flows to England and Scotland. This export benefited considerably from the opening of the Nieuwe Waterweg in 1872, which made transport from Westland via Rotterdam to Great Britain a great deal easier. After 1880, exports of potatoes to Great Britain decreased dramatically as a result of increasing competition and English production. Moreover, the quality of the Dutch potato was only middling and the services provided by the traders left a lot to be desired.

Just at this turning point at the end of the nineteenth century, Germany emerged as an important sales market, making the construction of a reliable rail connection to the German cities essential. From 1890 to 1930, new crops were introduced in Westland such as the strawberry, the tomato, the cucumber and asparagus, while other crops, such as potatoes and berries, disappeared. Production of grapes and tomatoes increasingly took place under glass; the orchards and grape walls disappeared.

A major turning point in Westland's development and successful entrepreneurship there concerned the emergence of the cooperative auction in the 1890s, which offered traders standardised products and growers a guaranteed market, and the cooperative Raiffeisenkas and Boerenleenbanken founded at the beginning of the twentieth century, which significantly expanded the growers' funding options and made further scaling up and specialisation possible.

However, the 1930s were a period of crisis for Westland: the declining purchasing power in the sales areas and trade policy measures imposed on imports were a serious impediment to Dutch exports of fruit and vegetables. In the mid-1930s, total sales were halved; aid operations for growers in trouble and crisis legislation were necessary. During the 1940s and 1950s, innovations in the greenhouse (more and improved light, heating, artificial light, supply of carbon dioxide), together with the introduction of (cheap) natural gas at the beginning of the 1970s, resulted in continuous productivity improvements. When the European grape market was liberalised in 1961, competition from Southern Europe was given free rein and national and international sales were marginalised. Conversely, there was an increase in sales of tomatoes and (for a few decades) greenhouse-grown lettuce, and later bell peppers and cucumbers. The expansive growth of flower sales (mainly cut flowers and pot plants) only materialised after 1970.

In the 1970s and 1980s, we see the introduction of climate control systems and the emergence of substrate, which not only contributed to higher productivity but also heralded the end of intercropping and steered Westland in the direction of a vulnerable monoculture. The impact of experimental stations and consultancies for the dissemination of knowledge and innovation among Westland growers and businesses, the effect of breeding companies such as Rijk Zwaan and (currently) Sion on improved, disease-resistant varieties and the contribution of greenhouse constructors such as Certhon and KUBO, which provide climate and energy neutral greenhouses, resulted in continued increases in scale and productivity.

More recently, we have observed the consequences of the long-term trend in Westland of cost-orientation with autonomous growth in mutual competition. Until 1990, sales of (additional) production were almost guaranteed, there was easy access to the capital market and active study clubs ensured access to and the sharing of the necessary technical and economic knowledge. The number of growers declined dramatically, but

the ones that endured produced more and more. In 1991, 1,500 growers produced 600,000 tons of tomatoes; in 2016, a few hundred tomato growers produced 900,000 tons. The larger growers took over the smaller ones, merged to become stronger together, had the upper hand in LTO Glaskracht and evolved to become dynamic, multinational enterprises with direct access to retail channels and other stakeholders, in a close network of pragmatically organised (temporary) cooperation partnerships and subsidiaries that stretched out across horticultural areas elsewhere in the Netherlands and far beyond. Like the remaining cultivation businesses, today's suppliers, processors and traders are also less focused on Westland's horticulture sector. As a result of this scaling up, the shared knowledge infrastructure, such as the experimental station, and the cooperative auctions are disappearing or being pushed out of the centre of the cluster. So what now? Future prospects for the horticulture cluster in Westland are not clear cut.

4.4.1 Future scenarios

After looking back, in this section we would like to make an attempt to look to the future in several scenarios. First, we see a scenario in which the increasing importance of knowledge is a key factor for successful value creation in Westland. Many of the more spatially demanding activities will be located outside Westland. Successful suppliers already allocate up to a quarter of their employees and turnover to research and development and marketing innovations, such as technical suppliers like KUBO, Certhon, Hoogendoorn and Metazet and suppliers of plant material like Priva, Axia Seeds, Beekenkamp, Dümmen Orange, Sion and Rijk Zwaan. A prime example is the breeder Rijk Zwaan, which operates in 30 countries. This company is independently investing no less than €250 million (2017-2022) in laboratories, new greenhouses and research centres. Of this, €150 million will be invested in the Netherlands, with a large share of that sum destined for the headquarters in Westland. Horticultural education at MBO (secondary vocational education) and VMBO (pre-vocational secondary education) institutions has been revamped and brought together with the innovative Demo Nursery in the World HortiCenter (WHC) in the centre of Westland. The focus on being an appealing employer and recruiting talent from outside the horticulture sector reflects the increasing importance of education and recruitment. This encompasses all levels of education. The education and training of personnel from (distant) foreign customers and partners in Westland are getting off the ground, for example in the WHC, through trial and error. In conclusion we refer to Tomatoworld, Westland's information, demonstration and education centre devoted exclusively to tomatoes. The foundation of the Demo Nursery in 2001 and Tomatoworld in 2008, together with the outcomes of these initiatives, reflect the trend of recognition for product, production, marketing and organisational knowledge as a factor that is becoming increasingly important in value creation in Westland.

In the second scenario, we see the continuation of logistical efficiency as a driving force for value creation and new activities. The Netherlands and

Westland are big players in international agricultural trade. The specialist agri & food business park ABC Westland, on the former auction site, includes more than 100 import and export companies, sorting firms, packing stations, transporters, cold stores, a food centre for wholesale, etc. Naturally there is the Westland complex at and around FloraHolland, at the start of the A20 motorway that leads to Rotterdam's ports and to Germany; this complex forms a large logistical trade centre where lorries from many European countries come and go. Closer to Rotterdam's ports, at Maasdijk and Maassluis, there are diverse industrial estates including Honderdland. These industrial estates, built alongside the A20, used to be entirely occupied by greenhouses. After the turn of the century, large-scale vegetable processors, such as RedStar, Agrocare, Lans, Van Kester, Van der Kaaij, Grootscholten and Van Vliet, built up their trade and packaging activities here (FresQ, Prominent, Rainbow, TNI, Greenpack). It was easy to transport products from new, large-scale branches in Zeeland and Noord Holland to this location. Following an initial 100 hectares for large-scale agrilogistics and agriculture-related activities, including storage and ripening buildings for Nature's Pride, Honderdland is expanding by over 30 hectares. A lot is being done now and will be done in the future to improve and scale-up the road network and connections to Rotterdam's ports, such as the scheduled Blankenburg Tunnel and more effective use of the Hook of Holland port. The success of these agrilogistic activities and industrial estates exemplifies the trend to develop Westland and the Rotterdam region as a hub of agrifood-logistical flows in North-western Europe.

A third scenario concerns value creation by being idiosyncratic, distinctive and entrepreneurial. The sector has often rolled out each successful flower and vegetable variety on a large scale, until the market has become saturated. Businesses involved in starting material, breeders, auctions, trade and retailers all had (and have) their reasons for jumping on the bandwagon. For a long time, this undermined the serious work on unique customer proposals. The success of salad meals, vegetable snacks such as Tommies, trend-sensitive packaging, sprouts and bouquets point out interesting social developments to entrepreneurs, such as a focus on fully-fledged, extremely healthy food, a conscious lifestyle, urban farming/ vertical greenery, a flourishing (work) environment, the company's carbon footprint, etc. The Internet and new media facilitate communication with links further along the chain, including with consumers. Some businesses and their leaders are highly skilled in this field and are in great demand as a result. Serving niche markets (sometimes quite large ones), short chains, health trends and highly demanding users and citizens require the social involvement of entrepreneurs, other experts, and a strong focus on end users. Given the prosperity in Western Europe, serving these relatively close, demanding customers by responding to a social demand appears to be a trend with a future for Westland.

The fourth scenario concerns businesses expanding far beyond their particular region. There is still so much more to be achieved in addition

to exporting the Dutch product. It is not easy to measure, but in terms of vegetable and flower sales, a number of countries such as China, the US, Japan, India and Mexico surpass the Netherlands. The 'Feeding the world' slogan provides room for foreign expansion in production elsewhere in the world with our knowledge and our craftsmanship. Is scaling-up internationally the only way forward? Virtually all leading companies (and certainly the other businesses) in the horticulture cluster are still family-run enterprises. In recent decades many of them have increased their size autonomously through expansion as well as through pragmatic collaboration with their friendly competitors. Through hard work and a helping of assertiveness, they have influenced many organisations such as auctions, product boards and LTO, and have set up businesses for packaging, sorting and packing, trade, energy sales, staff, seeds, etc. The HOT (Restructuring and Development of the Horticultural Sector) public-private partnership founded in 2015 also takes into account further decline in a number of smaller businesses, with scale increases. However, growth may cause the pragmatic, enterprising family culture to decline, and solutions that work here may not be as successful elsewhere. How do we deal with interest from (major) external capital? How do we pass on the company property, while retaining the culture? Many horticultural firms, and not only those in Westland, are building (a network of) branches in locations such as Britain, Spain, Kenya, Morocco, Central America, the US and China. Can the next generation of entrepreneurs continue to grow these businesses? Or will they search or develop capital companies such as Dümmen Orange that integrates diverse businesses; this is a private equity firm that does appear to see that there is money to be made in the 'feeding the world' theme. In Australia, China and the Middle East, financial actors are already actively taking the reins, and greenhouse constructors and horticulture firms here are taking note. In sum, expanding business far beyond one's particular region is a trend that automatically demands Westland's attention.

Lastly, we will discuss the ongoing scenario of cost optimisation resulting from the availability and cost of land, labour, technology, energy and other factors. Horticulture is traditionally a major customer of the energy and workforce production factors. The limited availability of labour and land has long constituted a reason for obtaining cheap labour elsewhere or for relocating outside Westland. We have already discussed the displacement of horticulture due to other claims on space, such as housing, infrastructure and logistics. The ICT-driven development to monitor and steer the growth of (individual) plants extremely closely offers unprecedented potential for working in a very productive manner from a (long) distance, requiring less labour. Space utilisation had already increased due to mechanisation and automation in (multi-layered) pot plant cultivation. Energy has remained a major cost item. CHP, residual heat, geothermal heat and potentially solar power make the energy item cheaper. Optimisation of LED lighting and heat control for the plant facilitates the step towards fully-conditioned multi-layered cultivation in buildings or halls, so-called vertical farming, or simply in

greenhouses. Will growing businesses become almost location-independent, with control rooms in Westland directing production elsewhere in the world? Increased productivity makes it possible to work on fewer square metres with less energy and labour. This scenario is self-evident, but it now offers potential for ground-breaking departures from the trend.

At the end of our discourse we draw attention to the modest – or not-so-modest – impact of departures from the trend. A first possible change is flagged by the emergence of trade platforms that use distributed technology (such as Blockchain) to enable direct trade between producers and consumers on a global scale. This is viewed as a successor to the current chain store (the retail majors). Initial attempts to develop this are currently being implemented (https://ins.world/). It is not yet possible to assess whether it will really take off, but it is definitely possible as the technology is fully ready and has been tested in other markets. With 1% transaction costs for sales that represent a quarter of global turnover of all supermarket chains, the period of return on investment is a question of weeks rather than years.

Another change that has been in the wings for a decade is the demand for local for local (L4L). This trend is gaining ground all over Europe and constitutes a risk to the trend of large-scale businesses in the Netherlands, which serve a significant portion of the European market. As mentioned above, businesses will have to control their production remotely. The necessary crop-climate systems are currently being developed by Dutch suppliers (Hortimax, Hogendoorn and Priva). In addition, we see that staff do not really have to be trained if they are equipped with augmented reality glasses. With the help of artificial intelligence, crops will be increasingly managed automatically. This may set in motion another search for new value creation models for entrepreneurs from the Westland.

Word of thanks

The authors would like to specifically thank the Westland and horticulture expert Aad Vijverberg who, instead of the scheduled brief interview, spent an entire afternoon in Museum Westland with us at the beginning of this study, sharing his knowledge of Westland and his insights into the catalysts and possible turning points in the development of this successful horticulture cluster. Unfortunately he was not able to comment on our publication, as he passed away in the summer of 2017. We would also like to thank Hans Bruining for his input related to our questions about private equity investments.

5 From Schiedam Jeneverstad to Schiedam Gin City: historic developments in the market, products and business population

Schiedam grew and became well known thanks to its jenever industry. The history of this sector, which is so important to this city in terms of sales, popular products and large firms, dates back more than three centuries. Since then, Schiedam's cityscape has been characterised by tall windmills (there

were once 20; now just seven enhance the landscape), used to mill the grain for the jenever industry. The windmills are extraordinarily high, partly to make them stand above the warehouses and partly because a lot of storage space was needed due to the high production levels. In recent years, with the disappearance of the typical Schiedam jenever distilleries over the past 40 years (the recently-bankrupt Koninklijke Dirkzwager being the latest addition), there is not much left of this cluster. Besides a couple of small traditional distilleries, there are just two icons left of the once-renowned Schiedam jenever cluster: De Kuyper and Nolet. Both companies, which enjoy national and international repute, are family-run businesses that have existed for over ten generations (De Kuyper was founded in 1695 and Nolet in 1691). Moreover, the companies' core activities no longer revolve around jenever: besides its range of jenever (the Rutte brand) De Kuyper focuses on its liqueur, cocktail and mixed drinks, and Nolet is mainly famous in North America with Ketel One vodka and Nolet's gin, in addition to its Ketel 1 jenever. Other traditional Schiedam distilleries that still exist are 'Onder De Boompjes' (1658) and Herman Jansen/Vlek-UTO (1777).

5.1 The production of (Dutch) jenever

The origin of traditional jenever dates back to the early sixteenth century, when people in the Low Countries first began producing spirits.[137] At first, people used stale beer or waste products from the wine trade to produce their own brandy (in addition to imports of brandy from France or German Grain). By the end of the sixteenth century, home-made distilled grain brandy ('korenbrandwijn'), based on distilling a fermented grain wash of barley, rye and malt, was popular in the Low Countries. The popularity was encouraged further by the active intervention of the government in imposing high import duties on German Grain and temporarily banning imports of French brandy (in 1671).

The distilling process was originally invented by the Arabs, with the primitive distilling methods later being refined in the medieval alchemists' chambers of Italian viticulture. The basic raw materials for traditional jenever – barley, rye, oats and maize – were prepared in the spirit & yeast factory. Mixtures of the grains were combined with water and yeast, after which the malt enzymes converted the starch to sugars. Next, the sugars, combined with the yeast, were converted into alcohol, after which the mixture with the sugar contained a few percent of alcohol. The liquid containing the alcohol was subsequently distilled three times to remove any waste substances. The first distillation produces the 'ruwnat' raw liquid (alcohol percentage: 10-11%). Distillation of the raw liquid produces 'enkelnat' single liquid (22%). The result of the third distillation is called 'bestnat' or malt wine (46-48%). During each of these stages the distiller could influence the flavour of the end product. The malt wine was then sold to distilleries, where the product was distilled once more and different herbs or herbal extracts, such as coriander, aniseed or fennel, were added to enhance the flavour of the end product.

One of the most important and most popular herbs added was the juniper berry (Juniperus Communis), which gave the spirit its name: 'jenever'. In the

sixteenth and seventeenth centuries the juniper bush was widely available in the Low Countries and there was a strong belief in its medicinal properties (people considered it to be a medicine for pneumonia and burned juniper berries to disinfect rooms occupied by people with the plague). People soon found out that this 'aqua vitae' had not only medicinal but also euphoria-inducing properties. In the Netherlands jenever was (and still is) a spirit with at least 35% alcohol, produced from malt wine made from alcohol obtained from grains or molasses (sugar beet) (in Belgium the alcohol percentage of jenever is considerably lower, around 25-30%). Based on the alcohol percentage of the malt wine used, a differentiation can be made between various types of jenever. The main differences between the varieties are provided in Table 7.

	% alcohol	% malt wine	% grain alcohol
Young jenever	> 35%	< 15%	No guideline
Old jenever	> 35%	< 15%	No guideline
Korn	> 38%	> 51%	100%
Malt wine jenever	> 35%	100%	No guideline
Grain jenever	> 35%	No guideline	100%

Table 7 Jenevers by type and size.

Malt wine, distilled from malt, rye and maize, is the raw material for preparing authentic jenever. In addition to this end product, one can distinguish between two more by-products in jenever production, namely yeast and swill. Schiedam was the birthplace of yeast production, although this leading position was later taken over by cities such as Delft and Bergen op Zoom and countries such as France and England. Towards the end of the eighteenth century, when many new and rapidly expanding malthouses were established, the spirit & yeast factories also began producing yeast. Some distillers even started specialising in making and selling yeast (to customers such as bakeries). When new, cheaper raw materials such as sugar beet (molasses), potatoes and maize emerged during the last quarter of the nineteenth century, yeast and spirits factories grew up in the large cities of the Netherlands to produce cheap, neutral alcohol on a large scale.

In 1870, the Nederlandse Gist- en Spiritusfabriek (later called Gist Brocades and now part of DSM) was founded in Delft, and began producing (cheap) molasses spirit (extracted from sugar beet) almost 30 years later. Nedalco, founded in Bergen op Zoom in 1899 and until recently a joint subsidiary of Coöperatie SuikerUnie and CSM Suiker, but sold to Cargill, grew in more than a century to become the largest Dutch producer of alcohol and the largest producer of natural alcohol in Europe. In Schiedam, the Schiedamse Alcoholfabriek was founded in 1887, where malt wine surpluses were converted into spirits. This factory faced liquidation within ten years because it could not keep pace with the competition from molasses spirits factories, which were mainly found in the regions where sugar beet was produced. Another important yeast and spirits factory was Branderij en Gistfabriek Hollandia, founded in Schiedam in 1909, which processed grains to produce both malt wine and grain alcohol.

Swill refers to the residues from the distilling process, which were used as productive livestock feed. The swill, or potstill residue from the first distillation, contains lots of nutritious substances such as proteins, fats, sugars, vitamins and minerals, originating from the grain and the yeast, in addition to the chaff of the grain. The swill was excellent animal feed precisely because of these nutritious substances. It also contained a little residual alcohol (0.8%), to which the animals became addicted. The swill had to be fed as quickly and preferably as warm as possible, because once cooled the nutritious residual product started to spoil. Originally, most distillers ran their own profitable pig farms, although not in the vicinity of the spirit & yeast factories, which regularly produced negative environmental effects, even worse than the swill. Moreover, distillers sometimes discharged their swill into the surface water. Later the distillers increasingly sold their swill to farmers on the outskirts of the city. The swill was then transported by boat or horse and cart to the swill district where livestock farmers fattened their cattle with this alternative feed. By around 1880, there were 400 or so spirit & yeast factories in Schiedam, which had many hectolitres of swill available every day as warm livestock feed to fatten up several thousand pigs, cows and bullocks in the 'swill district' to the north of the city.

When, at the end of the nineteenth century, the Schiedam malt wine industry came under increasing pressure from the competition of jenever produced more cheaply from molasses spirit, which is made from waste originating from the sugar (beet) industry, the traditional distillers united in the Brandersbond (Malt Distillers' Association). The aim of this association was to preserve the original distillers' craft, in which malt wine produced from grain served as the basis for jenever. One of the many initiatives carried out by the association was the application submitted to the municipality on 24 February 1900 regarding the introduction of an inspection of jenever's authenticity. The objective of this guarantee of authenticity was to prevent counterfeit Schiedam malt wine and Schiedam jenever reaching the market. The local authority would have to guarantee this authenticity, which would make it impossible to sell jenever produced from spirit as genuine Schiedam jenever. In May 1901, the council of Schiedam agreed to the introduction of a regulation (Figure 15) for the guarantee and inspection of the authenticity guarantee. The authenticity would be guaranteed by labels supplied by the municipality and signed by the mayor and the municipal secretary, and the inspections would be performed by municipal officials bearing the title of inspector (see Figure 15).

The role of the inspector was abolished in 1967 because the very last malt wine distiller could no longer satisfy the conditions of the inspection. However, 20 years later in 1987, with the introduction of Notaris jenever, the inspector's role was reinstated. Since 2008, jenever has been protected in terms of its geographical origin by the European Union, as was previously the case for whisky and cognac. As it is referred to in wine jargon, jenever thus obtained its own 'appellation d'origine contrôlée' (based on Regulation (EC) No. 110/2008 of the European Parliament and the Council of 15 January 2008 on the definition, description, presentation, labelling and protection of

geographical indications of spirit drinks). Specifically, this means that spirits bearing the name of jenever, genever or genièvre can only be produced in the Netherlands, Belgium, France (Nord-Pas de Calais) and Germany (NordRhein Westfalen).

Figure 15 Labels issued by the municipality, signed by the mayor and the municipal secretary, intended to guarantee authenticity.

5.2 The origin and development of the Dutch jenever market

The demand for jenever increased from when it was first produced in around 1500 to the early twentieth century.[138] The distilleries were mainly concentrated in Schiedam, where they grew in number from 188 in 1795 to 392 in 1881. There was an increasing number of distilleries in the rest of the country too, which concerned a relatively small-scale production of primarily regional spirits. The reasons for the success were mainly the euphoric effect and the medicinal properties attributed to jenever and the relatively low cost as a result of the low excise duties during this period. However, around 1880, the government began to meddle more and more in the production of alcohol and launched a policy focused on curbing its consumption. The government had (and still has) a love-hate relationship with jenever: jenever brings in lots of money, but it also constitutes a risk to public health. The government was concerned about excessive consumption of brandy and believed that grain was intended to make bread and not for producing grain brandy. Various educational campaigns were used to convince the consumer of the negative effects of alcohol, which resulted in its consumption decreasing. Moreover, alcohol was becoming more and more expensive, not only due to increasing excise duties but also because of the rising prices of the main ingredient: grain. The introduction of the relatively cheap molasses alcohol around 1900 resulted in strong competition for the traditional distilleries.

At the end of the nineteenth century the market was hit hard by a shortage of grain, which meant prices of malt wine reached a record high in 1897. As a result, a new process was developed to produce alcohol, using the waste from sugar beet (molasses). Besides the fact that prices of sugar beet were much lower than those of grain, molasses alcohol could be produced by a smaller workforce, which meant prices were even lower. Jenever based on molasses

alcohol is also called young jenever, given the relatively new preparation method used to produce it. Although the taste as well as the smell of this alcohol is more neutral, the relatively low price led to an increase in sales of young jenever.

Although domestic consumption decreased in the first decades of the twentieth century, exports rose. Several distillers produced more than half the jenever for the foreign market, which was mainly located in England, America, Australia and Africa. Since it was not possible to create a separate brand name in the local language for each country, a picture of an animal was often used. A few of these brands, including Olifant and IJsvogel, still exist today. However, the foreign market declined during the war years. High unemployment in the years following the Second World War made the government decide to stimulate the domestic market, including spirits distilled at home. Although demand increased slightly during the 1960s and 1970s, it was still lower than in 1880. Consumers below the major rivers, where jenever was traditionally drunk, had switched to drinking beer, due to the relatively high prices of jenever. The government tried to win back these consumers by lowering excise duties considerably, and succeeded. Demand increased once more, as did the number of distilleries in the 1950s.

Besides the jenever market, the 1950s also saw competition grow on the off-licence market. To provide a counterweight to the large organisations, particularly on the wine market, many off-licences decided to engage in cooperation partnerships in the 1960s. One example is Gall & Gall, in which the off-licences were able to significantly lower the purchase price through joint purchasing. The consolidation of the off-licence market also resulted in a high degree of consolidation on the jenever market in the 1960s and 1970s. This consolidation was also the result of greater demand for relatively cheap jenever, which meant the distilleries increasingly focused on achieving large volumes and the corresponding economies of scale. In 1985, this led to the foundation of Avandis in Zoetermeer, one of the largest production locations for spirits in Europe. All the products of Lucas Bols, De Kuyper and UTO were produced at this site, which naturally led to considerable economies of scale for the participating organisations. Lucas Bols B.V. also joined forces with Maxxium Worldwide, a sales, drinks and distribution organisation for spirits. This also enabled the drinks produced, including jenever, to be supplied at a lower price. At the end of the 1970s, demand for cheap, lower-quality jenever decreased. In contrast, the demand for high-quality and traditional drinks rose, a trend that continued in the years that followed.

Before presenting an overview of the characteristics of the Dutch jenever market, a differentiation must first be made between the different areas of the market. In 1900, a development came about whereby some producers began focusing on producing ‘industrial’ jenever of a relatively low quality, based on the fairly cheap molasses alcohol. Some other producers carried on producing jenever using the traditional artisan method, resulting in a specialist product. As a result of this development there was a division in the market, in

which it is possible to differentiate between a relatively large homogeneous sub-market and a smaller heterogeneous sub-market. The homogeneous sub-market consisted of the relatively simple jenevers based on molasses alcohol, in which there is little difference between the products. Due to the low degree of specialisation it was possible to fully automate the production process, which meant that economies of scale and cost reductions could be achieved in this part of the market. It also resulted in several distillers working together in distribution networks such as Avandis or Maxxium Worldwide. Examples of companies active in the homogeneous section of the market are Hooghoudt, Lucas Bols and Dirkzwager. On the other hand, the heterogeneous market consists of highly specialist jenevers, produced in the traditional way and without using molasses alcohol. The production methods used are extremely labour intensive, which means no economies of scale are possible: companies such as Van Wees, Herman Jansen/UTO and De Kuyper/Rutte are active in this part of the market.

In the past 25 years, the homogeneous part of the Dutch jenever market has been characterised by a high degree of consolidation, in which the relatively small distilleries have been taken over by larger enterprises in the market. The main reason for this is the possibility of achieving economies of scale in this part of the market. This was achieved by takeovers of relatively small organisations that were not able to achieve economies of scale independently. In addition, a trend emerged in which relatively large organisations started focusing more on the heterogeneous areas (niches) in the market. Precisely because the small organisations that had been taken over were often specialist firms, relatively large organisations also acquired specialities in their portfolios and thus constituted a competitor with regard to other specialists. One example is the takeover of Hoppe by Bols, in which the relatively specialist enterprise Hoppe ended up in the hands of a predominantly generalist company: Bols. Yet it is difficult for the specialities of these generalist organisations to compete with products from the specialists, primarily because generalists have to spread their focus and resources across multiple product types and target groups. The high degree of consolidation in the market has resulted in the market share of a few enterprises growing to over 30% of the market. Due to many takeovers, Bols has become an ever-larger player on the Dutch jenever market.

However, this concentration of the market has not happened in the heterogeneous sub-market. One of the reasons for this is the fact that in the traditional production of high quality jenever it is not possible to achieve economies of scale, mainly because of the high degree of labour intensity. Quality also plays a major role among consumers in this share of the market. When producing jenever, quantity is achieved at the expense of quality, which means many specialist organisations consciously opt to stay small. Most specialist distilleries set themselves the goal of producing high-quality jenever, in which matters such as sales or market share are far less important.

As of the 1970s, there has been a continuous decline in sales, with demand falling by between five and ten percent every year. The extent of the decrease mainly depends on external factors such as excise duties or special offers by off-licences. The flavour of the different jenevers produced by the homogeneous share of the market does not differ much, so consumers are highly sensitive to special offers and will readily change brand. Consumers in this homogeneous market are also characterised by a low degree of loyalty and appear to be insensitive to differences in value for money or innovations. In recent years, the demand for highly specialist products in the heterogeneous share of the market has remained fairly stable or seen a slight increase. In addition, there are relatively few price changes in this share of the market, which means turnover is fairly stable. Businesses in this share of the market produce at a relatively stable level for their niche market.

Price wars occur quite often in the homogeneous share of the market, which means profit margins for the companies are relatively small and are falling. Various enterprises that focus on producing large volumes of relatively simple jenever end up in difficulty because both the volume and the profit margin are growing ever smaller. Although some organisations have experimented with new products or marketing campaigns, nothing appears to be successful at stimulating demand. The high degree of consolidation has not done the market any good either. A number of organisations have been taken over, which means over time a kind of race has emerged between the larger organisations in the market (Bols against the rest). Consumers of high-quality and specialist jenevers are very loyal and display an extremely low degree of sensitivity to special offers. Specialists produce an authentic or artisan product, which in terms of quality distinguishes itself from other brands and encounters no competition in its own niche. Therefore specialist enterprises can demand a higher price precisely because of the specialisation, which means profit margins for businesses in this share of the market are relatively high. Demand in these niches is decreasing far less rapidly than in the homogeneous share of the market, so specialists are guaranteed their distinctive, relatively small market, in which demand is more constant and competition minimal.

Since the early twentieth century, hundreds of distilleries have ceased to exist in their independent form due to forced takeovers or bankruptcies. This means the number of independent distillers decreased from 392 in 1900 to 15 in 2006 (see Figure 16).

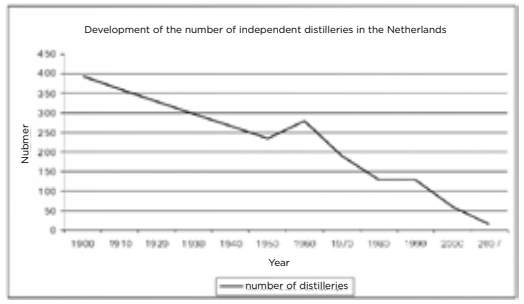

Figure 16 Development of the number of independent distilleries (Van Laere 2005).

The large number of company closures in the market is the result of decreasing demand for jenever, among other factors (see Figure 17). Due to this decreasing demand, a large number of distillers experienced a falling market share and were forced to end their business operations as independent entities.

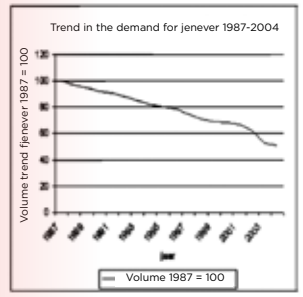

Figure 17 Development of total demand for jenever 1987-2004 (Commissie Gedistilleerd, 2006).

Figure 19 shows the development of the market share for various distilleries. To avoid any distortion of the data, the development of the market share of Lucas Bols, which fell by almost 40% in 20 years, is shown separately in Figure 18. In 2016, Lucas Bols was still the market leader with 25% of the jenever market, with De Kuyper, Nolet and Hooghoudt following at a suitable distance.[139]

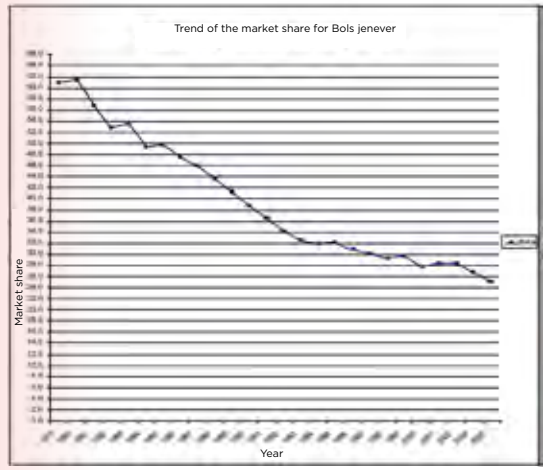

Figure 18 Development of the market share of Bols on the Dutch jenever market (Commissie Gedistilleerd 2007).

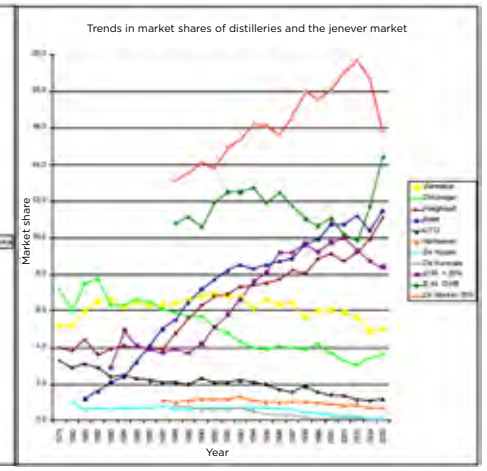

Figure 19 Development of the market share of companies on the Dutch jenever market 1979-2006; (Commissie Gedistilleerd, 2007).

5.3 The main players and clusters in the jenever market

Bols

Bols is a major pioneer and undisputed market leader on the Dutch jenever market, founded in 1575 with the Lootsje distillery in Amsterdam and thus the oldest distillery still in operation in the Netherlands. Almost 100 years later, in 1664, the company began producing jenever, alongside various liqueurs. Under the leadership of Lucas Bols, born in 1652, the company was also successful in exports. In 1816, when the last male heir of the Bols family died, the business was sold, including 250 handwritten receipts and on condition that the brand name be preserved. In the nineteenth century, Bols' international fame soared to great heights and sales increased both nationally and internationally. The company ultimately ended up in the hands of the Moltzer family, which floated it under the name of 'Bols Distilleries' in 1954, after the last family member involved withdrew from the management. The distillery moved to Nieuw-Vennep in 1969/1970 because further expansion in Amsterdam was not possible at the time. In the post-war years Bols integrated competing jenever and liqueur producers; the main takeovers involved the firms of Henkes, Hartevelt, Hoppe, Wynand Focking and Bootz.

In 1993, Bols merged with the food concern Wessanen in the expectation that it would bring synergy gains. The BolsWessanen combination was not a success and the two businesses separated again in 1996. Through a management buy-out (in which the incumbent management worked with private equity fund CVC partners) Bols settled in Zoetermeer and was sold four years later to Rémy Cointreau. In 2006, Bols was bought from Rémy Cointreau through another management buy-out by former manager Huub van Doorne (25%), in association with AAC Capital Partners (75%). Bols has become a lean & mean business in which production, distribution, sales and marketing are outsourced as much as possible, and the company invests little in machinery and buildings. Bols' sales stagnated in the growing market for spirits and a shrinking jenever market. The new Bols increasingly attempts to connect more with the young, internationally-oriented drinker and tries to seduce them using bartenders as its ambassadors. In 2008, Bols launched Bols Genever as the basic ingredient for special cocktails and mixed drinks. At the same time the House of Bols Cocktails & Genever Experience opened in Amsterdam. The latter includes a training area for bartenders and an innovation centre for developing new drinks for this professional group. Bols also organises its very own World Championship of Bartending, for which the company has bartenders fly in from all over the world.

In 2015, after 17 years, Bols returned to Damrak. The company produces vodka, gin and liqueurs, as well as jenever. At the time of its stock market listing, Bols achieved 70% of its sales from the international brands and 30% from regional brands such as Bokma, Hartevelt and Coebergh (the ratio was different ten years earlier: 55/45%). On the global market, according to Bols, its growth is the result of the continued popularity of the cocktail culture (Bols has a leading position with its liqueurs such as Pisang Ambon and Coebergh).

Moreover, its stock market listing provides room for acquisitions, as with the recent joint takeover of the remains of Koninklijke Dirkzwager in 2016.

With the major motivation that Bols is an interesting financial investment, both Nolet and the De Kuyper-affiliated Enix investment fund recently gained a 25% and 5.4% interest, respectively, in the oldest jenever distiller in the Netherlands.

Nolet

Joannes Nolet opened a jenever distillery in 1691. His son Jacobus expanded the business and purchased shares in the De Star windmill, which ensured the company's supply of milled grain. The sixth generation, another Joannes, relocated the business to its current location near the Maas. Nolet also acquired shares in several windmills and participated in the joint alcohol and spirits factory Hollandia in Schiedam at the beginning of the twentieth century. Nolet branched out to North America (Baltimore) in 1902. It opened a distillery there, but within two decades it had to close as a result of prohibition.

In 1977, Carel Nolet (the tenth generation) introduced Ketel 1 jenever and visited Dutch off-licences with his new product like a true salesman. In 1983, Ketel One vodka was introduced to the American market and this new brand began gradually gaining popularity. Nolet uses a marketing and distribution deal with the drinks concern Diageo for the further commercialisation and market penetration of Ketel One vodka from Schiedam. Since Diageo's assortment lacked a popular vodka and Nolet could really make use of the marketing and distribution power of Diageo to launch a global offensive, both parties set up a joint 50/50 marketing and distribution business, Ketel One World Wide, for which Diageo paid Nolet $900 million. This deal has proved extremely successful for both parties: production has risen by 40%, Ketel One is now on the map and Nolet is now a 90% producer of vodka. Plans for launching a gin by Nolet were kept out of the deal with Diageo; this product was introduced to market autonomously by Nolet. While Bols makes €78 million in turnover with 70 employees, Nolet does considerably better, making around €300 million with 120 employees.

De Kuyper

De Kuyper, the other internationally-famous jenever producer from Schiedam, was founded in 1695 in Horst in Limburg, originally as a producer of vats. In 1769, De Kuyper took over a spirit & yeast factory in Rotterdam, followed by the purchase of four more. Later on, two malthouses were added, as well as a majority shareholding in the stone malt mill De Arend. In 1792, the company moved definitively to Rotterdam. De Kuyper soon focused on exports, and achieved success. In the early twentieth century, De Kuyper participated in the joint malt wine and yeast factory Hollandia (together with Blankenheim & Nolet Distilleerderij). In 1925, De Kuyper withdrew from the distilling business and no longer developed the raw material alcohol itself. The involvement in Hollandia was handed over to the Nederlandse Gist- en Spiritus factory in Delft. Since the Rotterdam location was at best barely suitable for installing a

larger and more modern production system, De Kuyper moved to Schiedam in 1911. The firm had owned land there since 1893, and the new factory was built and fitted out there. In 1920, the firm started producing liqueurs (lemon jenever, lemon brandy and vieux, also known as Dutch brandy) and expanded the jenever assortment, but the liqueurs gradually dominated. De Kuyper also opened distilleries in Canada (1932) and the US (1934) and important partnerships were agreed with John Hope & Co and later with Maegher in Canada and with National Distilleries New York, followed by James Bean Distilling in the United States. By now De Kuyper, along with its fellow jenever distillers Bols and UTO, had acquired a minority stake of 33.3% in the bottling plant Avandis in Zoetermeer. In 1995, De Kuyper acquired Erven Warnink in Middelharnis for the production and sale of advocaat and cream liqueurs. The company diversified into the chocolate industry in the 1980s and 1990s, with the acquisition of De Baronie-De Heer, and into an exercise that was completely alien to the sector, involving surfboards, by investing in the firm Wayler. In 1998, De Kuyper gave up the chocolate business De Baronie by means of a management buy-out. In 2009, De Kuyper made an important purchase with regard to its assortment of liqueurs: it took over the Belgian Mandarine Napoleon.

As the world's largest producer of cocktail liqueurs, approaching bartenders and ensuring access to cocktail bars and their trendy visitors are essential for De Kuyper. Nevertheless, the family-run business has not forgotten its roots: with the acquisition of Distilleerderij Rutte in 2013 it aimed to put jenever (back) on the international map. Rutte was founded in Dordrecht in 1872 and remained a family-run business until 1991, when it was taken over by a group of shareholders and a different management team. After the takeover by De Kuyper, the market orientation of Rutte's products (which included seaweed jenever) changed from regional to national.

Koninklijke Dirkzwager

Another large jenever distiller with a clear Schiedam origin is Koninklijke Dirkzwager, originally founded in 1879, which was once the largest organisation on the jenever market, measured on the basis of the number of employees. With famous brands such as Floryn and Legner, as well as non-Schiedam brands it took over such as Hulsink and Hellebrekers, Dirkzwager was mainly active in the homogeneous jenever market. As a result of an active acquisition policy outside its Schiedam home base, Koninklijke Dirkzwager moved its operations to Tilburg in 2012. In 2006, the company still employed 1,800 people; ten years later this figure was 180. In 2016, the company was toppled as a result of the mismanagement of the subsidiary Mitra, the off-licence chain, being pursued for bookkeeping fraud at this business unit. Buyers were found relatively quickly for the different parts of the company. The production and bottling activities were purchased by the drinks producer Avandis (a cooperation partnership involving Lucas Bols, Herman Jansen and De Kuyper), Lucas Bols took over the jenever market, De Kuyper acquired the liqueurs, and the wine bottling plant became part of Herman Jansen/UTO.

5.4 Amsterdam – Weesp / Rotterdam – Schiedam

Grain brandy served as the basis for jenever and was produced from old wine from France. However, around 1600 there was a ban on imports of wine from France and the distillers shifted to using grain. The jenever distilled from grain soon gained in popularity. Around 1600, there was enough grain in the ports of Rotterdam, Amsterdam and the surrounding area. In the first half of the seventeenth century, large grain stacks were established in Rotterdam and Amsterdam where grain was stored to bridge the period between two grain harvests and to be able to provide the ships with a return cargo. In the ports, some consignments were affected by seawater and insects. These wares were no longer fit for consumption, but could still be used to produce grain brandy. The city needed the additional environmental impact caused by the spirit & yeast factories, which also involved serious fire risks, like a hole in the head. Consequently, the town of Weesp, an outer harbour for Amsterdam, was given the opportunity to expand to become a flourishing distilling centre.

During the second half of the eighteenth century, grain brandy production experienced huge growth, mainly in Rotterdam, Delfshaven and especially in Schiedam; this came at the expense of the position of Amsterdam and Weesp. The increasing concentration of distilling activities in the Maas cities was predominantly due to the low price of raw materials: the malt and coal came from England, Russian grains from Riga were shipped directly to Rotterdam and Schiedam, and sales of jenever went to North America and England. This all benefited Rotterdam. The lack of business space would have impeded the establishment of (new) spirit & yeast factories on a large scale in Amsterdam. The initial boom of grain brandy distilling in Weesp between 1600 and 1650, with many small distillers at first, was followed by a period of concentration, speculation and mismanagement, and as a result Weesp lost its pioneering role too.

The fact that Schiedam became so large can be explained by three factors.[140] Schiedam had a (sea) port, valuable for the supply of grain and exports of jenever; Schiedam possessed natural, clean spring water; and the local authorities stimulated the labour-intensive jenever distilleries from the outset. The Municipality of Schiedam had made space available for it: herring fishing had moved to the Maasmond by the early nineteenth century, leaving many premises vacant in Schiedam on canals that were directly connected to the open water. In Rotterdam, which was experiencing strong growth at the time, spirit & yeast factories were not wanted in the city centre due to their environmental impact and the risk of fire. Rotterdam's city council directed new spirit & yeast factories to the outermost corner of the city, where the land was more expensive. The many vacant fishing premises in Schiedam and low wage costs compared with Rotterdam meant that many distillers went to try their luck in Schiedam and started new, small-scale spirit & yeast factories with a small amount of capital.

As a result, Schiedam acquired a high concentration of the Dutch jenever industry with a differentiated and integrated cluster that operated with

great success until the early 1900s.[141] In the heyday of the jenever industry, between 1840 and 1890, Schiedam was home not only to hundreds of jenever distilleries but also to warehouses, grain mills, the grain exchange and two swill exchanges. There were 188 spirit & yeast factories there in 1795; by 1881, the number of spirit & yeast factories had increased to almost 400. The jenever industry resulted in the whole city flourishing. Not only did the distillers have lots of work, but the bag carriers, the coppersmiths, the glass-blowers and the printers (labels) also profited from the high demand for the drink, which was extremely popular at that time.

However, the industry also had its downside. The continuous roasting and distilling meant that the city was permanently shrouded in a dark haze. There was the vapour from the spirit & yeast factories, not to mention the stink and muck from the pigs that consumed the waste products from the grain spirit & yeast factories. Everything was covered in a thin layer of soot, earning the city the nickname 'Black Nazareth' in the nineteenth century.

At the beginning of the twentieth century the traditional spirit & yeast factories became less and less profitable. In 1920 there were just 14 spirit & yeast factories, and only four remained in 2004. To provide a counterbalance to the emergence of column-distillate jenevers (based on neutral alcohol instead of traditionally based on malt wine), Schiedam's city council issued a special quality label in 1902, in favour of the traditional spirit & yeast factories: 'Authentic Schiedam jenever'. Today, just two jenevers still bear this quality label for jenever brewed entirely in the traditional manner: 'Old Schiedam', distilled in the Schiedam jenever museum, and 'Notaris jenever', distilled in the 'De Tweelingh' spirit & yeast factories, formed by a merger between the Delft firm 'Vlek' (1860) and Schiedam's 'Herman Jansen' (founded in 1777). The company name was restored to 'Herman Jansen' in 2011.

5.5 A new Schiedam?

The jenever industry in Schiedam may have seriously declined over the past decades, but there are still strong traces of the industry, albeit in the guise of tourism and art. The national jenever museum is based in the De Locomotief former malt wine distillery, the warehouse next door has been transformed into a bed and breakfast, the steam dairy factory has been restored by the Nolet family and converted into the Ketelfactory gallery and the Wenneker malthouse has been transformed into an arts centre (Bayer et al., 2015).[142] The national jenever museum is also getting a new élan: according to a recently-published master plan, the jenever museum will play a major role not only in city marketing for Schiedam, but also in the reinvigorated Museumkwartier (National Jenever Museum, 2016). The jenever museum complex, with its three locations (the Jenever Museum, Distillery Museum and Windmill Museum), complete with festivals, day of the windmill and other events, will tell visitors the full story of Schiedam jenever.

The former distillers' mills, which still stand tall above the houses to catch enough wind to mill the grain for the jenever industry, have also acquired

a new purpose linked to the museum, catering and hospitality, tourism and education (Bayer et al., 2015). Their numbers may have fallen from the original 20, but there are five authentic and two more recent ones. Of the five historical windmills, Vrijheid is the only one that still mills and produces flour for bakers, distillers and other businesses. Nieuwe Palmboom currently operates as a working corn mill museum, Walvisch is a shop selling a wide range of bakery products and Kameel serves as a meeting centre and events venue. De Drie Koornbloemen, the oldest authentic distiller's windmill, which dates back to 1770 and which was reacquired by the Municipality of Schiedam in 1976, is now open to the public following a comprehensive restoration: in combination with the miller's house, the windmill can be hired for all kinds of events. The sixth windmill, called De Nolet, was newly constructed in 2005. The historic façade conceals a hyper-modern wind turbine, which is used to supply Nolet's distillery with power. With the exception of two houses, the street between the Nolet windmill and the Ketelfactory is owned entirely by the Schiedamjeneverstok.[143] Number seven, Kameel, is a replica of one of the distillers' windmills that burned down in the nineteenth century.

5.6 A comeback for jenever?

Until recently, craftsmanship, conservatism and venerable age defined the image of the jenever sector. In the advertisements the emphasis was not on innovation and new flavours, but on continuity and nostalgia. It is important to acknowledge the major difference between artisan-produced jenevers for connoisseurs and jenever produced industrially for the general public, as well as the tension between the preservation of certain recipes and the drive to innovate. Moreover, it has proved very difficult to reach new groups of consumers with traditional products like jenever, as well as lemon jenever and vieux. The world prefers to drink whisky, vodka, brandy or rum, then gin – and last of all jenever.

For a number of years, the decline in sales of ordinary jenever has appeared less serious. Indeed, jenever seems to be making a comeback (see for example NRC, 25/01/2012). We are undeniably seeing a shrinking market with fewer and fewer jenever products as a result of closures, bankruptcies and takeovers, whether forced or not. However, we also see that several jenever distillers have an increasing market share, sales and/or profit and that in recent years innovative jenever products have been developed and new entrants have emerged on the jenever market. These innovations could consist of new flavours and packaging, and/or collaborations with first-class restaurants and top chefs, who use the jenever products as an ingredient or serve jenever to accompany dishes. New jenever brands such as Kever and Jajem have also recently appeared on the market.

Spirits.nl, the spirits branch organisation in the Netherlands, along with other actors including Herman Jansen, De Kuyper, Lucas Bols and Hooghoudt, recently launched an information and sales campaign focusing on the renewed promotion of European jenever in America. This programme

is subsidised by the European Commission as part of the 2017 working programme 'Enjoy, it's from Europe'. Important criteria used to select Dutch and Belgian jenever producers for this programme include their high quality, the use of traditional artisan methods and the geographical protection of their products.[144] Jenever was once a prominent feature on menus of American cocktail bars, but due to the emergence and later dominance of gin, this position has been marginalised. With the rise of micro-distilleries (craft spirit) in the Netherlands and beyond, and the return of the cocktail culture in the US, Spirits.nl and its partners see new possibilities for jenever on the American market, especially for the use of jenever in cocktails. The new activities to be developed by Spirits.nl and its partners, in addition to the already famous Genevergenootschap, Jenevercafés, Jenever Festival & National Jenever Museum, involve setting up trade fairs, promotional and study trips and media campaigns.

Besides older consumers (50+ category) who continue to drink jenever from a shot glass, jenever is becoming trendy among a new generation as a mixed drink or camouflaged in gin and/or vodka. Nolet organises monthly Friday afternoon drinks and Bols sponsors club evenings with cocktails for people aged 25 and over who enjoy going out and who have disposable income. The Genevergenootschap, along with former minister and current King's Commissioner of North Holland Johan Remkes as a prominent figurehead, is busy rejuvenating itself with former judoka and DJ Dennis van de Geest as its new ambassador. Apart from in the companies cited above and the extremely active National Jenever museum (including De Gekroonde Brandersketel Museumbranderij and the Museummolen De Nieuwe Palmboom[145]), the distilleries from the former jenever capital are disappearing. But, with the successful launch of Ketel One Vodka or Nolet's gin by Nolet, and the launch of other new trendy gin brands such as Loopuyt Gin and Bobby's Gin, Schiedam could be renamed Gin City or Noletstad. It already has a Nolet Street!

The once-illustrious jenever cluster lacked resilience when the sector opted en masse in 1900 for cheap and standard molasses alcohol instead of the labour-intensive but high-quality production of jenever using malt wine as the basic ingredient. When, at that time, producers of whisky and other foreign spirits such as cognac began to successfully obtain protection based on regionally enforced production and quality requirements, it was too late for the Schiedam cluster: most distillers lacked interest in this development (unlike their suppliers of malt wine products) and were focused more on mass production and price competition than on quality and craftsmanship. Alas, a missed opportunity: in less than 40 years' time (between 1880 and 1920), most distillers and malt wine producers had disappeared, been toppled or merged. Nevertheless, the disintegrated jenever cluster in Schiedam has produced a small number of successful companies that survived the national and international competitive struggle and demonstrated the necessary resilience. Companies such as Nolet, De Kuyper and Herman Jansen have

now proven themselves and shown that resilience sometimes arises from collaborating in the marketing domain with large, international players and sometimes from serving niche markets (such as the cocktail market or special jenevers and gins). It remains to be seen whether a powerful cluster of small, artisan businesses will emerge. Whether or not they are assisted by the Jenever Museum, there are a few local initiatives by a new generation of micro-distillers to give the production of traditional and high-quality jenevers a new lease of life. Perhaps, in the future, the Rotterdam consumer market will be fertile soil for the development of new flavours and innovative marketing concepts. History has taught us that Schiedam has been a fall-back location for Rotterdam rather than Rotterdam proving to be a source of renewal for Schiedam.

6 Rotterdam Wholesale Market: future driving force of a food cluster at the Spaanse Polder business park?

The Wholesale Market at the Spaanse Polder business park was recently in the news because the Municipality of Rotterdam sold the complex to Urban Industrial – an investment fund focusing on industrial and logistics real estate in the Randstad.[146] The Municipality was looking for an investor because the complex was no longer a good fit for its real estate portfolio. Urban Industrial plans to invest in the Wholesale Market: the existing buildings will make room for new work premises with greater surface area and a covered inner courtyard. The Wholesale Market has been located at the Spaanse Polder business park for decades. How did the Wholesale Market emerge and what have been the most important developments in recent decades? What role does the Wholesale Market play in the food sector, and how does its future look?

6.1 Development of the Spaanse Polder business park

The Spaanse Polder business park occupies a strategic location near two major arterial roads, the A20 and A13, with the A4 not much further away. Therefore, the Spaanse Polder is situated in the south wing of the Randstad and offers good connections to the Port of Rotterdam and Schiphol airport. It is the largest contiguous 'dry' industrial estate in North-western Europe, with a surface area of approximately 190 hectares.

The Spaanse Polder lies to the north of the Rotterdam district of Spangen; the area was originally called the Spangense Polder and was established between 1250 and 1300.[147] The polder was named after 'Huis te Spangen', which stood in the polder and which was demolished in the nineteenth century. In popular language 'Huis te Spangen' was bastardised to 'the castle of Spain' and the Spangense Polder became the Spaanse Polder.[148] For centuries it served as a grazing area for livestock farming. In 1795, a cemetery was constructed along the Delfshavense Schie, the main sailing route to Delft, and a timber business and sawmill were later added to the south. This was the first industrial area in the region.

The most famous building in the Spaanse Polder dates back to before the area was classified as an industrial estate: the Van Nelle factory, a national listed building dating back to 1929. In 1916, the Van Nelle company, based in the city centre, bought a large piece of land in the Spaanse Polder. The Van Nelle concern in the city centre was not able to expand and the owners of the business foresaw that this site could be an appealing location for future urban expansion. In 1929, the production of coffee, tea and tobacco began in the Van Nelle factory in the polder. The building is still standing, after it was saved from demolition in the 1990s. The former factory is a UNESCO World Heritage Site and now serves as a conference centre and houses multiple businesses. For a long time it was the only building in the polder.

The bombardment of Rotterdam in May 1940 devastated many companies in the city centre. As a result, in 1941 the Rotterdam Municipal Executive decided that all industrial activities had to move out of the middle of the city. The Spaanse Polder was viewed as an adequate new location for receiving the devastated companies.[149] The Spaanse Polder was classified as an industrial estate, but it still took years before the first businesses moved there. After the Second World War the development of the industrial estate picked up pace. In 1947, the first plots became available and bit by bit the first companies registered their interest. The first group of businesses included some from the food sector, such as large-scale bakeries like Van der Meer and Schoep.[150] Once the Municipality of Rotterdam invested in improved access to the site in 1952, interest in the estate grew and it gradually filled up. The later wave of businesses to come to the site also included firms involved in the food sector, with the most well-known being Verstegen Specerijen, which moved to the Spaanse Polder in 1964.

At the end of the 1960s, the Schiedam part of the polder – 's Gravelandse Polder – was added to the estate, increasing its size. From then on the business population at the Spaanse Polder also changed: the industrial estate became a business park, because companies involved in trade, distribution, transport and business services also moved to the Spaanse Polder. The changing economic structure of the city was also visible in one of the largest collective business parks in the Province of Zuid Holland.

In the 1980s, the Spaanse Polder had to cope with multiple vacant buildings. Rotterdam suffered badly from the economic crisis, and businesses at the Spaanse Polder estate also went bankrupt or left the site for cheaper locations elsewhere in the Netherlands. The average percentage of vacant plots at the business park during this period was between six and eight percent. An additional problem for Spaanse Polder was that many of the buildings in the area had been constructed for specific production processes, and this real estate could not be used by other tenants without drastic renovation work being carried out. The requirements that entrepreneurs impose on business sites were also changing. A study by Twijnstra Gudde from 1987 reveals that entrepreneurs at the site signalled the following problems:

- Access to the site by car or public transport was not optimal;
- The site's layout was such that it was difficult to access some areas;
- The roads were too narrow for lorries and there were issues with parking and loading and unloading;
- There was no adequate signage;
- The appearance of the site was not representative, partly due to the lack of greenery or that greenery being poorly maintained;
- The activities were decreasing in scale due to the fact that larger companies were moving out;
- Management by the Municipality was not optimal. There was insufficient attention for the demands of users, and too many official bodies were involved in day-to-day management.

During the second half of the 1980s, with support from central government, the Municipality invested 23 million guilders (approximately €10.4 million) in restructuring the Spaanse Polder. This process created new connections to the site (bridges and a link to the A20), and the site was given better parking facilities and a new (and 'greener') look.

The investments were the start of a series of efforts made by the main land owners, the Municipality of Rotterdam and the Municipality of Schiedam to revitalise and restructure the site in order to prevent businesses vacating and withdrawing from the area.

The investments in the 1980s and 1990s proved insufficient. In April 2001, Rotterdam's council decided to revitalise the Spaanse Polder and 's-Gravenland-Zuid 'over a period of around 15 years, in association and consultation with the Municipality of Schiedam, to transform it into a modern, mixed site with the aesthetic appeal one would expect from such a location.'[151] More major investments were made by the municipalities (with a financial contribution from the Province) between 2002 and 2015 in restructuring the Spaanse Polder. The Spaanse Polder suffered diverse problems: outdated real estate, illegality, social security, the environment and poor image.[152] The Spaanse Polder appeared to be stuck in a vicious circle: outdated and vacant premises promoted degradation and pollution and this attracted criminal activities, which meant that established or potential new businesses opted for other business parks. This resulted in the Spaanse Polder acquiring a bad reputation. Its restructuring was urgently needed, but it was not an easy feat. The challenge consisted of, for example, demolishing outdated property, investing in streets and roads, improving processes of traffic flows, renovating the external space and increased maintenance.

In recent years, substantial improvements have been made and success has been achieved in maintenance and social security. Today, many of the components involved in the restructuring project have been completed, security has been improved, problems with streets and roads have been

tackled, the real estate has been revamped and redeveloped plots have been released. The changes have not gone unnoticed: in 2011, the Spaanse Polder business park won the 'Menzis Best Business Park Award' due to its successful restructuring. Entrepreneurs at the Spaanse Polder welcome the progress made. They consider that an improvement in the situation at the Spaanse Polder has been especially visible in recent years, such as the activities of a city security officer and a more proactive attitude from the police.

6.2 Spaanse Polder food & business park: the Wholesale Market

The food sector has been represented at the Spaanse Polder business park from the outset, as mentioned above. One iconic element for the food sector at the Spaanse Polder business park is the Wholesale Market. The firm De Zakenpartner formulates it as follows: 'When you think of food at the Spaanse Polder, the Wholesale Market springs to mind.'[153] The Market currently plays a major role in the catering and hospitality sector, retail and related businesses, with over 200,000 visits a year. The site covers eight hectares and has 147 units and 45 tenants. Estimates vary regarding the total sales and number of jobs supplied by the market: PwC reported a turnover of €700 million and 800 jobs[154] in 2007, and in a 2016 press release the Municipality of Rotterdam stated a turnover of €1.5 billion and 800 jobs.[155]

6.2.1 Food distribution: from Noordplein to the Spaanse Polder

The wholesale centre for fruit and vegetables was established at the market on Noordplein in the Oude Noorden district of Rotterdam in 1969. It was a hive of activity, with farmers and growers from the surrounding municipalities bringing their products to Noordplein. During the period between 1938 and 1968, around 3,800 day places were leased on average every day. The customers included shop owners, traders and (street) sellers who purchased the products that had to reach the consumer quickly due to their limited shelf-life. Organised trade became increasingly important during this period: more traders and wholesalers appeared and became more significant. People also started selling products on behalf of the farmers and growers. Due to the hustle and bustle, hygienic conditions were inadequate and the market caused a lot of nuisance to the neighbourhood. In 1959, the Municipal Executive decided to move the Wholesale Market to the Spaanse Polder, although it took until 1969 before the Wholesale Market could actually be put into use. Arranging the funding was not easy: in the end it was partially resolved with a contribution from the European Agricultural Guidance and Guarantee Fund (EAGGF). It was also consistent with the image of the changing Spaanse Polder, evolving from a site devoted exclusively to industry to a business park, as explained earlier.

Image 1 Opening of the Wholesale Market 1969 (source: Sjaak Heimeriks).

Back then, the Wholesale Market for potatoes, fruit and vegetables was developed by the Municipality to safeguard food distribution. The catchment area of the Wholesale Market was not limited to the city; it also served the region. In 1980, the Wholesale Market also acquired the role of meat distribution centre, whereby businesses based in Boezemstraat (near the Public Slaughterhouse) moved to the Wholesale Market. The flower wholesalers followed, having moved from the Agniesebuurt in 1984. Fourteen additional units were built to accommodate this growth. In total the Wholesale Market comprised 147 units after this expansion, occupied by fruit, vegetable, meat and flower wholesalers.

Figure 20 Location of the Wholesale Market in the Spaanse Polder.

The role of the Municipality had been decisive from the outset because guaranteeing adequate food distribution was considered one of its core tasks: the Municipality supplied the sites in the form of leaseholds, managed the distribution centre for wholesale, rented out units to both large and small wholesalers and ensured order and supervision. The management tasks were later outsourced to private parties. From 1986 onwards, discussions were held between the tenants and the Market Department (Dienst Marktwezen) of the Municipality of Rotterdam, about the possibilities of a different form of management. During the same period the tenants organised campaigns to have rents reduced. The rents had risen from 7,000 guilders per 100m2 in

1969 to 18,676 guilders in 1985. These campaigns were effective: in 1986 the prices were lowered and rental prices would not exceed 18,000 guilders again until 1996. Unrest among the tenants was caused by, for example, by the deterioration in the condition of the Wholesale Market and the Spaanse Polder, where subsidence meant the ground was difficult to negotiate. Until 1998 the Market Department of the Municipality of Rotterdam was responsible for the Wholesale Market, followed by the Rotterdam Development Company and recently the Urban Development Department. The Wholesale Market covers 45,000 m² of business space and the total market site spans 114,000 m². The site is located to the north of the dock and Vlaardingweg. On the eastern side, the water of the Delfshavense Schie forms the border with the residential district Overschie (see Figure 20).

The development of the Wholesale Market more or less followed the development of the Spaanse Polder. In the 1970s, entrepreneurs at the Wholesale Market benefited from the economic prosperity, but during the economic crisis of the early 1980s they were also hit by the economic malaise. In addition to the effects of the economic crisis, entrepreneurs at the Wholesale Market increasingly felt the effects of the rapid growth of supermarkets. Supermarkets do not need wholesalers – they purchase potatoes, fruit and vegetables directly from the producers. They were also the final blow in the demise of the small retailer: many greengrocers, butchers and florists disappeared because they could not compete with supermarkets. The loss of customers was felt by the entrepreneurs at the Wholesale Market, and it was also visible in the concentration that occurred over the years: in 1970 there were still 102 wholesalers distributed across the available units; by 1984 the number had decreased to 65. Small-scale entrepreneurs went bankrupt and the units were taken over by the larger businesses. The Wholesale Market suffered from an operating deficit, which caused the Municipality to consider privatising the market.[156] Specific investments by the Municipality ensured positive operating results from 1993. Research into opportunities for the Wholesale Market to continue and discussions with tenants did not result in privatisation. Demolition was also considered, but the conclusion was that the current situation would suffice until 1998. During the 1990s, partly due to the lack of investment, a number of tenants moved to other locations, including the Barendrecht-Ridderkerk Trade Centre (such as Van der Staay and Van Ooijen). In 1998, management of the Spaanse Polder was transferred to the Rotterdam Development Company, which started preparing a large restructuring project for Spaanse Polder because there was a major shortage of business parks in Rotterdam at the time.

Sjaak Heimeriks – Heimeriks

The family-run business Heimeriks moved to the Wholesale Market in 1969. The business is currently managed by Sjaak Heimeriks and his brother who, having taken over the firm from their father and uncle, are continuing the company as the fourth generation of fruit and vegetable traders. Before doing business at the Wholesale Market, the Heimeriks family were first located at the market on Noordplein in Rotterdam. When this market became too small to ensure that matters such as hygiene were in order, they moved to the Wholesale Market in the Spaanse Polder, which was specially constructed for this purpose.

The firm trades foreign fruit and vegetables from countries like France and Spain. Sjaak Heimeriks explains that until the end of the 1980s they traded only Dutch products, sold to Dutch customers by Dutch traders. Today the public at the Wholesale Market is more diverse, given that both traders and customers have different backgrounds. Sjaak Heimeriks has now been in the business for around 30 years and has seen the target group of the Wholesale Market change. His Dutch clients mainly come from the region, while immigrant Dutch customers also come from a distance. One of his customers with an immigrant background is prepared to make the trip all the way from Arnhem to the Wholesale Market because the products are cheaper here. In the past this was also true for Dutch customers, who came from all corners of the country. Heimeriks explains that it was considerably busier at the Wholesale Market in those days. The number of customers now appears to be stable, with few new customers and few departing customers. Heimeriks' non-Dutch customers predominantly sell to non-Dutch consumers, which means the products traded have also changed. The assortment has reduced compared with when the Wholesale Market first opened. Traders at the site frequently focus on their own speciality, such as Surinamese products (Tur-Ned) or strawberries (Gold Fruit). Many Dutch greengrocers have gone bankrupt over the years, resulting in a decrease in the number of Dutch customers for the Wholesale Market. In the past, Heimeriks ran six warehouses side by side at the Wholesale Market; today there are three left. The extended opening hours of supermarkets have been a disaster for retailers. Moreover, prepared vegetables sold by retailers means fewer customers for businesses such as that run by Heimeriks. The largest group of Heimeriks' customers consists of vendors who sell their products door to door. They come to the Wholesale Market for their products, or he delivers them to his customers in his delivery van. Heimeriks reveals that the mood at the market has changed. Whereas in the past he used to know everything about his customers and vice versa, relationships have become more distant. Like one of the last Mohicans, Dutch fruit and vegetable trader Heimeriks is still operating at the Wholesale Market. With a reduced stock and high quality, Heimeriks is trying to ensure his survival for the coming years.

Image 2 Sjaak Heimeriks' father and brother at the opening of the Wholesale Market in 1969 (photo: the Heimeriks company).

The reputation of the Wholesale Market is vulnerable, like that of the entire Spaanse Polder. Both regularly make the news due to crime, in which drugs often play a role. The Municipality of Rotterdam's revitalisation strategy for the Spaanse Polder (2001-2015) devoted explicit attention to the Wholesale Market. The revitalisation was intended to offer more space at the site for tenants and to guarantee security. Improving infrastructural access was also part of the plan. In total, €6.5 million was invested[157] in elements such as

security cameras, the energy supply and soundproofing measures for the surrounding area. The intention was for the site to be divided into five clusters: food (naturally including the Wholesale Market), design, transport, a mixed area and flatted factories. This clustering did not happen in the end because it did not prove feasible.

The Municipality of Rotterdam had previously considered privatising the Wholesale Market. The role of the Wholesale Market as a crucial food supply for the city and the region was largely taken over by the rapidly expanded supermarkets. The Municipality decided to sell the Wholesale Market to a private party. Management of the Wholesale Market from 2011 to 2016 was handed to the firm Vastestate, which specialised in making 'unusual real estate' ready for sale. In the end privatisation became a fact in 2016 through the sale to Urban Industrial.

Gold Fruit – Rusmir Latic

Rusmir Latic started working as a paid employee at the Wholesale Market 20 years ago. After his employer went bankrupt, in 2016 Latic rented a property to set up on his own with Gold Fruit in the same street of the Wholesale Market.

The first street, the busiest one according to the site manager, is home to various fruit and vegetable traders. Most owners originate from beyond the Dutch polders. Latic is one of them, originally from Bosnia. He has seen the Wholesale Market change over the years: in the past the site did not open until 3 a.m., and dozens of cars stood waiting outside the gate. Today it starts as early as 11 p.m. or 12 a.m., which means a longer night's work for the traders. Customers are no longer queueing at the gate, even though the decrease in the number of customers has stabilised in recent years.

Image 3 - Rusmir Latic (right) and a fellow trader at his business premises Gold Fruit (2017).

Latic also reports that the demography of the customers and the tenants has changed dramatically: almost all products are now sold by immigrant Dutch traders to immigrant Dutch customers. Latic comes from Bosnia; his neighbour is Moroccan. Opposite them there are Turkish Dutch traders, with Surinamese at the end of the street. This transformation began in around 2005 when an increasing number of indigenous Dutch tenants disappeared. Their units were taken over by traders with an immigrant background. The composition of the clientèle has also changed, as Dutch greengrocers and market traders

ceased trading or passed their businesses on to foreign successors. This has also caused a change in purchasing behaviour: people haggle much more about the price now than in the past.

Latic has also seen the range of products evolve over the years. Today you will not find leeks, celery or other 'traditional' products anywhere at the site. The majority of businesses at the market sell the same kinds of fruit and vegetables. Gold Fruit's trade mainly concerns strawberries. In this way, Latic attempts to make his business stand out from the dozens of other fruit and vegetable traders at the Wholesale Market. There are multiple businesses that sell one or two products with which they distinguish themselves.

Furthermore, Latic says that many suppliers first deliver to supermarkets. The products that are 'left over' go to the Wholesale Market. Competition from the supermarkets is fierce for the market traders and thus also for traders at the site. This results in falling prices and shrinking margins. According to Latic, customers of the Wholesale Market cannot compete with the special offers in supermarkets, and he expects smaller greengrocers to disappear over the next few years. Consequently the number of traders' customers at the Wholesale Market will also decrease. Due to the challenging working hours and constantly increasing price competition, Latic sees few future prospects. 'When I stop, I'll throw away the key. My children don't have to take over this business.'

6.2.2 The development of the population of entrepreneurs at the Wholesale Market

Various studies conducted in 2007, 2008 and 2016 clearly reveal that the Wholesale Market's clientèle has changed over the years. In 2007, PwC found that the 'diversification of the population of Rotterdam' was also reflected at the Wholesale Market. At that time, approximately 30% of wholesalers and 45% of customers had an immigrant background.[158] There is no doubt that these percentages are even higher in 2017. The current tenants estimate that a significant change has occurred in these ratios: the majority of today's customers and tenants now have an immigrant background. This change in clientèle means that entrepreneurs at the Wholesale Market had to be more flexible in terms of their product range and working method. This proved to be a bridge too far for some, who could no longer keep their heads above water or who ceased trading of their own accord. In several cases the tenancy was taken over by a former employee with an immigrant background (such as Tur-Ned, Gold Fruit and Aktalan). At the same time, there are still family-run businesses that have been renting their units at the Wholesale Market for a very long time. One example is the firm Heimeriks, which sold fruit and vegetables at the market on Noordplein before the Wholesale Market existed, moving there in 1969. Outsiders would expect diversification at the Wholesale Market to have a bearing on the product range sold there, but this is not really the case. Fresh, tropical products are sold at the market, but this is similar to what you would find in the supermarket. Special, exotic products are traded at the Wholesale Market, but less than one might think. These products are often too expensive for the customers who visit the market. At the moment the kaki fruit is extremely popular, which means it is found at many sites in the Wholesale Market.

There are businesses that have specialised, such as Tur-Ned in Surinamese products, but this is not representative of the product range of the market as a whole. In broad terms, the AGF firms at the Wholesale Market can be divided into companies that specialise in special 'exotic' products (a small group), companies that sort and sell surpluses of fruit and vegetables and a group that serves the top end of the market with quality products. According to the entrepreneurs, the number of customers has remained stable in recent years and the tenants' situation has not changed dramatically. Entrepreneurs at the Wholesale Market also meet the needs of the fixed clientèle and new markets are constantly being penetrated.

Wijnand de Mooij

Fruit and vegetable wholesaler Wijnand de Mooij was founded in 1966 by the father of the current owner, Frits de Mooij, who has followed in his father's footsteps. Just as with the Heimeriks firm, this business started out on Noordplein and moved to the Spaanse Polder when the covered wholesale market was opened. In 1988 Frits' son Wijnand joined the business; since then the company has grown, and may well now be one of the most successful traders at the Wholesale Market. However, these traders have also seen the market change and diminish.

The company's growth was partly made possible because of the opportunity to expand from one to three warehouses. This provided more capacity and traders could better serve their customers. However, it seems that entrepreneurship was the main driving force behind this growth, for example by effectively responding to changing demand, as long as sufficient volume could be achieved. The share of products that were not traditionally sold, such as Turkish spinach, now collectively accounts for 50% of sales. However, the step to import fruit independently from Italy and introduce it to the market under the company's own brand name (Unicavera) reveals this family-run business's entrepreneurship and demonstrates how wholesale trading can offer a certain counterweight to the assault by the supermarket; here, too, supermarket discounts are cited as the greatest threat to trade at the market when the question comes up.

Although in general the product range at the Wholesale Market may not have become more exotic, the composition of the assortment has changed. Trade in fruit and vegetables was the main activity of 48% of entrepreneurs in 2007 (Figure 21) and this fruit and vegetable trade increased to 54% in 2017. The percentage of entrepreneurs selling potatoes has fallen significantly from 14% to 4% in ten years. Flowers are also sold by fewer traders: 6% in 2007 compared with 2% in 2017. The percentage of entrepreneurs who mainly sell general foodstuffs has more than doubled from 8% to 17%. One explanation for this is that customers with an immigrant background demand these kinds of products. The companies currently based in the area of the Wholesale Market are shown on the map in Figure 22. One important company at the site is Sligro, which makes it appealing to be based in or close to the Wholesale Market.

Figure 21 Distribution of entrepreneurs by product groups in 2007 and 2017 (Source: PwC (2007) and Wholesale Market site (2017).

Figure 22 Businesses in the Wholesale Market on the map according to activity. Source: LISA

6.2.3 Yes or no to a food cluster?

In 2007 and 2008 PwC conducted a study, commissioned by the Municipality of Rotterdam, into the economic potential of the Wholesale Market. PwC concluded that trade in fresh food – especially fruit and vegetables – is the core of the market. The entrepreneurs serve loyal customers who value the broad assortment available at the market. These are mainly entrepreneurs with an immigrant background and market traders from the city and the region who come and purchase goods several times a week. Traders based in the Wholesale Market have been operating there for a long time and have also invested in the properties. Based on a survey conducted among customers and traders at the market, the PwC consultants estimated that the market's volume could grow by five percent a year. This estimate also takes into account the fact that the Rotterdam Wholesale Market is relatively small compared with similar markets abroad, but that profits per m^2 are higher in Rotterdam. A comparison was also made with the Food Center Amsterdam (FCA), where turnover is approximately twice as high as that in Rotterdam and where also comparatively

more general foodstuffs are sold, even though the region is not twice as large. The survey revealed that (some of) the entrepreneurs would like to rent more space in order to expand. This is another sign that the market could grow.

PwC talks of a food cluster in the Spaanse Polder where the activities of the Wholesale Market produce a spin-off in the immediate environment of small clusters of transport, food wholesalers, non-food catering and hospitality-related and other businesses. It is a factor that plays a role in the business location for a number of companies in the immediate vicinity of the Wholesale Market due to the high number of visitors. PwC states that the Wholesale Market has an impact on 1,000 entrepreneurs and 8,600 employees in the Rotterdam region, although the basis for this estimate is not entirely clear. What is evident is that the Wholesale Market has played a major role in the development of the retailers with an immigrant background in the city and the region.

The PwC report was overly optimistic about the future and the impact of the Wholesale Market. A more recent study by De Zakenpartner (2016) into the food sector in the Spaanse Polder is more cautious than PwC's. It identifies links between food entrepreneurs in the Spaanse Polder, but not a cluster. Brenner (2004) proposes that clusters have two important characteristics. They are concentrations of businesses in the same and closely related sectors and the businesses have something in common, which means knowledge exchange and collaboration takes place more readily.[159] The Wholesale Market (and surrounding area) is a geographic concentration of businesses in the same or closely related sectors. But by no means all food companies are located close to the Wholesale Market (such as Schmidt Zeevis and Verstegen Spices & Sauces). The key question is what the businesses in the market and businesses in the surrounding area have in common, apart from the location. Market tenants are after all each other's competitors, and the entrepreneurs focus on trying to keep costs down to be able to compete on price. They are more concerned about 'surviving' rather than innovating and responding to food trends in the sector. Collaboration is hard to get off the ground and there is still no evidence of any structural exchange of knowledge. Major players such as Sligro, Zegro and Schmidt Zeevis do little or no business with traders at the Wholesale Market.

There are also rumours that the Wholesale Market is not future-proof. The facilities are outdated and basic conditions are not satisfied: logistics at the site are sub par, there are no loading bays, there is nuisance caused by vermin in the outdated units, hygiene leaves a lot to be desired and the units are too small (food regularly stands outside). The dominant position of the large supermarkets and buyer groups is only increasing, which makes it difficult for Wholesale Market customers to keep their heads above water. In 2014 Van Oort found that (a major share of) the AGF cluster in the Rotterdam region finds itself in the consolidation and declining phase.[160]

Characteristics of these phases include scaling up and lower margins. Entrepreneurs will have to innovate to secure their future. Without investment, the future of the Wholesale Market is uncertain. In this regard, the enduring negative image of the Spaanse Polder as well as the Wholesale Market is a handicap.

6.3. The future: 'the puzzle of the Spaanse Polder'

In 2016, the Wholesale Market was sold to Urban Industrial, a relatively new company (2015) that invests American pension money in industrial real estate in the Netherlands. This acquisition was consistent with the strategy of the company, which is rapidly building a substantial real estate portfolio in which the food sector constitutes a major share. So far, it has built a portfolio worth €250 million. The Wholesale Market represents industrial real estate, focused on the second city of the Netherlands and also on food.
The American pension fund considers this a good investment. Urban Industrial acknowledges that major investment is required in the Wholesale Market. The objective is to make the Wholesale Market future-proof again with a stable profit for the investor.

The takeover does not mean that work will begin in the short term. At the regional meeting of the Rotterdam Food Cluster on 20 September 2017, managing director Jan Brouns indicated that Urban Industrial is taking its time in order to arrive at an effective decision. What is the right concept for the Wholesale Market of the future? The core continues to be trade in fresh products, but this could be achieved in various different ways. According to Brouns, difficult choices will have to be made considering the limited surface area of the Spaanse Polder (eight hectares). 'We cannot facilitate everything. We will focus on the depth or the breadth. That is why we are first getting to grips with all the pieces of the puzzle and examining them to see if they fit.'[161] The 'pieces of the puzzle' are 'clustering, flexibility, diversification, multifunctionality, quality and sustainability.'[162] The Urban Industrial team is doing its homework; in a short period of time it visited 20 wholesale markets in and outside of Europe to learn lessons for the future of the Rotterdam Wholesale Market. What is a suitable model, and what concepts could also work in Rotterdam? At the same time, the company is keeping an eye out for the acquisition of surrounding sites and premises to obtain more spatial leeway.

It is evident that logistics processes and online sales play a major role in the future of the Wholesale Market. It is also clear that distribution is far more important than cash & carry: 'In the past, 80% of sales consisted of cash & carry and 20% was distribution; this is now the other way round,' Brouns announced at the food cluster meeting. Two directions play an important role in the future plans. First, they are examining the idea of offering more services: further diversification and more multifunctional spaces (such as a waste processing area). Secondly, the company is explicitly looking at 'chain deepening': the combination of food processing, wholesale and distribution. Bubble Post, an ecological urban distributor, moved into the site in May 2017 to find out whether this could work for the Wholesale Market. Urban Industrial

views Rotterdam as an experimental garden for putting new concepts and ideas into practice.

The investor is aware of the vulnerable reputation of the Wholesale Market and the Spaanse Polder, and he has praised the Municipality's decision to tackle undermining and security issues. This appeals to the investor because quality, sustainability and being future-proof is crucial for an investor. 'It's not the number of tenants that is important to us; the fact that tenants want to be there because it is good for their business' is far more important to the director. Urban Industrial is going to assist tenants with the roof that has been announced and by improving logistic flows and functions. The process to piece the puzzle together cannot take too long, as the planning deadline set by the Municipality expires in four years and the implementation must be completed within nine years. The new concept will most likely involve diversification as well as chain intensification. The objective is to create an ecosystem in which there is more added value than in the current set-up.

7 Barendrecht-Ridderkerk Trade Centre: 100 years of auctioning leads to the creation of a potatoes, vegetables and fruit (AGF) cluster of international significance

7.1 Introduction

The Barendrecht-Ridderkerk Trade Centre is located to the south-east of Rotterdam at an important intersection of main roads (A15, A16) and railway lines (including the Betuwe line). The Trade Centre occupies a strategic position between major (greenhouse) horticulture and arable farming areas in the Netherlands and provides direct access to the Port of Rotterdam by rail and road. The Trade Centre achieves a turnover of around €3.6 billion and this location makes it an important part of the Dutch AGF sector. Related economic activities, including other food industry activities, transport and services, add roughly another €1.5 billion in turnover. The Trade Centre can be subdivided into the 'ZHZ Trade Centre/Oost Business Park' and 'Verenambacht' sites. The area is located on the municipal border between Barendrecht and Ridderkerk, whereby the two areas are divided by the Veren Ambachtseweg. Historically, the area mainly had a wholesale character, but it has increasingly diversified into specialist (international) trade, food processing and services. The 'Nieuw Reijerwaard' business park has recently been released. This huge area spanning 90 hectares focuses on companies involved in the food sector, with the aim of reinforcing the position of the Barendrecht-Ridderkerk Trade Centre.[163]

7.2 Genesis of the Barendrecht-Ridderkerk Trade Centre

Horticulture was implemented in the Netherlands until the mid-nineteenth century, but not on such a large scale that products were exported. A crisis after 1850 led to serious chaos, because there was no public pricing system. The crisis reached its peak in 1880 and sowed the seeds of the auction industry. The Barendrecht-Ridderkerk Trade Centre was created from the society in the municipalities of Barendrecht and Ridderkerk and the surrounding municipalities, which was originally an agricultural community.

The economy of these municipalities was primarily based on growing sprouts and strawberries in the late nineteenth century. These products were supplied to the 'large city' of Rotterdam at 'Noordmarkt vegetable market' on Noordplein in the Oude Noorden district. Growers produced their goods on an individual basis and brought them to the local market themselves. The buyers were sellers, shop owners and people who performed the role of wholesaler. Prices were established through haggling. The trip to the market was very taxing at the time: people got up at 1 a.m. to travel to the market, which often started trading before 6 a.m. People returned to their farms at 9 a.m. and resumed their usual activities. It was worth taking the produce to market, as sales averaged four to five guilders, with exceptional peaks of up to 25 guilders. There were also intermediaries in the form of purchasers who created the link with wholesalers at the Noordplein. Trust was not great in these intermediaries, and many growers sent a family member to supervise. Many of these family members later set up their own trading businesses. In the Netherlands, the Rotterdam market was an important point for trade between producer, wholesaler, retailer and end user. This form of sale at the Noordplein constituted the basis of a sales structure using the clock. Depending on supply, demand and the quality, prices fluctuated a lot between seasons and between the different market locations. Growers did unite in municipal associations in which there was some limited cooperation (Visser, 1995).

Figure 23 Areas of the Barendrecht-Ridderkerk Trade Centre. Source: own production/PDOK.

The history of the current trade centre begins in 1912, when the first plans were forged to set up a fruit and vegetable auction. In 1915, this resulted in the various horticulture associations around the municipalities of Barendrecht and Ridderkerk uniting to form the 'Cooperative for a fruit and vegetable auction

in Barendrecht and the surrounding area'. The objective of this association was to centralise auctions of the products with clear pricing and quality control. This auction was also situated closer to the businesses and offered an attractive alternative to the vegetable market in Rotterdam, because products could be sold to traders on a large scale. The auction's early years were difficult: there was no organisation, experience or money. The auction started out with 38 growers and more joined the auction step by step. No agreement was reached with the Municipality of Barendrecht about the location, but land was leased from the Staatsspoorwegen (state-owned railway company) 'for the fair price of a guilder a year'. A slatted barn was later built for the price of 100 guilders (Visser, 1995).

In the first instance, only strawberry growers were obliged to supply the products through the auction. During these early years, buying and bidding took place in the slatted barn mentioned above, near today's Stationsweg in Barendrecht, where products were delivered by horse and cart and auctioned. In 1917 it was taken to the next level and the board decided to purchase a meadow in Barendrecht for 10,000 guilders. A loan was taken out to pay for it and to construct a special auction building on the Gebroken Meeldijk for 60,000 guilders. A box warehouse was added in 1918, and in 1919 a site manager was appointed; there were no fewer than 131 applications for the post. The auction expanded rapidly. At first, growth was achieved through the trade of sprouts and strawberries, but more products were soon traded, including beans and onions (Visser, 1995).

The auction profited from the neutral status of the Netherlands during the First World War (1914-1918) and a broader range of products was sold. Agricultural produce from the neutral Netherlands was snapped up by surrounding countries and during this period the government made it compulsory to auction agricultural products for export (Visser, 1995). Not all growers were happy with this measure, not least because the exclusive right of auction had to be arranged and the other free auction had to be paid for by the members. The Municipality of Barendrecht also wanted to profit from this and demanded between a quarter and half a percent of the auction proceeds. These developments resulted in tensions between members and the board. Purchasing power had fallen considerably in countries surrounding the Netherlands and the compulsory auction proved to be unenforceable: growers traded products directly on the market again. In 1921, a members' meeting was held during which the decision was announced to liquidate the auction, but it did not obtain enough votes. Times remained hard until 1924, with revenues of around 400,000 guilders, whereas five years before revenues of 1,800,000 had been achieved. Nevertheless, those involved looked to the future, because the horticulture auction reserved 10,000 guilders of the budget for paving the 1st Barendrechtseweg, the Gebroken Meeldijk and part of the Noldijk. The importance of investing in infrastructure was acknowledged early on by the board of the horticulture auction.

Things improved for the auction in 1925: sales rose spectacularly and exports resumed. Growers began returning to the auction. In 1926 the site even became too small, and additional land was purchased and warehouses built where the buyers could store their products. The rapid growth made it necessary to appoint an inspector. Volumes became substantial, with a quarter of a million cauliflowers being supplied in one year, most of which were transported to Germany by rail. Rail congestion resulted in the auction board itself investing in a rail connection and loading area; neither the minister nor the railway company got involved. In 1928 the seed business W. de Zeeuw built premises opposite the auction site. Construction work began in 1929 and the loading area was put into frequent use almost immediately. In 1930, the company of Mr Bakker launched its activities, a company that would evolve to become a major player in the area. Unfortunately, things took a turn for the worse in 1930. As of 1933, growers were obliged to register and measures were introduced to boost the sector. It was mainly the 'coarse' horticulture businesses (with products such as cauliflowers) that needed to be contained. Yet making these businesses profitable once more proved challenging. The supply of fruit increased significantly and in 1934 a sorting machine was purchased, with the construction of a cold store following in 1935.

7.2.1 The emergence of a cluster

An important development in the creation of the Barendrecht-Ridderkerk Trade Centre took place when the site was connected to the rail network in 1930, as recalled above. This connection expanded the trade centre's scope and provided access to the hinterland. During the 1930s, fruit (strawberries) and cold-season vegetables (cauliflower and sprouts) were the main products sold in the area. However, these are seasonal products and in some seasons there are substantial surpluses. This applied mainly to the strawberries mentioned above, which were also made into preserves. A considerable share of the strawberries were made into jam by the firm 'De Betuwe Tiel'. This company acquired its own warehouse behind the auction in 1930. Although it is not possible to ascertain the activities performed in the warehouse, it is likely that the strawberries were processed into jam there. In any case, we can establish that production, trade and the processing industry converged at the trade centre. Here we see the first signs of a food cluster in which different companies involved in the food chain (production, trade and processing) came together spatially and probably collaborated in the chain. These developments were interrupted by the crisis years of the 1930s, which had a negative impact on the Dutch Agricultural and Horticultural sector because England and Germany closed their borders to these products. This resulted in a more restrictive government policy, with growing regulations and minimum prices. Nevertheless, the trade centre appeared to grow steadily during this period: a film from 1939 provides a fascinating insight into the ups and downs of the Barendrecht auction shortly before its 25th anniversary.[164] During the years around 1940, Barendrecht's economy was mainly focused on agriculture, with sprouts as the main product group. The auction celebrated its 25th anniversary in 1940, but the gloomy times resulted in a subdued celebration.

During the war years a lot of production was kept out of the Germans' hands, instead of being sent to Germany as a 'friendly gift' (Visser, 1995). 1950 is the year in which Bakker Barendrecht begins its collaboration with Albert Heijn, the grocer that would grow to become the largest supermarket chain in the Netherlands. Albert Heijn had just taken over its competitor Amerongen, thus acquiring an additional 92 branches.[165] The fast-growing supermarket enterprise became one of the major purchasers on the Dutch AGF market, and this fact did not escape the attention of the entrepreneurs actively involved with the auction. Albert Heijn had to make purchases to supply the shops and structurally paid an (overly) high price. To escape this price pressure, Albert Heijn signed a contract with Bakker in Barendrecht, which meant they negotiated outside the auction: the start of a long-lasting partnership that continues to this very day.

In 1953 many growers were hit by the devastating North Sea flood, which inundated fruit and vegetable growers' land with salt water. While it was drying out, there were questions to resolve related to the restoration of the land and company resources. The network of ZHE (The islands south of Rotterdam) auctions, in association with the State horticultural education department in Barendrecht, organised diverse afternoon and evening info sessions (Visser, 1995). This could be viewed as one of the first indications of regional collaboration and integration.

7.2.2 Regional integration

In 1954 the site was given fresh impetus when work began to construct a new auction building on the Gebroken Meeldijk in Barendrecht. This building still exists today and now houses the company Jabaay, a supplier of agricultural and horticultural essentials. The old building was demolished. These premises were put into use in 1955, heralding a new period of growth for the Barendrecht-Ridderkerk Trade Centre, with a modern auction building where fruit and vegetables were sold. A major innovation was brought about when the auctions in the region connected with each other for the first time to communicate prices and volumes by telephone. This led to price alignments and insight into supply and demand; it also gave rise to the first virtual trade. At the same time, the cluster continued to develop: supply services emerged that sold horticultural essentials, seeds and storage for goods and packaging material. An impression of this period can be obtained from a film from 1955.[166]

In 1956, infrastructural expansion took place around the Gebroken Meeldijk, in particular a direct link from the premises of the Pijpers and Van den Heuvel firms to the auction site. During this period, G. van Gelder was a board member of the cooperative auction. The names Van Gelder and Van den Heuvel crop up later in the trading companies. In 1958, during a special meeting of the Merchants Association, Mr Van den Heuvel puts a stop to sales outside the auction. This is interesting, because this model went on to play a key role later on in the trading concerns (especially beginning in the 1990s). A year later, Huib Bakker took the reins of the auction clock, and his name also crops up later on. These gentlemen were pivotal in the continued

expansion of the trading firms at the Barendrecht-Ridderkerk site. In 1958 the Municipality of Barendrecht presented its plans for the site's expansion. After closer inspection, little came of these plans. In the 1950s and 1960s efficiency increased in importance and more matters were organised centrally at the auction site, including sorting the products. The trading establishments around the auction site grew. From 1950 onwards, Bakker Barendrecht supplied Albert Heijn, a service that would expand to account for up to 80% of the turnover of the company, whose 700 employees processed 1,400 tons of fruit and vegetables every day.

Figure 24 Barendrecht auction sales 1927-1969. Source: Auction annual reports, Visser, 1995.

7.2.3 Growth and scaling up

In the 1960s, the Barendrecht-Ridderkerk Trade Centre enjoyed strong growth. In 1965, the fruit and vegetable auction achieved a record turnover of 65 million guilders,[167] despite the 'wet year' that limited product supplies. In 1972, the activities in Barendrecht received a boost through the fusion of regional auctions. The original Horticultural Association for 'Barendrecht and the surrounding area' held its final meeting in 1975. The auction moved to a larger building in that year and continued under the name 'Cooperative fruit and vegetable auction of Zuid Holland Zuid'. This new auction consisted of a merger of the auctions in Barendrecht, Fijnaart, Oud-Beijerland, Rotterdam, Vierpolders and Zwijndrecht. This was a nostalgic time for the Municipality of Barendrecht because its 'own' auction was closed, but the council was happy to work on the opening of the new auction, which was expected to provide a lot of jobs. The council provided a connection to the main roads and the new auction complex was completed in record time: the largest auction complex (in terms of surface area) in the Netherlands (Visser, 1995).

In 1975, the Trade Centre was established at the former auction site. Things went so well that it developed autonomously. New product groups were introduced to the market, such as citrus fruit, bananas and raw vegetables: product groups that also proved important later and that are still sold at the Trade Centre today. In 1975, the Trade Centre housed 25 wholesale businesses, with 400 to 500 employees. The mergers that had taken place so far made the auction increasingly efficient. The auction company learned from the

expertise of the staff on a daily basis and everyday activities were performed ever more quickly, also thanks to a modern computer system. Each player in the chain, from the halls to shipping, became continually better coordinated, according to the company's reports. The auction also strove to keep internal and external communication as open as possible in order to capitalise on wishes and opportunities. There was consultation with the Central Bureau for Horticulture Auctions (CBT) about market prospects, with the Horticulture Consultancy (Consulentschap door de Tuinbouw) about technical cultivation aspects, and with growers about the supply and its distribution.[168]

A second merger between 1988 and 1990 with Zeeland auctions resulted in the name 'Cooperative of the Holland-Zeeland Auction' (CHZ) and a further increase in scale. This new auction offered an even wider range of products, many of which came from the greenhouse horticulture sector. During this period auctions were more closely linked, this time with the introduction of the 'tele-auction', in which it was possible to trade at other auctions displayed on screens. Prices could now be communicated directly, which meant that price differences between auctions disappeared. In the early 1990s revenues increased significantly every year, but the tide turned in 1993: fewer products were supplied, which meant prices and revenues fell. The sector found it hard due to low prices and a bad reputation abroad. At the same time the horticulture sector in the area was under pressure. The increasing use of space for housing came at the expense of many horticulture businesses, and firms were bought out or expropriated in anticipation of the construction of the Betuwe line. There was unrest in local politics and trade unions about unemployment and job security, resulting in a period of tension between unions and employers.

The entrepreneurs' association Fresh World Barendrecht was founded in 1994, creating an organisation in which 36 businesses in and around the Trade Centre cooperated. They called themselves the ultimate AGF centre in the Netherlands, in which the CHZ also played an important role. The objective was to point out the importance of the sector for the local economy, which employed over 1,500 people. Small specialist firms and large companies complemented each other, with collaboration and consultation being paramount. Providing added value became an increasingly important aspect. AGF products were no longer simply traded, but also processed: vegetables were cut and packed for the retail and catering and hospitality sectors, and fruit was processed into salads and juices. There was continuous product innovation and the sector tried introducing new products to consumers on national and international markets.

At the same time, it was during this period that the first suggestions were mooted about merging the Dutch auctions. In 1993, the CBT suggested a plan to concentrate all 22 fruit and vegetable auctions, but the time was not yet ripe for it and the plans were diluted. Nonetheless, progress continued. The five fruit and vegetable auctions in Zuidwest Nederland, including the CHZ auction in Barendrecht, launched a study into the possibilities of an auction

association. This moved the merger of the auctions one step closer. In 1994, a cooperation partnership was agreed and the merger was announced. This was a necessary step, because the auction's turnover decreased considerably between 1991 and 1995 and hardly any profit was made. In 1995, the merger was prepared and the CHZ's economic situation improved slightly: it made a profit and turnover increased. In the first half of 1996 a majority of members of the CHZ voted for the merger, but the required two-thirds majority was not reached. During a re-vote in the autumn the required two-thirds majority was achieved, because the members did not want to be left behind as a relatively small auction after the announced merger. In October 1996, the nine auctions comprising Westland (Poeldijk), De Kring (Bleiswijk), Veldhoven, VON (Bemmel), KZIJ (IJsselmuiden), RBT (Breda), CHZ (Barendrecht), Zundert and Utrecht merged to form the Verenigde Tuinbouwveilingen Nederland (United Horticultural Auction Netherlands), and thus the firm The Greenery International (see inset on The Greenery). Three large auctions remained in the region: Barendrecht, De Lier and Bleiswijk. Barendrecht became the headquarters. The aim of the merger was to be able to cope with the growing power of retailers that had scaled up to an ever greater extent and united in purchasing collectives (such as Superunie). However, scaling up is nothing new: in 1970, there were 88 horticulture auctions in the Netherlands; following this merger, there were ten. Moreover, the relationship between growers and The Greenery was put to the test by failed price agreements with ZON (the Limburg auction). The auction attempted to alleviate this unrest by providing information to the growers. Relations between the Municipality of Barendrecht and the auction complex also hardened in relation to land negotiations. In 1997, the Chairman of the Board of Directors of The Greenery International, Mr Van der Mee, wrote: 'We realised that beginning a new enterprise based on the merger between ten existing organisations would be a huge task. And we should not beat around the bush: it was an even greater challenge than we had anticipated.' [169]

The turnover of businesses in Barendrecht-Ridderkerk Trade Centre increased during the 1990s, together with the number of trading establishments. There were more and more trading establishments that mainly conducted business outside the auction clock, and many businesses invested in their national and international networks.

The high-profile company The Greenery is ready for the future

The Greenery was (partly) created in response to the scale increase on the demand side (from retailers), increasing international competition in the market, the growing desire to do business directly – outside the auction clock – and the increasing importance of a long-lasting relationship between major customers and large suppliers. However, the cooperative is also the only shareholder in a new constellation (known as Coöperatie Coforta U.A. since 2010). During the years following its establishment, The Greenery has focused on strengthening its position through the purchase of trading establishments such as Hagé in order to expand and to shift away from 'the old sales method via the auction clock to a sales and marketing organisation'.[170] *However, it continues to be a large company with an unusual set-up. The growers are at once the owners and the suppliers of The Greenery, which means*

that the growers' short-term interests – a good price for their products – conflict with the long-term interests of the same growers as owners of The Greenery: a profitable company that benefits from competitive purchase prices. Therefore, it has not always been easy to manage the company in times of increasing competitiveness within the AGF sector and the growing power of retailers. The Greenery suffered considerably during the crisis and the company's management came under pressure. The strategy for 2014-2018 included a major reorganisation to make the trading firm more profitable, in which over 400 jobs would be scrapped.[171] *The reorganisation is a clear wake-up call for both the company and the owners. It is a reminder that the transition that has been adopted must be continued in order to safeguard the company's future. The Greenery is also selling its sites including (outdated) property to real estate investor WDP, which will build new, state-of-the-art company premises for The Greenery in Barendrecht. Income from the property deal, the construction of new facilities and the reorganisation will mean that The Greenery can once more look to the future. The firm serves large customers (including Jumbo) and is now profitable again.*

7.2.4 Internationalisation and spatial pressure

Between 1996 and 2000 the horticulture sector experienced a shake-out. Small businesses found it hard to keep up during a period of continued scale increases and consolidation. There was also considerable pressure on the use of space, in which the sector often had to make room for housing and the development of nature. A Greenhouse Horticulture steering group was set up to manage the sector's spatial usage, and sustainability increased in importance: every year The Greenery maps out its impact on the environment in a sustainability report. The sector does demonstrate innovation: one interesting example from this period is the link made by the firm Renes Afvalverwerking by generating biofuel from fruit and vegetable waste.

During the first decade of the new millennium, the (large) trading houses expanded their product range significantly, as did The Greenery. It was also becoming increasingly common for these players in the Barendrecht-Ridderkerk Trade Centre to sign long-term contracts with retailers outside the auction clock. Since the 1990s, the AGF sector has become more and more international and at times even global; companies at the trade centre also operate at the international and global level. This became especially apparent in 2014.

In the aftermath of the conflict in Ukraine in 2014 and Malaysia Airlines flight MH17 being shot down, multiple countries issued a boycott on products from Russia. The Netherlands was one of the countries that supported the boycott, because many Dutch people were killed in the MH17 crash. In response to the boycott, in August 2014 Russia decided to stop imports of fruit and vegetables from European countries, including from the Netherlands. Russia was a huge market for the Dutch AGF sector – according to estimates, Dutch AGF companies' exports to Russia equated to €184 million a year. However, the direct impact on exports was not the only problem the sector had to cope with. The Russian boycott immediately resulted in a surplus on the European market and a corresponding fall in prices, because the products concerned

were fresh products that could not be stored while the company looked for a new customer. Another factor was that other countries in the EU were also highly dependent on the Russian market: Russia was Poland's largest market. This caused Polish companies to focus on other sales markets, including Germany, which meant that Dutch businesses were hit hard.[172] The direct impact was lower: total exports of agricultural products to Russia equalled €1.5 billion. Fruit and vegetables accounted for less than 2% of that figure, although it was the sector's main non-EU market after the US. In 2013, a total of 8.5% of vegetables intended for countries outside the EU were exported to Russia; the percentage for fruit and nuts in the same year was 15.8%. The crisis also had consequences for businesses in the Barendrecht-Ridderkerk Trade Centre. Diverse companies that had a strong position on the Russian market suffered badly as a result of the boycott. These entrepreneurs immediately stepped up their efforts to serve other markets and (partly) compensate for the loss of income. Most affected companies succeeded in doing so within a few months. One example is the Barendrecht firm Hillfresh, which exported peaches to Russia until 2014. When the Russian market closed, the businesses succeeded in ensuring that their wild peaches, with which the Dutch consumer was relatively unfamiliar, were given space on Dutch supermarket shelves. The Dutch public embraced the fruit and these peaches are now sold all over the Netherlands.[173]

The flexibility of AGF businesses could not avoid the boycott resulting in unpaid invoices in Russia no longer being honoured, outstanding credit expiring and amounts that were settled being worth less in euros due to the seriously devalued rouble. The former research institute LEI (now Wageningen Economic Research – WER) at Wageningen University calculated that the damage to the fruit and vegetable sector in 2014 amounted to €440 million. Later, exports were shown to have decreased in value by 25%. However, according to WER, Dutch fruit and vegetable businesses subsequently succeeded in raising the export value, despite the Russian boycott. The explanation for this increase lies in lower production, good prices and more exports to other EU countries and especially to markets outside the EU (such as Brazil, Turkey, Africa and Asia). In 2014 a headline in Het Financieele Dagblad announced that the boycott had predominantly forced people to reflect on agriculture and horticulture. The article discussed the possibility of exporting technology instead of produce. In the article, researchers at WER proposed that technological intensity leads to overcapacity and surpluses on the markets, and that a clean-up was required. Therefore the Russian crisis may have been a healthy wake-up call for the sector, and also for companies in the Barendrecht-Ridderkerk Trade Centre.

The geopolitical developments thus had a serious impact on businesses in the cluster, but at the same time the cluster was able to hold its own by responding to new opportunities in an adaptive manner at both the national and the international level. However, this was not straightforward: After 2014, Barendrecht businesses found a new trading partner in Greece, but the Greek debt crisis ultimately resulted in yet more payment issues and a number of

businesses in the cluster had to deal with yet another setback.[174] The cluster is closely linked to the global economy for imports of products, its own foreign production locations and export markets. Companies in the cluster will also have to effectively monitor international geopolitical and economic dynamics.

In 2016, 101 years after the foundation of the first auction cooperative in Barendrecht, The Greenery ended physical auctions in Barendrecht. Trade was already largely conducted through the Internet, although a few traders still physically met in Barendrecht in 2016. With the construction of new business premises there was no longer space for physical trade. The Greenery's new premises and the end of physical auctions are consistent with developments in recent years. Trade is international and digitised. The auction no longer constituted a reason for spatial concentration, though the cluster that has emerged did. In 2015, a total of 234 companies were based at the site, of which 44% were directly or indirectly active in the food industry. These businesses provided 54% of jobs in the area. The Trade Centre had expanded considerably in the preceding period: between 1999 and 2014 the trade volume increased by 74%. Employment in AGF wholesale firms also grew in this period by a similar percentage. Companies in the area were specialised: of the 25 largest companies, 11 focused on general trade while the other 14 opted for a more specific strategy in terms of cost leadership, service provision, specialist products and services.[175] A trade cluster was created, comprising businesses that anticipated, kept up with and responded to dynamics in the market. The cluster demonstrated that it is resilient in difficult circumstances and it can rely on a rich tradition. Many of the companies at the Trade Centre emerged, either directly or indirectly, because the auction was located there. These are family-run businesses and spin-offs of original Barendrecht businesses such as the Van den Heuvel, Bakker, Van Gelder (see inset on Van Gelder) and Kraaijeveld families. The Kraaijeveld and Van Gelder companies were founded from (the purchase of) greengrocers, but expanded to become mature trading companies. However, Kraaijeveld moved to Maasland at the end of 2014, while Van Oers, another major player, built new premises in Dinteloord for a number of its activities.[176]

The headquarters are still located at the Barendrecht-Ridderkerk Trade Centre. The Van den Heuvel family is also still operating in the area (Hillfresh, Olympic Food). Coolfresh is another example of a typical Barendrecht business, founded in 1957 during the heyday of the Barendrecht auction.

The Barendrecht-Ridderkerk border is definitely home to a cluster. There is a specialist pool of labour that is based in the region. Businesses stay in the region, partly due to the available labour potential and ties with current staff. There is still a joint intermediary agency where staff can be exchanged, and there is considerable labour mobility between the businesses. This labour potential may form a possible obstacle, as many companies are introducing automation for routine jobs. There are also intensive networks in which businesses collaborate. Each business has its own specific specialisation in the cluster. They serve multiple product groups, but are all stronger in

one of the product groups than their friendly competitors in the cluster. Collaboration based on history and trust makes the cluster strong. There are parties that specifically specialise in selling overstock from the big players or supplementing shortages among the big players ('the gap fillers'). It is a 'live and let live' system. Indeed, tomorrow a company may well have overstock or cannot fulfil an order, meaning that it requires the help of its friendly competitors. Another characteristic of the cluster involves collaborating in specialist services. Logistic flows are combined, in which purchases are transported from several parties elsewhere to Barendrecht-Ridderkerk in a single lorry, or the products from several parties depart in the same lorry to diverse customers. The colocation of these businesses pays off in lower transport costs. We also find business services in the region: not only agrifood businesses, but also specialist (highly-skilled) services. One example is 'GreenLegal', a legal consultancy firm focused specifically on the agricluster. This shows that this is an international trade cluster of national significance.

The Van Gelder family-run business: successful enterprise in the AGF sector

The Van Gelder family-run business has grown to become one of the leading companies in the AGF cluster on the Barendrecht and Ridderkerk border. Leen van Gelder founded the company. Following a brief stay in Canada, he and his wife returned to the country of his birth. He started out as a self-employed grower in 1953 and built the company up to be a solid wholesaler. Later, he also opened shops: the first in Rotterdam (1972), and the second (1975) and third (1985) in Ridderkerk. To this very day Van Gelder still has a shop in the fresh produce market in the centre of Ridderkerk, which opened in the early 1990s. The wholesale business and the production firm grew rapidly throughout the 1990s: in 2002, new premises were acquired at Verenambacht in Ridderkerk, which had to be expanded with logistics facilities comprising nine docks in 2008. The business continued to grow at a fast pace and by 2017 it had once more outgrown its premises.

Van Gelder has evolved to become a modern fruit and vegetable wholesaler with a sold market position. The company invested in product development, mechanisation, automation, e-commerce (e-marketing) and logistics. The assortment consists of unprocessed, ready-made and cooked potatoes, fruit and vegetables, salads and meals. The firm has more than 5,000 products in stock that usually come fresh from the source, and it supplies many large companies in the catering, healthcare and hospitality sectors. Examples include Hilton Hotels & Resorts, Landal Greenparks, TU Delft, the Reinier de Graaf Group and Sodexho. The common theme in the company's development is the entrepreneurial spirit of the Van Gelder family that continuously looks to the future. Van Gelder benefits from national coverage for all its target groups due to takeovers: AGF specialist businesses, wholesalers, caterers, industrial kitchens, the institutional market and catering and the hospitality sector.[177] *The company works closely with the international food service firm Bidfood (previously Deli XL). Van Gelder has also built up a network of growers throughout the Netherlands and the company has invested internationally in a network of suppliers.*

Van Gelder is the first company to move to the Nieuw-Reijerwaard Food Centre, returning to the place 'where it all began in the early 1950s'. The first stone has already been laid of the hyper-modern company premises that will span 30,000 m² (including a 15,000 m²preparation kitchen), which should ensure that the business can continue to grow in

the future. The warehouse will be automated to the fullest extent: a shuttle system will be installed, which is unique in the food sector. There will be 35 production lines, a high-care kitchen, a hot kitchen and a packaging department. Van Gelder is clearly responding to the trend of scaling-up, automation and mechanisation in the AGF sector. The most striking component of the new construction plans is the 'Experience Centre' that revolves around healthy food and the consumer's experience of it. Director Gerrit van Gelder formulates it as follows: 'Guests, customers, pupils and authorities can have a guided tour and there is space for an exhibition and a display. A vegetable greenhouse in bloom covering 1,600 m² on the roof and the total experience in the Experience Centre will soon be a definite eye-catcher for the company. From this location we can further expand our story about healthy food. Seed-breeders, growers and breeders can lease their own space for merchandising and farm-to-fork stories.'[178] *The company expects to be able to move into the new facilities in 2019.*

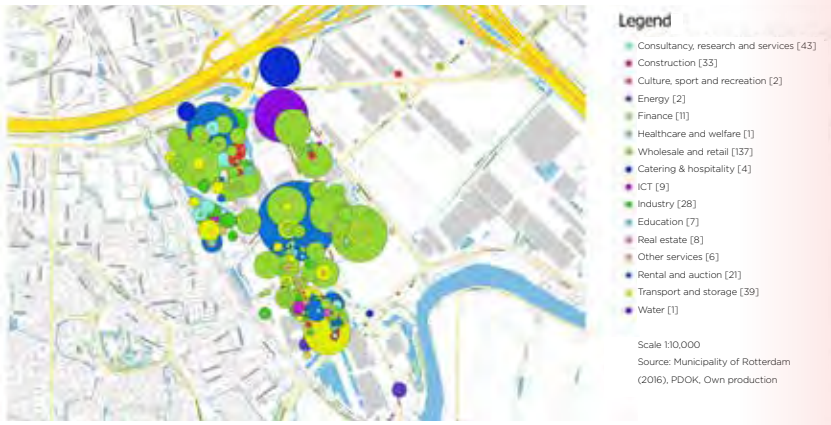

Figure 25 Activities by company size in number of employees at the Barendrecht-Ridderkerk Trade Centre 2016. Source: Municipality of Rotterdam/PDOK/own production

Nevertheless, there are also challenges. The location is the victim of its own success. The layout and access to the existing sites no longer comply with the requirements for international fresh produce logistics: more far-reaching containerisation, increased sustainability and responsiveness from retail.[179] Consequently a dual issue arises: at the property level, some businesses have a serious shortage of space and are partially or completely pulling out, and at the regional level the cluster's appeal is waning. As a result of the lack of space at the level of premises/sites (as well as congestion), companies such as Staay, Kraaijeveld and Van Oers have either partially left or moved away completely.[180] Various companies (including Bakker Barendrecht) have indicated that they are approaching their capacity limits.

7.3 Space for the cluster: the development of Nieuw Reijerwaard

Entrepreneurs attempted to put the issue of more space for the cluster on the administrative agenda as long ago as the beginning of the millennium. The existing area barely has room for any further expansion. The interests of the cluster were defended by Freshworld (now VBO Freshworld), of which most AGF businesses were members. During these years, there was huge demand from the sector for space to expand. In 2005, the RR2020 regional plan

was established by the Province. This plan makes it clear that Reijerwaard – located between the Trade Centre and the A15 – and Hoeksche Waard are options for developing new business parks. Entrepreneurs in the cluster supported Reijerwaard at the national and provincial level. The regional plan provided AGF entrepreneurs with a boost to their lobbying for more space close to the cluster. Freshworld and a number of leading companies from the area engaged in dialogue with administrators and launched various plans to expand the cluster.

During the first months of 2008, the Council of Ministers decided that large-scale developments in Hoeksche Waard were not possible for the time being and that Reijerwaard and WDO were the priorities in Dordrecht. This meant that businesses from the cluster were referred to Reijerwaard for expansion, near the trade cluster located on Ridderkerk territory. Finally lobbyer Freshworld designed a phased redevelopment plan in which the new business park would be systematically developed, including a green strip to compensate residents and taking the environment into account. The Municipality of Barendrecht was positive, but the Municipality of Ridderkerk was less enthusiastic because the plans were met with local opposition. In the end Stadsregio Rotterdam compiled a business case for 'Nieuw Reijerwaard'. After a long period of pressure and lobbying from VBO Freshworld and the large companies in the area, additional space was obtained for expansion – a considerable area between the Trade Centre and the motorway. The Municipality of Ridderkerk agreed to this, and a contract was signed by the three partners (Barendrecht, Ridderkerk and Rotterdam) just before the elections in March 2010. In 2012, a Common Regulation entered into force in which these municipalities collaborated to redevelop the area and create a large, 96-hectare business park, with the corresponding access and greenery.[181] Until 2012, the area was used for agriculture and greenhouse horticulture and was intended to make space for activities in food-related sectors.

The risks of the regional development were equally distributed between the three parties. However, for Barendrecht and Ridderkerk the project involved a much higher investment and greater potential risk (in relative terms, compared with the municipal budget) than for Rotterdam. This was also demonstrated in the dissent uttered by the smaller municipalities, which mainly emerged from Ridderkerk after local elections in 2010. Ridderkerk wanted to withdraw from the plan, but the Province did not agree: if Ridderkerk did not cooperate, the intended site would become Barendrecht territory. Following a brief debate, Ridderkerk did a U-turn and agreed to cooperate. New local elections in 2014 and 2018 revealed that some of the inhabitants of Barendrecht were also concerned about the project and the considerable risks involved, but the Municipality of Barendrecht was no longer able to withdraw from the project either. In 2015, the Council of State established that the first phase of the plan was irrevocable and thus had to be implemented regardless of any objections. Some companies thought the development of Nieuw Reijerwaard was progressing too slowly, and partly for this reason they left the area or did not opt for Barendrecht-Ridderkerk

(including Natures Pride). Entrepreneurs were also not convinced that access to the area would be adequate, given the plans.[182]

It was not only the political developments in Barendrecht and Ridderkerk that played a role in the delayed development of Nieuw Reijerwaard. After 2010, the financial crisis also made a significant contribution. The large demand for space for expansion petered out during the crisis and some companies looking for space found premises elsewhere (including in Westland). Large-scale regional development was in dire straits throughout the Netherlands as a whole, and Nieuw Reijerwaard was no exception. The situation has now changed: the economy is growing again, AGF business are profiting as a result, and the first stone has been laid in Nieuw Reijerwaard by the firm Van Gelder fruit & vegetables. This major player will move to Nieuw Reijerwaard in 2019 and vacate its current premises on Handelsweg. During the past year, interest in the plots in the area has grown dramatically. There is apparently serious interest in or options have been taken on plots for two-thirds of the area. This makes infrastructural concerns related to the area's accessibility more urgent. The way in which Nieuw Reijerwaard is developing will become clear in the coming years, but the situation is considerably more favourable than it was a couple of years ago. Many businesses in the area are positive about the future of the internationally-oriented cluster that still has its roots planted firmly in the region.

Image 4 Nieuw Reijerwaard planning area. Source: http://www.nieuwreijerwaard.eu/www/Projectinfo/Kaart+van+het+gebied/

8 Innovation in arable farming on the ZHE (Zuid Holland islands): sector under pressure from competition and scaling-up

8.1. Introduction

When we talk about the food cluster in the Rotterdam region, several locations spring to mind. These include the large horticulture area in Westland, but the Trade Centre on the border between Barendrecht and Ridderkerk is also of international significance. The industrial complex in the port is also home to major flows of food, such as in the grain and fruit ports. In addition, a great deal of digital trade is conducted by large commodity traders in the city of Rotterdam. Relatively little attention is devoted to the islands below Rotterdam. However, the ZHE (Zuid Holland Islands) also provide an impressive acreage occupied by food companies: examples include large companies such as 'Farm Frites', 'FrieslandCampina' and 'Mars', supplemented by the arable farming sector where the Netherlands' largest cooperative of potato growers, Nedato, is located. This requires closer inspection: how did food-related activities emerge here, what is their significance and how resilient are these activities under pressure from external influences?

8.2 The history of 'De Eilanden'

The ZHE (The islands south of Rotterdam) cover a diverse area to the south of Rotterdam in the Province of Zuid Holland. Part of the Province of Zuid Holland historically consisted of islands and lakes, namely the areas of IJsselmonde, Voorne, Putten, Hoeksche Waard, Rozenburg, Goeree, Overflakkee, Tiengemeten and the Eiland van Dordrecht. These islands were separated from the mainland by various branches of the Rhine and Maas, and thus form part of the Zeeland-Zuid Holland delta. The area was created as a result of the interaction between humans and water: many of these areas were reclaimed and managed from the thirteenth century onwards, but were regularly flooded due to the dike being compromised. One of the most drastic events was the St Elisabeth flood during the night between 18 and 19 November 1421. Details about this episode of flooding are scarce and originate from lore, but the impact appears to have been significant. During this night, 72 villages are said to have disappeared and an estimated 2,000 people were killed. Much of the agricultural land was covered in salt water and became unusable. It would take almost a century before river deposits made the ground productive once more. The economic primacy shifted to trade by river and sea. Along with the landscape, the trading position of various locations in the area was changed by this flood; the position of the city of Dordrecht in particular lost its power over time due to channels silting up. An increase in agriculture finally emerged as a result. The dynamics of trade and agriculture characterised the area in medieval times: the cities traded and the delta offered access to the sea and diverse trading partners.

Image 5 The Zuid Holland islands circa 1300.[183]

In 2017 only Tiengemeten remained a traditional island, in the sense that it is not connected to the mainland and can only be reached by ferry. The other islands are connected to the mainland by multiple bridges, tunnels and dams. However, the area is still referred to as the Zuid Holland islands and in the past was also known as Overmase (because it was below the Maas in relation to the city of Rotterdam).

8.2.1 From mixed farming businesses to specialist arable farming

The agricultural function on the islands was the most important by far until the late twentieth century. In 1849, 43% of the Dutch population worked in agriculture. During this period, the percentage of farmland was high by current standards, even in urbanised areas. Many of the farmers' businesses had a mixed character: they kept livestock for consumption and dairy, as well as performing arable farming and horticulture activities to grow diverse crops, mainly for direct consumption and to sell at the local market. The good soil conditions in the fertile delta offered lots of opportunities for agricultural businesses: the heavy clay is particularly suited to growing potatoes and grain. The businesses slowly began to diversify towards arable farming, and other products became available through trade. Most of these businesses specialised, mainly in growing grain and potatoes. However, it is precisely this trade that would later put margins under pressure. Imports of grain from North America increased. North American agriculture is much cheaper, due to the high economies of scale, and this led to a serious decline in purchasing power for Dutch farmers. Consequently, the farming profession became less appealing. During the same period we see industrialisation, which means a lot of the jobs on the farm could increasingly be performed by machines. This resulted in major migration flows to the city from the countryside at the end of the nineteenth century. The cities were booming, but the farm became more labour extensive. The First World War had a relatively mild effect on the neutral Netherlands. Products from the Netherlands were sold

in neighbouring countries plagued by shortages. The interwar period that followed was a 20-year crisis in agriculture, predominantly caused by the lag in productivity growth compared with the rest of the economy.

The Second World War hit the Netherlands hard, especially in and around Rotterdam. Dutch trade was severely isolated due to the strict regime, which made specialisation unfavourable. Among other effects, this led to the Dutch Famine of 1944 in Rotterdam. The pain would be felt for a long time: the war and the halt in trade also resulted in a lack of parts needed to maintain tools and machines. These implements ended up in bad condition at the end of the war, a situation that was not repaired until 1950. However, this also had an upside: it produced a high demand for labour. The shortage of machines meant more labour-intensive farming, along with a demand for labour for industry to restore the machinery. The many repairs led to high demand for labour and wages rose in the countryside. The sector recovered and specialisation continued: whereas in the past farmers had been arable farmers as well as livestock farmers in a mixed business, they increasingly specialised and their businesses increased in scale. In 1960, the number of jobs in the agricultural sector amounted to 9,600, of which 7,720 were in Goeree-Overflakkee and Hoeksche Waard. In these two areas this accounted for as much as 33.4% of total employment, compared with 14.5% in the whole of the southern part of Zuid Holland. The sector was also under pressure from industrialisation, housing construction and nature management.

Figure 26 Expansion of the Rotterdam Ports in the ZHE (1400-2008).[184]

Zuid Holland is a Randstad province, and as such had to cope with structural changes in the economy in which agriculture played a less and less prominent role in the economic order. Agriculture was under constant pressure in both the twentieth and twenty-first centuries from urbanisation and the expanding port industry. During the 1960s, two plans were discussed for this industrial expansion, in which a possible spread of 'suburban activities' to Noord Brabant was considered. The Rotterdam area and arable farming there were not spared in the expansion of the port industry. As with horticulture

in Westland, the islands were under pressure from the encroaching city and industry. Agricultural areas made room for the construction of housing and industry. Growers in Westland were mainly under pressure from increasing residential expansion out towards Hoeksche Waard or Voorne-Putten. On the islands of Rozenburg and IJsselmonde pressure was predominantly felt from the port industrial complex, with the developments of the Petroleum Ports, Waalhaven, Botlek and Eemhaven, Europoort and Maasvlakte I and II. In the late twentieth century, the sector was subjected to a new pressure: an increased focus on nature management.
In 2008, the Province of Zuid Holland introduced plans to re-flood the reclaimed Zuiderdiep polders on Goeree-Overflakkee. As stated by director De Bruijne of Farm Frites (Voorne-Putten) in 2008, it is difficult to maintain an agricultural area with the encroaching nature and major urbanisation in the province. On one of the islands the farm completely disappeared under pressure from the focus on nature management: the small island of Tiengemeten (see inset on Tiengemeten). Other islands were transformed, too. The island of Rozenburg, a former agrarian landscape, was absorbed by the port industrial complex of the city of Rotterdam (see inset on Rozenburg).

Tiengemeten

The island of Tiengemeten increasingly grew in size due to land reclamation between 1750 and 1860, to over 1,000 hectares of land, of which 700 were used for agriculture. Until 1903, the island was owned by Baron van Brienen, famous for the Van Brienenoordbrug, who was the last sole owner. The Van Brienen family occupied the island until 1967, when it was sold to Volker Stevin and subsequently to the insurer Fortis AMEV in 1987. The island was ultimately bought by the Province of Zuid Holland in 1996 in association with the Ministry of Agriculture, Nature Management and Fisheries and Rijkswaterstaat for 30 million guilders. Arable farmers had to move, since plans had been drafted to open the island up to nature. The transformation of the agricultural island into a nature island ultimately took place in 2006, when all agriculture had disappeared from the island.

Rozenburg

While Rozenburg was previously an agricultural area, with large, modern businesses, as of the 1950s it changed to accommodate industry. The first farmer sold his land to the Municipality of Rotterdam in 1950, with more farmers following suit over the next few years due to the construction of Maasvlakte, Europoort and Botlek. The island once comprised 4,000 hectares, of which the village still occupied 250 hectares in 1999. The remaining land was raised and populated by industry or deepened and developed to create a watercourse. The remaining farmers on Rozenburg were compensated with farms on Voorne-Putten. In 2010, Rozenburg became part of the Municipality of Rotterdam, and the agricultural sector is no longer part of the landscape. Rozenburg is now a place primarily occupied by the port industrial complex. The transformation is clearly visible in the following pictures, where the same dike is shown again almost a century later.

Image 6 Rozenburg: The inner dike, 'Present' (2010) and 'Past' (1926).[185]

8.3 Collaboration and cluster formation

The cooperation partnerships between the farmers and the authorities are important, if not crucial, for the retention and innovation of the agricultural sector on the islands. This was already evident at the beginning of the nineteenth century, when fertiliser was jointly purchased by farmers to obtain a lower price, since prices were much higher for an individual farmer, who had less negotiating power. An important intermediary and spokesperson for the sector on the islands was LTO Noord (Agriculture and Horticulture Organisation for the North). This was created from several mergers of Westelijke LTO (WLTO), Gewestelijke LTO en Noordelijke LTO in 2005. With 500 members, in 1992 Hoeksche Waard was the WLTO's largest work area.

The WLTO itself is a product of the Hollandsche Maatschappij van Landbouw (Holland Society for Agriculture) (HMvL, founded in 1847) and the Catholic Association. The organisation defends the interests of agricultural firms, with the organisation mainly acting as a representative with regard to plans for regional classifications. In 1997, Chairman Roth advocated for the retention of agricultural land at Hoeksche Waard. The same happened in 2003 related to the regional classification on Voorne-Putten. Yet these pleas were in vain: in the period leading up to 2010, the land available for farming decreased by 1,000 hectares, followed by another 1,175 hectares in the ten years afterwards. The WLTO acknowledged that farming needs related activities and businesses so that agricultural activities can expand. In 2010, LTO Noord asked the Province to stop purchasing agricultural land, whereby for example in the Buytenland Plan 600 hectares of agricultural land in Rhoon, on the island of IJsselmonde (see inset on IJsselmonde), would be converted to a nature area.

IJsselmonde

The former island of IJsselmonde covers the current districts of Charlois, Hoogvliet and Pernis in Rotterdam; Hendrik Ido Ambacht, Ridderkerk, Barendrecht, Zwijndrecht, Rhoon and Poortugaal are also situated on the island (not to be confused with the district of IJsselmonde, part of the Municipality of Rotterdam). Pernis, one of the oldest villages on IJsselmonde, was known for its strawberries, and was home to a lot of horticulture and arable farming. However, in 1929, the first petroleum port was constructed, which meant that nature disappeared from the landscape. Businesses, mainly operating in the port industry, settled in the dike villages. This activity was facilitated thanks to the Maas bridges, Barendrecht bridge, Spijkenisse bridge and the tram connections. In 1996, the IJsselmonde region was home to many small-scale growers involved in mixed farming. The growers were

afraid they would have to succumb to The Greenery in Barendrecht, which was extremely powerful. Partly due to the creation of the second Maasvlakte, half the farmers wanted to cease their business activities in Midden-IJsselmonde, since 750 hectares had been planned there for nature to compensate for the port industry. At the time, the island was dynamically divided, with the area being semi-urbanised and partly featuring creeks and dikes. Recreation in particular (mainly at Oude Maas) took place in the south of IJsselmonde. IJsselmonde-Oost, where greenhouse horticulture firms were operating, is also known as the Deltapoort. Scaling-up was no longer possible here because of spatial limitations, and modernisation was lagging behind partly due to this situation. Greenhouse horticulture had limited resources for continued development in Oost-IJsselmonde. The vision for the area mainly focused on creating better options for recreation and retaining existing greenhouse horticulture.

Since the beginning of this century, a Rijnmond lobby has been working in European politics. The lobby strives to obtain funds for sustainable agriculture around the urban area. Businesses at Voorne-Putten as well as in Hoeksche Waard are part of an experiment for new European agricultural policy which studies the role of nature in farming businesses. For example, strips of field flowers are created around the farm, to promote the combination of nature and farming. In addition, Hoeksche Waard, Voorne-Putten and Goeree-Overflakkee have been designated as LEADER areas. These are areas subsidised by the European Union in the context of a programme of rural development, in which specific attention is devoted to regional socio-economic innovation.

In 2002, a pilot business was established on the Voorne-Putten island for precision farming, where modern techniques take into account soil conditions. Voorne-Putten can be considered as the Dutch birthplace of precision farming: as early as 1997, A. van Bergeijk, an entrepreneur on the island of Voorne-Putten, was the first Dutch farmer to be involved in precision farming.

'The Van Bergeijk arable farming and contracting business was the pioneer of precision farming in the 1990s. It systematically applied this method as of 1995. Step one consisted of mapping out the substrate. A grid measuring 50 metres by 50 metres was used to determine the thickness of the clay layer and peat subsoil, as well as the weight of the clay, for three-quarters of the farm. The next step involved further refinement of this soil map by fitting the plough with a traction sensor. This delivered very precise data of the plots about the distribution of the clay's weight,' explains Marc [van Bergeijk]. 'We adapted the nitrogen fertiliser accordingly. The heavier soil supplies better nitrogen; the lighter clay needs more fertiliser. We already had GPS on the plough in 1996 to be able to produce the traction maps.'

However, this also reveals that the Netherlands was losing its competitiveness during this period. Fully 80% of farmers on the large-scale farms in the North American Midwest were already using GPS technology for precision farming at the end of the 1990s, when the first pioneers in the Netherlands were just starting to use GPS on their farms. In 1997, Van Bergeijk senior looked to the future and envisaged fully-automated farming in which robotisation,

precision farming and more accurate GPS technology led to farming 'down to the square centimetre'. We know that it has not yet advanced that far, but automation does have a major impact on the farm. A robot may still be far off, but the fact that agricultural machinery retains a lot of data and can function autonomously is obvious. In any case, Van Bergeijk's current generation will only invest in smart farming when it actually pays off, although they do closely follow other innovators such as Novifarm (of which more later).

In 2006, a project was launched in which 39 arable farmers on the ZHE (The islands south of Rotterdam) worked together in the Bergo cooperative to establish the Rotterdam bioethanol factory (BER). The Cooperative Southern Sales and Purchasing Association (CZAV) worked with arable farmers to set up the factory at Botlek. In the strategic study conducted in 2015, the Province of Zuid Holland indicated that it wanted to support agricultural entrepreneurship in the province, on the condition that sustainability play a key role in developments related to scale increases and intensification. According to the accompanying ambition document: 'Making the agricultural chain and food chain more sustainable through a sustainable innovative approach for healthy, sustainable and affordable food for all', in which €7 million of European funding (the LEADER 3 programme) will be invested in innovation.

Voorne-Putten

The Voorne-Putten area has traditionally focused on agriculture and livestock farming, which continued up to and including the first half of the twentieth century. The construction of the Spijkenisse bridge in 1902, with an RET tramline, provided improved access to the mainland and a trade boom. As a consequence of the disastrous flooding in 1953, the Haringvliet dam was completed in 1971 as part of the Delta Plan, ensuring that Haringvliet was sealed off and creating a permanent connection to Goeree-Overflakkee. During the period 1967-1979, a large-scale re-parcelling process took place on the island of Voorne-Putten, where small, spread-out plots were merged and the island as a whole was transformed. This was in response to the growing concern of farmers that they would face the same situation as Rozenburg, where farmland was sacrificed for industry. The re-parcelling resulted in a huge scaling-up of agriculture as well as horticulture. However, just three percent of people in Voorne-Putten worked in agriculture in 2002, compared with the vast majority a century before. During the 1960s, there were around 60 chicken farms with 110,000 animals, almost all of which had disappeared by 2002. Voorne-Putten is the southernmost outlet of the 'glass axis', with 866 hectares of horticultural land in 2002. Voorne-Putten currently consists of the Municipalities of Nissewaard (Spijkenisse and Bernisse before 2015), Hellevoetsluis, Brielle and Westvoorne. According to figures from the CBS, these amounted to 6.9% of cultivation ground in Zuid Holland in 2000, compared with 7.1% in 2016. A report by the WLTO on the opportunities for rural renewal on Voorne-Putten recommended stimulating agritourism and appointing an area broker to consult with the different players and explore the possibilities. In 2004, the area broker disappeared and the role was taken over by the Association for Rural Renewal, which would support farmers on Voorne-Putten in, for example, performing secondary activities such as agritourism. In 2003, Voorne-Putten was also under pressure from encroaching new-build projects, road construction and new nature

projects. This made it impossible to expand arable farming, as in the case of the Poldevaart family who focused primarily on modernising activities and creating recreational options. Cooperation partnerships played a major role in this endeavour, as with 20 farmers on Voorne-Putten who have tried to reduce the distance to the consumer as much as possible. They sell vegetable packages directly to the customer, so that consumers know where their vegetables come from.

Van Peperstraten Group is one of the remaining arable farmers based on Goeree-Overflakkee (see inset on Goeree-Overflakkee). This business is a sustainable initiative launched on the basis of historic farming activities. This family-run business has mediated for five generations between sellers and buyers of agricultural land and parcels. In 2014, it launched a project focused on sustainable fuel stations, in which farming, technology and innovation come together to generate energy using natural resources without any harmful waste substances. The family-run firm strives to be CO_2 neutral in its arable farming business. It is one example of a company that was created from the agricultural cluster but developed new innovative activities to invest sustainably in the future.

Goeree-Overflakkee

Until 1751, Goeree-Overflakkee was two islands: Goeree and Overflakkee. Then the Staten dam was constructed and the islands were connected. The St Elisabeth flood of 1421 also played a major role in the land reclamation process on these two islands, which created the polders. Since this reclamation resulted in the watercourses becoming ever narrower, people opted to dig out port channels to obtain decent access to the open water from the ports. During the twentieth century, the small ports predominantly shipped agricultural produce (Stellendam, Middelharnis, Goedereede-Havenhoofd and Ouddorp). However, over the years, the ports lost their commercial traffic and acquired a recreational function.

In 1994, the municipalities of Goedereede, Middelharnis and Dirksland indicated they wanted to join the Province of Zeeland, since Zeeland was apparently more focused on the countryside. The urban province of Rotterdam indicated it did not want to include Goeree-Overflakkee in its borders, which made the municipalities feel marginalised. The Municipality of Oostflakkee announced it would be pleased to remain in Zuid Holland, but ultimately it did not, and in 2003 the freshwater supply was improved for the quality of agriculture and drinking water. Dozens of farmers would need to relocate for the new facility.

In 2007, the plans to re-flood reclaimed land in the Zuiderdiep polders, related to the new nature reserve, were the cause of great discontent among the population. 7,000 signatures were collected. The current zoning plan still included converting the farming landscape into a landscape in which nature can develop. As Mayor De Vries of Middelharnis said in 2005, the island is not suitable for large-scale farming. People prefer to focus on tourism and recreation. This was also apparent from the Smart Water vision and strategy for 2025, developed in 2016, in which the agricultural sector and the developments are not mentioned. Due to a fall in employment of approximately four percent between 2011 and 2014, the island wanted to focus its strategy on the future and facilitate growth. People concentrated on innovation and sustainability, in which the spearhead objective is to be the most sustainable island in Western Europe through energy savings and sustainable energy generation by

2020. The island is currently mainly known for its recreational options, such as water sports at the Brouwers and Grevelingen dams.

What is remarkable is that the arable farming sector is under considerable pressure on all the islands: spatially, due to developments for housing and industry; ecologically, as a result of an increased focus on nature management; and economically, thanks to globalisation and shrinking margins. At the same time, examples can be found on all the islands of companies that appear capable of successfully innovating and holding their own under this pressure. We observe diverse solutions, ranging from scaling up to technological innovation. A cluster has also appeared to form around arable farming activities on the ZHE (The islands south of Rotterdam). The first seeds for this cluster were sown in the 1960s and 1970s. Nedato was formed in 1963, following a merger involving several businesses active in potato storage. Nedato is a cooperative, two-thirds of which is owned by the growers and a third by CZAV. The organisation consists of united growers from Voorne-Putten and Hoeksche Waard, who had already joined forces in cold stores where produce was stored. In the years that followed, an ever-growing organisation was formed as a result of mergers, ultimately covering the whole of the Netherlands and uniting 800 growers. Another large firm involved in the potato industry is Farm Frites, founded in Oudenhoorn (Voorne-Putten) in 1971 by the de Bruijne family.

Nedato and Farm Frites worked together briefly in a joint venture in the 1990s. In 1998, they began negotiations to integrate the chains, with the underlying idea of creating short lines for transport and logistics and pooling knowledge. According to Piet De Bruijne (CEO of Farm Frites), the collaboration between Farm Frites and Nedato led to lower transport costs due to shorter distances.[187] Unfortunately, the collaboration proved to be short-lived: in 2000, the joint venture was dissolved due to significant conflicts of interests between suppliers and customers. Farm Frites continued to expand and is now one of the largest potato processing companies in the world, with 1,600 employees and over €300 million in turnover in 2006. It is a high-tech firm in which smart technology using cameras and AI is deployed to inspect potatoes. The company works with large parties such as Aviko and Simplot (United States) and supplies to large parties such as McDonald's, Burger King and KFC. Farm Frites' business model focuses on organising chain partnerships between partners, in which growers receive a bonus if they make additional efforts to deliver exceptional quality. The Farm Frites business model is exceptionally profitable and results in a financially sound, healthy company (Farm Frites Annual Reports, Bureau van Dijk, 2017).

Another appealing example is Novifarm in Hoeksche Waard. Novifarm is a collaboration of five arable farming families from Zuid Holland that emerged from the malaise in the sector around the turn of the twenty-first century. The traditional arable farm in Hoeksche Waard was no longer profitable and several arable farmers bundled their resources at the beginning of the

twenty-first century. Together they were named Agricultural Entrepreneur of the year 2017: a fitting celebration of Novifarm's tenth anniversary. The company was founded in 2007, by merging the businesses of the Noordam and Visser families. The De Bruijne, Kruijthoff and Verhoeven families joined the collaboration in 2009, 2010 and 2012, respectively. Between them, they now work 800 hectares. Since 2010, Novifarm has engaged in precision farming. They know the soil condition per square metre in real time, based on data from sources such as satellites and sensors. The business also focuses on chains: smart connections, such as the one with the Bram Ladage chips, make the company profitable. Novifarm can uniformly serve the chain because it can also process (wash) the potatoes and deliver them to the end user itself. The success of the Ladage family with the new 'Bram's Gourmet Frites' concept thus indirectly led to success in Hoeksche Waard. Within the collaboration, the families bring all movable goods together and run the business in the form of a VOF (general partnership). The immovable property remains outside the collaboration; that would be a step too far in terms of the companies' integration. A new business will join in 2018. Novifarm employs eight FTEs, which demonstrates that arable farming has become very labour extensive in 2017. This trend is expected to continue in the coming decades: Novifarm claims that in 20 years drones will be indispensable in farming.

The Novifarm business case is illustrative of collaboration within the cluster in Hoeksche Waard (see inset on Hoeksche Waard). Sustainability and a new business model go hand in hand in this regard. The activities in Hoeksche Waard are, in turn, illustrative of the attitude of innovative entrepreneurs on the ZHE (The islands south of Rotterdam). Innovation is not only necessary for maintaining healthy business operations, but also safeguards the future for future generations: the entrepreneurs feel responsible for the arable farms and the arable farming sector on the ZHE (The islands south of Rotterdam).

Hoeksche Waard

The Hoeksche Waard currently consists of the municipalities of Binnenmaas, Cromstrijen, Korendijk, Oud-Beierland and Strijen. It is a fertile area that was drained between 1230 and 1270. Just like Voorne-Putten, the connection to the mainland constituted a driving force for the economic activities in the region. In 1888, it surrendered its isolation with the construction of the Barendrecht Bridge, the result of regional cooperation. Mayor Van Driel in Puttershoek had tried to have the bridge built in 1876, as national and international routes did not pass through Hoeksche Waard and this impeded trade. Moreover, the previously cited RTM tram connection established in 1898, with extensions to Numansdorp Port (1900), Goudswaard (1903) and Middeldijk-Zwijndrecht (1904), ensured good access to the region.

The cultivated ground in the municipalities occupied 13.2% of the total cultivated ground in Zuid Holland in 2000, compared with 14.2% in 2016. This is virtually double the amount of ground for cultivation on Voorne-Putten (6.9% and 7.1% respectively), indicating the importance of the region in relation to other regions on the ZHE (The islands south of Rotterdam). According to a European funded report, the region 'serves as an international model in the field of functional agrobiodiversity'. This was demonstrated, for example, by the various national and European pilots and projects that had been carried out at Hoeksche Waard, as an example of agriculture in Zuid Holland. The Hoeksche Waard formula revolved around the focus on biodiversity with recreational paths (cycling or riding) and a revenue model for the farmer. In 1994, a water drainage project was set up by arable farmers to study the water flowing in the fields, related to water pollution caused by fertilisers. This reveals the environmental awareness of farmers in the area. There were also several biodynamic (BD) farms in Hoeksche Waard which in 1994 celebrated the 70th anniversary of this type of agriculture, which does not use any artificial fertilisers or other chemical agents.

In 1995, the State, municipalities and Provincial Executive of Zuid Holland released a total of 200,000 guilders to compile a landscape policy plan for Hoeksche Waard. The plan subsequently resulted in considerable unrest due to differences of opinion between the Ministries of Agriculture, Economic Affairs and Public Housing. Up for debate was the question of whether areas had to be reserved for greenhouses in horticulture or for industrial estates in the port-related industry. In 1998, it appeared that the construction of greenhouses on 265 hectares in Hoeksche Waard would be contrary to European regulations concerning nature conservation. Agreement on creating industrial estates in the north of the area followed in 1999. The need for industrial estates was partly due to the pressure on nearby Rotterdam and the Randstad. The industrial estates are crucial for the economy and employment in the south of the Randstad. In 2004, a plan finally emerged to release 300 hectares for port-related industry. In 2005, this was limited to 180 hectares, partly thanks to the fact that Hoeksche Waard was named a National Landscape. This means that it possesses a unique combination of nature and agricultural areas that must be preserved. However, this nomination does not involve any national policy implications, although agriculture was recognised as an iconic feature of the Hoeksche Waard landscape. In 2008, the municipalities indicated that they wanted to devote space to agriculture in the centre of Hoeksche Waard, on the condition that the farmers strive for biodiversity.

H-WodKa was founded in 2006, an abbreviation of the Hoeksche Waard on the Map Foundation, with the aim of stimulating cooperation between arable farmers in the region. In 2007, for example, it established Novifarm, which aims to bundle resources by making joint investments and exchanging ideas about the latest techniques in arable farming. Seven farmers in the foundation set up the Arable Farming in Green and Blue project, ending up with 20 farmers in 2013. The name of the pilot refers to the green and blue services, or social services of landowners. They focus on developing precision farming techniques and using computers to classify their land. H-WodKa initiated the HW2O project as a follow up to the temporary project mentioned above. This project involves improving the soil and making it more sustainable, funded by means of a European grant. The above projects were implemented in association with the Hoeksche Waard Cooperation Body (SOHW). As Gerard Leggedoor from SOHW explained in 2014, cooperation is vital to facilitate sustainable farming in Hoeksche Waard. The SOHW works with residents, the authorities and landowners to retain and improve the region's liveability. In 2015, the Hoeksche Waard Cooperative Collective (CCHW) was founded, an initiative that arose from new European agricultural policy. The policy stipulates that agricultural nature management must be implemented by a regional collective. The CCHW acts as a collective point of contact for the authorities in which the farmers are addressed individually.

Due to the effective collaboration between the farmers and their external communication, in 2015 the Province set up a project called De Hoeksche Boer maakt het Waard ('the Hoeksche farmer makes it worthwhile'). In association with the Veldleeuwerik Foundation, a two-year sustainability plan was compiled for nine pilot businesses in the region. The plan focuses on precision farming, agrobiodiversity and agricultural nature management. In 2017, the Hoeksche Waard Works policy programme was published, in which the Province made arrangements for the future. Sustainable farming is one of the programme's themes. The Foodlab is consistent with this policy programme, since this exhibition space reflects the innovative and sustainable side of the Hoeksche Waard.

Image 7 Film about the Hoeksche Waard policy programme.[188]

8.4 A sector with stamina, but under pressure

In summary, we could say that the arable farming sector on the ZHE (The islands south of Rotterdam) may not be the most eye-catching, but it has endured for many years and is constantly developing. The sector is standing firm under pressure from the expansion of the port industrial complex, housing and recent nature management. Most arable farming businesses appear not to be able to keep up with progress and in the past century many businesses have disappeared, either because the land was used for other purposes, or because increasing competition on a global scale resulted in unprofitable business operations. In some cases, a lack of successors also played a role. Yet some parts of the sector proved innovative enough to be a profitable business in the new order. Companies that are capable of innovating and of reinventing themselves survive. The examples of Van Peperstraten, Novifarm and Van Bergeijk demonstrate that there are businesses that move with the times and are focused on sustainable business operations. They are resilient and innovative because this is what is required to remain a step ahead of the competition, to be and remain profitable, and because this guarantees the companies' future. The companies are resilient because the business also has to continue to pass on the right to exist to the next generation.

Footnotes

52 Blink, in Groot, F. (1992), Roomsen, rechtzinnigen en nieuwlichters. Verzuiling in een Hollandse plattelandsgemeente Naaldwijk 1850-1930 (Catholics, orthodox and novices. Fragmentation in a rural municipality in Holland, Naaldwijk 1850-1930). Hilversum: Uitgeverij Verloren (p. 27).
53 Risseeuw, P.J. (1967), De glazen stad. Roman uit de Eurotuin (The Glass City. Tale from the Euro garden). Kampen: J.H. Kok. N.V.
54 Greenport (2013), Visie 2030. Mondiale tuinbouwkern voor voedselvoorziening, gezondheid en welbevinden (Vision 2030. Global horticulture hub for food supply, heath and well-being). Greenport Westland-Oostland.
55 Greenport, 2013. See above.
56 Kamer van Koophandel Haaglanden/Rabobank (Haaglanden Chamber of Commerce/Rabobank) (2006), De kracht van het Westland. Economische thermometer 2006 (The power of Westland. Economic thermometer 2006). Naaldwijk.
57 Verbraeck, A.A.A. (1933), Het Westland. Sociografie van een tuinbouwgebied (Westland. Sociography of a horticulture area). Groningen: Wolters. University of Amsterdam thesis.
58 Oudshoorn, H.I. (1957), De Tuinders in Wateringen en De Lier: Bijdrage tot de Godsdienstgeografie van het Westland (The Growers in Wateringen and De Lier: Contribution to the religious geography of Westland). University of Utrecht thesis.
59 Groot, F. (1992), Roomsen, rechtzinnigen en nieuwlichters. Verzuiling in een Hollandse plattelandsgemeente Naaldwijk 1850-1930 (Catholics, orthodox and novices. Fragmentation in a rural municipality in Holland, Naaldwijk 1850-1930). Hilversum: Uitgeverij Verloren (p. 27).
60 Barendse, J. (1951), Hollands tuin. De Westlandse tuinbouw van vroeger tot nu (Garden of Holland. Westland horticulture from the past to the present).
61 IJsselstijn, M. & Y. Van Mill (2016), Atlas van het Westland. 10.000 jaar ruimtelijke ontwikkeling (Atlas of Westland. 10,000 years of spatial development). Bussum: Uitgeverij Thoth.
62 IJsselstein & Van Mil, 2016. See above.
63 IJsselstein & Van Mil 2016, p. 54. See above.
64 Prins-Hoogendam, M.(1989), De nieuwe tuinen van Honselersdijk. Historisch Jaarboek Westland (The new gardens of Honselersdijk. Historic Yearbook of Westland). pp. 77-94.
65 Hoogenraad, J. (2008), Van kloostertuin tot stad. De Loosduinse (en Westlandse) tuinbouw van 1230 tot 2006. In eigen beheer (From monastery garden to city. Loosduinen (and Westland) horticulture from 1230 to 2006. Own copy).
66 Dessing, in IJsselstijn & Van Mil 2016. See above.
67 Verbraeck, 1933. See above.
68 IJsselstijn & Van Mil, p. 158. See above.
69 IJsselstijn & Van Mil, pp. 121-132. See above.
70 IJsselstein & Van Mil, 2016, p. 104. See above.
71 Bond Westland (Westland Association) (1964). Van crisis tot kracht. Gedenkboek ter gelegenheid van het vijfenzeventig-jarig bestaan van de Bond Westland (From crisis to strength. Commemorative book on the occasion of the 75th anniversary of the Westland Association). p. 83.
72 Westland Association (1964) p. 153. See above.
73 Porter, M. & Van der Linde, C. (1995), Green and Competitive: Ending the stalemate. Harvard Business Review 73, pp. 120-137.
74 Vijverberg, A.J. (2007b), De Canon van de Kassen. De geschiedenis van de Nederlandse glastuinbouw in 50 verhalen (The Canon of the Greenhouses. The history of Dutch greenhouse horticulture in 50 stories). Wateringen: Lakerveld Uitgeverij
75 Berkers, E. & F. W. Geels (2011), System innovation through stepwise reconfiguration: the case of Berkers, E. & F. W. Geels (2011), System innovation through stepwise reconfiguration: the case of technological transitions in Dutch greenhouse horticulture (1930–1980). Technology Analysis & Strategic Management, 23 (3): 227-247.
76 Winden, W.A. van (1985), De ontwikkeling van de kassenbouw in het algemeen en in het Westland in het bijzonder. Een literatuurstudie (The development of greenhouse construction in general and in Westland in particular. A literature study).
77 Vijverberg, 2007b. See above.
78 Van Winden, 1985. See above.
79 Kruyk, P.A. (1975), 75 jaar onderzoek in Naaldwijk (75 years of research in Naaldwijk). Naaldwijk: Experimental Station Naaldwijk.
80 Wageningen Economic Research (previously LEI) (2012), Glastuinbouwcluster Westland. Kenschets van de economische betekenis (Westland Greenhouse Horticulture Cluster. An outline of the economic significance.) The Hague.
81 Risseeuw, 1967. See above
82 This ranking is based on the Hillenraad100, published by the consultancy Hillenraad & Partners. The Hillenraad100 contains the annual ranking of the hundred most pioneering enterprises in the knowledge and capital intensive (greenhouse) horticulture sector. See www.hillenraad100.nl (2017)
83 Benseddik, A. & M. Bijl (2004), Onzichtbaar achter glas. Onderzoek naar de bijdrage van illegalen in de glastuinbouw van het Westland (Invisible behind glass. Study of the contribution of illegals in Westland's greenhouse horticulture). Stek / Okia.
84 Schrauwen, N. (2012), Innovativeness of innovation. A study on the effects of social institutions on innovation practices in the Westland horticulture sector, MSc thesis TU Delft.
85 Grosscurt, T. (2017), Becoming a global market Leader. The rise of the Dutch Phalaenopsis Cluster, MSc-thesis Wageningen UR.
86 Hillenraad100, 2017. See above.
87 www.decorumplantsflowers.com (2017).
88 www.robbaan.com (2017).
89 www.Kubogroep.nl (2017)
90 www.rijkzwaan.nl (2017)
91 Prins, J. (2012), 'De geschiedenis van Priva in De Lier', Historisch Jaarboek Westland (The history of Priva in De Lier, Historic Yearbook of Westland), 7-14.
92 Plantenberg, P. (1987), 100 jaar veilingen in de tuinbouw 1887–1987 (100 years of auctions in horticulture 1887–1987). Centraal Bureau van de Tuinbouwveilingen en Vereniging van Bloemenveilingen in Nederland (Central Agency of Horticulture auction houses and Association of Flower auctions in the Netherlands), p. 12.
93 Kemmers, W.H. (2000), Het Streekplan Westland en de Commissie voor Westlandse belangen, Historisch Jaarboek Westland (The Westland Regional Plan and the Committee for Westland's interests, Historic Yearbook of Westland), 13: 5-18.
94 Plantenberg 1987, p. 24. See above.
95 Kemmers, W.H. (1993), Hoe conjunctuurgevoelig was het Westland? (How sensitive was Westland to the economic climate?), from: Historisch Jaarboek (Historic Yearbook) 1993, no. 6, pp. 33-45.
96 Plantenberg (1987) p. 69. See above.
97 Plantenberg (1987) pp. 30-31. See above.
98 CCWS (1973), p. 75.
99 CCWS (1987), p. 87.
100 Westland Association (1964) p. 43. See above.
101 Westland Association (1964) p. 86. See above.
102 Westland Association (1964) p. 83. See above.

[103] Westland Association (1964) p. 153. See above.
[104] Plantenberg (1987) p. 44 and onwards. See above.
[105] Holsteijn, G.P.A. van (1998), Het eerste middelbaar tuinbouwonderwijs in het Westland (The first secondary horticultural education in Westland). Historisch Jaarboek Het Westland (Historic Yearbook of Westland) 11: 45-61, p. 5.
[106] Rabobank Westland (2008), Concise annual report 2008. Naaldwijk.107 Wageningen Economic Research (previously LEI) (2012). See above.
[107] Wageningen Economic Research (previously LEI) (2012). See above.
[108] Plantenberg (1987) p. 57. See above.
[109] Westland Association (1964). See above.
[110] Kemmers (1993). See above.
[111] Beginning in 1882, the Westlandse Stoomtramweg Maatschappij (W.M.S.) ran various tramlines through Westland. The last tramlines were replaced by bus transport in 1970.
[112] Wageningen Economic Research (previously LEI) (1965), De ontwikkeling van de tuinbouwvestiging in het ZuidHollands glasdistrict (The development of the horticultural branch in the Zuid Holland glass district), Studies no. 17. The Hague: Agricultural-Economic Institute.
[113] Kemmers (1993). See above.
[114] Wageningen Economic Research (previously LEI) (1965). See above.
[115] Wageningen Economic Research (previously LEI) (1965). See above.
[116] Kemmers (1993). See above.
[117] Westland Association (1964) p. 39. See above.
[118] Kemmers (1993). See above.
[119] Westland Association (1964) p. 43. See above.
[120] Westland Association (1964) p. 92. See above.
[121] Westland Association (1964) p. 45. See above.
[122] Westland Association (1964) p. 86. See above.
[123] Visser, J. (1969), Evaluatie van de tuinbouwvoorlichting in het Westland en De Kring (Evaluation of horticultural education in Westland and De Kring). Afdelingen voor Sociale Wetenschappen, Landbouwhogeschool Wageningen. (Department of Social Sciences, Wageningen Agricultural College).
[124] Van Holsteijn (1999). See above.
[125] Van Holsteijn (1999). See above.
[126] Van Holsteijn (1999). See above.
[127] Kruyk, P.A. (1975), 75 jaar onderzoek in Naaldwijk (75 years of research in Naaldwijk). Naaldwijk: Experimental Station Naaldwijk.
[128] Vijverberg, A.J. (2007a), Ontwikkeling en betekenis van de proeftuin (Development and significance of the experimental garden). Historisch Jaarboek Westland (Historic Yearbook of Westland), 20: 5-24.
[129] Visser (1969). See above.
[130] See www.rotterdamfoodcluster.com/thema/food-for-the-future/ (2018).
[131] Food for the Future (2016). See above.
[132] Heijningen, L. van (1990), Loosduinen, van zelfstandige gemeente tot Haagse woonwijk (Loosduinen, from independent municipality to residential district of The Hague). Historisch Jaarboek (Historic Yearbook of Westland) Volume 3, pp. 16-34.
[133] Hoogenraad (2008). Van Heijningen (1990). See above.
[134] Kemmers (2000). See above.
[135] Kemmers (1961). See above.
[136] Greenport (2013). See above.
[137] Kramers, C. (1946), De moutwijnindustrie te Schiedam (The malt wine industry in Schiedam). Amsterdam: Uitgeverij Lieverlee.
[138] Lans, N. (1996), Schiedam bouwt op jeneververleden. Een wandeling door de tijd (Schiedam builds on its jenever past. A walk through time). Artemis. And: Lans, N. (1993), Wereldwijd verbreid. De jeneverindustrie in Schiedam 1860-1993 (Global penetration. The jenever industry in Schiedam 1860-1993). Stedelijk Museum Schiedam
[139] Commissie Gedistillleerd (2001-2007), Key figures brochure. The Hague.
[140] Dobbelaar, P.J. (1930), De branderijen in Holland tot het begin der 19e eeuw (Distilleries in Holland up to the beginning of the 19th century). Utrecht University thesis.
[141] Jansen, J. et al. (2001). 400 jaar jenever. Ach lieve tijd 2 (400 years of jenever. Oh, dear time 2). Waanders Uitgevers/Schiedam Municipal Archives.
[142] Bayer, M. et al. (2015), Terug naar de fabriek. 25 industriële iconen met nieuwe energie (Back to the factory. 25 industrial icons with new energy). Oostenwind Uitgeverij.
[143] Bayer, M. et al. (2015). See above.
[144] Spirits (2018), Genever traditions: Promoting European Genever in the United States. The Hague.
[145] National Jenevermuseum (2016), Zinnen prikkelen. Integraal masterplan Nationaal Jenevermuseum 2016-2020 (Rousing the senses. National Jenever Museum integrated master plan 2016-2020). Schiedam.
[146] http://www.agf.nl/artikel/151180/Urban-Industrial-koopt-Groothandelsmarkt-Rotterdam
[147] http://www.stadsarchief.rotterdam.nl/spaanse-polder
[148] http://www.stadsarchief.rotterdam.nl/spaanse-polder
[149] Blijstra, 1965 in Van 't Verlaat (1997), Productontwikkeling binnen Regiomarketing – Naar een nieuwe rol van overheden, bezien in een Rotterdamse context (Product development within Regional marketing – Towards a new role for governments, viewed in the context of Rotterdam), Erasmus University Rotterdam thesis.
[150] Producer of King Corn bread with a long shelf life, popular in the 1960s.
[151] Municipality of Rotterdam (2001), Policy lines for revitalising the Spaanse Polder up to 2015.
[152] Source: Rotterdam city region industrial estates monitor 2014 (Monitor bedrijventerreinen stadsregio Rotterdam 2014).
[153] De Zakenpartners (2016), Handelingsperspectief Foodsector Spaanse Polder Rotterdam (Trading prospects of the Spaanse Polder Food Sector Rotterdam).
[154] Van den Dool, Straetmans and Ensberg (2007), Een markt met potentie?, Adviesgroep Binnenlands Bestuur (A market with potential? Domestic Policy Advisory Group), PwC.
[155] https://www.persberichtenrotterdam.nl/bericht/1822/Herontwikkeling-Groothandelsmarkt-impuls-foodsector-Rotterdam/
[156] Van den Dool, Straetmans and Ensberg (2007), Een markt met potentie?, Adviesgroep Binnenlands Bestuur (A market with potential? Domestic Policy Advisory Group), PwC.
[157] Idem.
[157] Idem.
[159] Brenner, T. (2004). Local industrial clusters: existence, emergence and evolution. Routledge.
[160] Van Oort, F.G. (2014) De Weerbare Regio, Ruimtelijk-economisch beleid in de Zuid-Hollandse kenniseconomie (The resilient region. Spatial-economic policy in the Zuid Holland knowledge economy). The Hague: Province of Zuid Holland.
[161] http://www.agf.nl/artikel/163032/Puzzelen-op-Spaanse-Polder

[162] http://www.agf.nl/artikel/163032/Puzzelen-op-Spaanse-Polder
[163] For the description of this location repeated use was made of Visser, M. (1995). Veiling Barendrecht in vroeger tijden 1915-1975 (The Barendrecht auction in days gone by). Oostvoorne: Deboektant. The number of references is limited for purposes of readability.
[164] See https://basromeijnfilms.blogspot.nl/2016/01/de-tuinbouwveiling-barendrecht.html
[165] https://www.ah.nl/over-ah/geschiedenis/1900
[166] https://www.youtube.com/watch?v=9dwtvlB1lpE
[167] An estimate of today's equivalent of this conversion is €1 billion.
[168] Zuid-Holland-Zuid. (1981). Annual Report 1980. Barendrecht: Zuid-Holland-Zuid.
[169] Greentime. (1997, 23 October). Opening word. Greentime, 2(10).
[170] https://www.thegreenery.com/organisatie/historie
[171] https://www.fnv.nl/sector-en-cao/alle-sectoren/handel/nieuws/980527-nieuwe_reorganisatie_bij_kernbedrijf_van_the_greenery/
[172] Volkskrant, 6 August 2014
[173] NOS. (2017, July 24). Nederland overspoeld met wilde perziken (The Netherlands flooded with wild peaches). Retrieved from https://nos.nl/artikel/2184814-nederland-overspoeld-met-wilde-perziken.html
[174] Barendrechts Dagblad, 13 July 2015.
[175] Figures in this paragraph are based on Alterra (2015) Ontwikkelperspectieven FCR (FCR Development Prospects).
[176] AGF (2015) Photo report Kraaijeveld premises Maasland.
[177] Source: http://www.agf.nl/artikel/64683/Landelijke-dekking-voor-L.-van-Gelder-groente-en-fruit
[178] http://www.agf.nl/artikel/163885/Van-Gelder-slaat-eerste-paal-en-licht-groeiambities-toe
[179] Alterra (2015)
[180] AGF (2015) AGF-handelaren Ridderkerk/Barendrecht in discussie over toekomst handelscentrum (Ridderkerk/Barendrecht AGF traders debate the future of the trade centre).
[181] http://www.nieuwreijerwaard.eu/www/Projectinfo/Gemeenschappelijke+Regeling/
[182] VBO Freshworld. (2013, June). 'Derde ontsluitingsweg noodzakelijk' ('Third access road required'). VBO Freshworld, 24(2), pp. 18-19.
[183] Source: http://beeldbank.cultureelerfgoed.nl/alle-afbeeldingen/detail/9741352c-bffd-a3ab-73b0-3a18d29fdf65/media/64e88dfc-785d-4d3f-64f0-ebda3e335d6f
[184] Source: https://www.maasvlakte2.com/uploads/ontwikkeling_rotterdamse_haven_2.png
[185] Source: Left: Google Street View. Right: https://www.plaatsengids.nl/rozenburg.
[187] WLTO. (1999). Agrarische kwaliteit van Hoeksche Waard: 150 jaar geschiedenis van agrarische belangenbehartiging in de Hoeksche Waard (Agricultural quality of Hoeksche Waard: a 150-year history of defending agricultural interests in Hoeksche Waard).
[188] Source: https://www.youtube.com/watch?v=sOc2mEtCJaQ (1848-1998).

Part 3

Innovative capacity of the existing business community

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Centre for Business Innovation

With thanks to Robbert Jan Wanna and Liselotte Smelt, students at the Rotterdam School of Management

9 Innovation in the business model to align with the Next Economy

The Next Economy Roadmap for the Metropolitan region assumes a transition of society and the economy. Renewable energy, omnipresent sensors and connections between devices (Internet of Things) and the transition to a circular economy will represent important themes in this transition. These are themes that will also undoubtedly affect businesses in the food cluster – sometimes in the long term, but in some cases perhaps sooner than expected – and require fundamental change. Renewing existing business models and developing completely new ways of creating value necessitate considerable innovative capacity. The region will also have to play a facilitating role. After all, businesses do not operate in a vacuum and will extract specific resources from their environment to be able to innovate.

Using a questionnaire, a wide range of entrepreneurs from the food cluster was surveyed about these matters (see the appendix at the end of this chapter for a list of the respondents' characteristics). The survey was partly compiled from an existing, scientifically-validated questionnaire and partly customised for the study of the food cluster. The results are discussed in the following sections. Moreover, we point out that this was an initial, exploratory survey that cannot be representative for the food cluster as a whole. That kind of statistically representative study would require greater efforts than were possible as part of this set-up. Nevertheless, the results are revealing and provide a first impression of the cluster's innovative capacity.

9.1 A leading role for the processing industry?

Based on the results of the survey, we find that companies in the food cluster have a limited focus on innovation. On the one hand this applies to the commitment to exploitation of the existing business model, which is to say a commitment to incremental improvement and expansion. On the other hand, this also applies to the capacity to develop new business models, known as the exploratory innovative capacity. With regard to businesses facing a transition challenge, a company's capacity to reinvent itself is incredibly important. This also constitutes a major challenge for the cluster as a whole.

Figure 27 shows the results of the survey among the food cluster in the region, compared with the average outcomes of businesses in the Netherlands. The fact that businesses devote more attention to exploitation (improvement) than to exploration (innovation) is not striking in itself. We see this pattern virtually everywhere. However, the results for both areas are substantially lower than the average in the Netherlands.

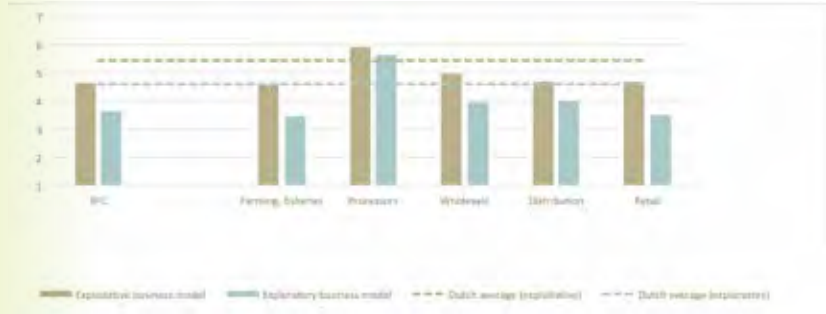

Figure 27 Exploitation and Exploration within the Rotterdam Food Cluster.

Figure 27 reveals that this does not apply to every business sector. The 'processors' form a (positive) exception within the food cluster.[189] The factories studied appear to have found a good balance between business model exploitation and business model exploration. In this, they differ not only from the other parties in the Rotterdam Food Cluster (RFC) but also from many other business sectors outside the food cluster. The processing industry could therefore play a leading role in the food cluster's transition, according to an initial, cautious conclusion.

Apart from differences between business sectors, we also see differences between size categories. It appears that the larger the company, the more attention it devotes to improvement and growth. Medium-sized companies score significantly higher than small businesses when it comes to the business model exploitation.[190] Therefore, some scale does seem to be important for the further development and growth of an existing business model. This requires a greater focus on scaling-up issues to facilitate the large population of small companies in their growth.

9.2 First lever for innovation: entrepreneurial management

As already stated, the capacity of a business or business sector to reinvent itself is incredibly important for the transition to the Next Economy. Research has revealed that management has a greater impact on this capacity than do the qualities of the organisation (see Table 8). Therefore, the main factor is a combination of a change-oriented management style and an entrepreneurial focus (not averse to risks).

Management is also important – again, more important than the organisation – when it comes to exploiting an existing business model. However, the effects[191] are considerably less significant. While the management style can explain up to 30% of the differences for exploration, for the business model exploitation this is 'only' 12%.

The qualities of the organisation manifest in the extent to which employees are able to work autonomously, in the organisation's culture and in the qualities of the employees (the 'human capital'). Although all these matters are important to an organisation, our research shows that they only have an impact on innovative capacity in small companies. This regards the capacity for business model exploitation.

	Effect on exploitation	Effect on exploration
Management	Reasonably high (12%)	Very high (30%)
Flexible management style	Individually: **weak**	Individually: **reasonably weak**
Flexible organisation	Individually: **weak**	Individually: **reasonably strong**
Enterprising orientation	Individually: **average**	Individually: **strong**
Organisation	Reasonable (10%, in small businesses)	Very low (7%)
Employee autonomy	Individually: **weak**	Individually: **weak**
Innovative organisational culture	Individually: **none** (not significant)	Individually: **none** (not significant)
Human capital	Individually: **weak**	Individually: **very weak**

Cited percentages reflect the degree of explanation. For example, 30% of the variation in exploratory innovation can be explained using the 'management' variable.

Table 8 The effect of management and the organisation on the capacity to innovate.

Although 'organisation' in this study appears to have a weak relationship with innovation, this relationship is emphasised in diverse literature. Therefore, it is relevant to mention that we mainly encounter a relatively high degree of autonomy and innovative cultures in medium-sized companies, not least because medium-sized companies score remarkably highly with regard to the business model exploitation. A certain size and an innovative form of organisation thus appear to be desirable for a company to be able to thrive in a changing world.

9.3 Second lever: collaboration in the chain

Collaboration with other companies and institutions can be a powerful source of innovation. The study confirms two general assumptions about such collaboration:

1. Collaborating with chain partners is especially useful for the business model exploitation. The specialist knowledge of suppliers, customers, competitors and complementary players in the value chain is 'familiar territory' and can be directly applied to improve processes and products or services.
2. Collaborating with parties that are more distant from the business, such as knowledge institutions and technical and professional service providers, is mainly useful in terms of exploration. Since knowledge is primarily acquired from outside the chain and more generic knowledge is applied, there is a greater chance that entirely new technologies, processes or value propositions will be developed.

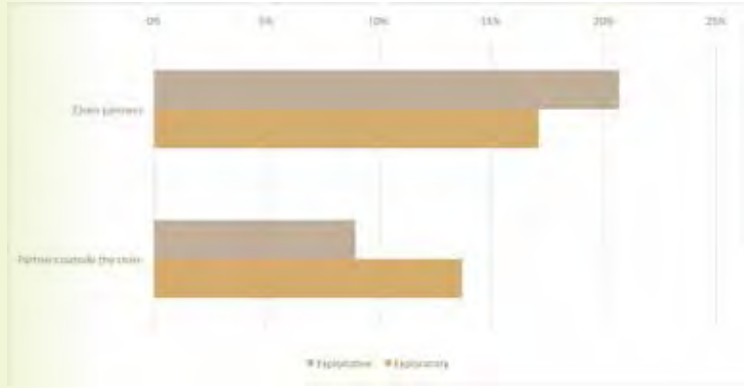

Figure 28 Collaborating with partners within and outside the value chain.

Figure 28 clearly shows that collaborating with chain partners is the best way to improve and expand the existing business model. The effect of collaborating with chain partners is twice as great as the effect of collaborating with partners outside the chain. Collaborating with partners outside the chain, or obtaining knowledge from a distance, is primarily of interest if the aim is to renew the business. These forms of collaboration are not mutually exclusive: the best results are achieved by working with parties both within and outside the chain.

This does not mean that cooperating with knowledge institutions and technical and professional service providers will always have a relatively limited effect. These types of cooperation partnerships simply do not crop up very often, as we will see later on. They may therefore offer a world of opportunities.

9.4 Collaboration offers a world of opportunities

9.4.1 On the number of different types of parties

Collaborating with a diverse group of partners significantly boosts the capacity to innovate. Diversity is important for actually conceiving new ideas. This applies to exploitation of the business model as well as exploration of a new business model: for both types of innovation, 12% of the innovative capacity is explained by the fact that a company collaborates with two or more different types of parties.

Striking differences emerge when we compare small businesses with medium or large companies with regard to the number of different types of parties with which they collaborate. Small businesses do innovate with others, but on a very limited scale! Of the small businesses studied, a quarter do not collaborate with other parties to innovate at all. If they do, this predominantly happens with one or at most two different types of parties.

Medium-sized businesses – which, as we have already concluded, innovate more than smaller businesses – are considerably more likely to work in heterogeneous partnerships with different types of parties. Fully 74% of the companies studied collaborate with two or more types of innovation

partners. In contrast, just seven percent do not innovate with others at all, a stark contrast with small businesses. Policies to also involve them in diverse innovative partnerships could make a difference.

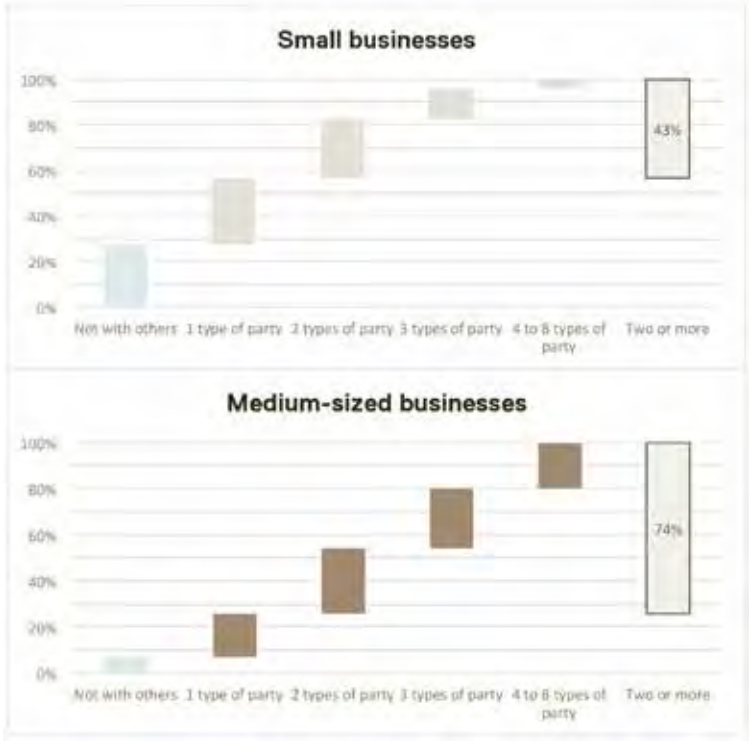

Figure 29 How many types of parties do businesses innovate with?

9.4.2 On collaboration with specific parties

When businesses in the food cluster collaborate on innovation, they mainly do so in the primary ecosystem; in other words, with parties that have a direct link with their primary process, their customers and suppliers (see Figure 30). Innovation with parties from the knowledge ecosystem – in particular with educational institutions that supply them with new employees – is still relatively limited (11%). Partners from the innovation ecosystem with whom collaboration only takes place for innovation purposes still seem to be rare. Collaboration with knowledge institutions (with no related educational activities) only occurs in one in ten businesses from the cluster. Collaboration with start-ups is very rare: 80-90% of companies indicate that they never or rarely collaborate with start-ups (businesses that have been operating for less than three years). This is another area with untapped potential: start-ups can nourish the food cluster with radical ideas and innovations from actors that are a little more distant from the usual cooperation partnerships.

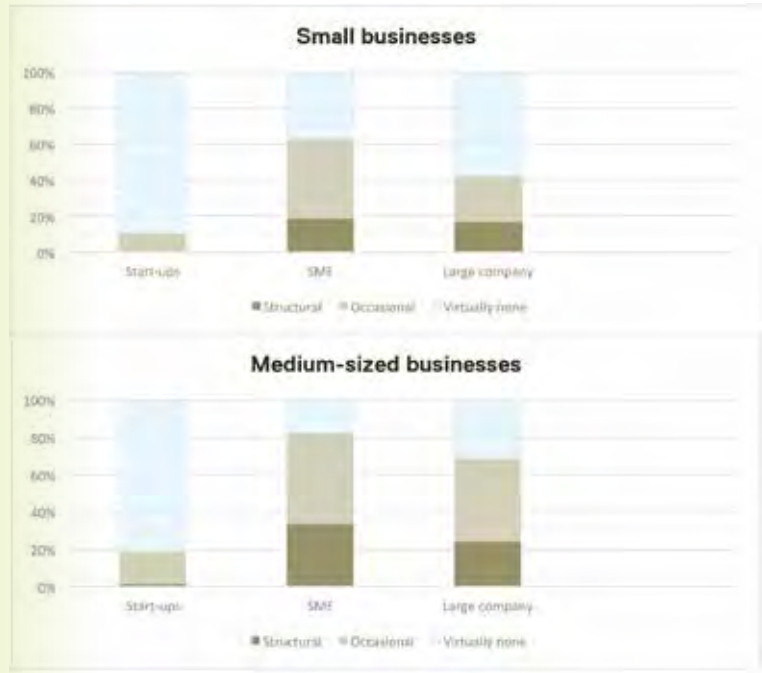

Figure 30 Who do businesses from the food cluster innovate with?

Finally, here are two rankings: who are the best parties for businesses from the food cluster to innovate with? Table 9 shows the parties that have the greatest effects on business model exploitation and business model exploration, based on the answers from respondents in this study. Perhaps it is more interesting to examine how businesses from the food cluster could set up new cooperation partnerships. How do they establish relationships with knowledge institutions? How do they come into contact with start-ups? It is precisely these actors that could give the innovative capacity of the cluster a boost!

Ranking: collaborating for exploitation			Ranking: collaborating for exploration		
#1	Suppliers	9.6%	#1	Customers	7.2%
#2	Customers	8.2%	#2	Professional service providers	4.9%
#3	Complementary businesses	4.1%	#3	Suppliers	3.4%
	Competitors	n.s.	#3	Technical service providers	3.4%
	Technical service providers	n.s.	#5	Educational institutions	2.1%
	Professional service providers	n.s.		Competitors	n.s.
	Educational institutions	n.s.		Complementary businesses	n.s.
	Knowledge institutions	n.s.		Knowledge institutions	n.s.
Scores (%) represent the explained variation in exploitation and exploration: n.s. = not significant					

Table 9 Which are the best parties to innovate with? Scores (%) represent the explained variation in exploitation and exploration. n.s. = not significant

10 The matters that will make a difference

The study also revealed the strategic themes on the radar of the companies in the cluster and the aspects that obstruct them in their growth and innovative capacity. These are the matters in which the metropolitan region could make a difference and promote the innovation climate.

10.1 Strategic themes of the Rotterdam Food Cluster

What themes do businesses in the cluster bank on? What gets their attention, and what does not come onto their radar? Figure 31 ranks the main themes in order of importance, as demonstrated in the study. What stands out is the focus on ecological and social issues: it is not digital technology, but rather new sources of energy and shorter chains that are on the agenda. Ethical issues, individualisation and urbanisation appear to take precedence over the Internet of Things and robotics.

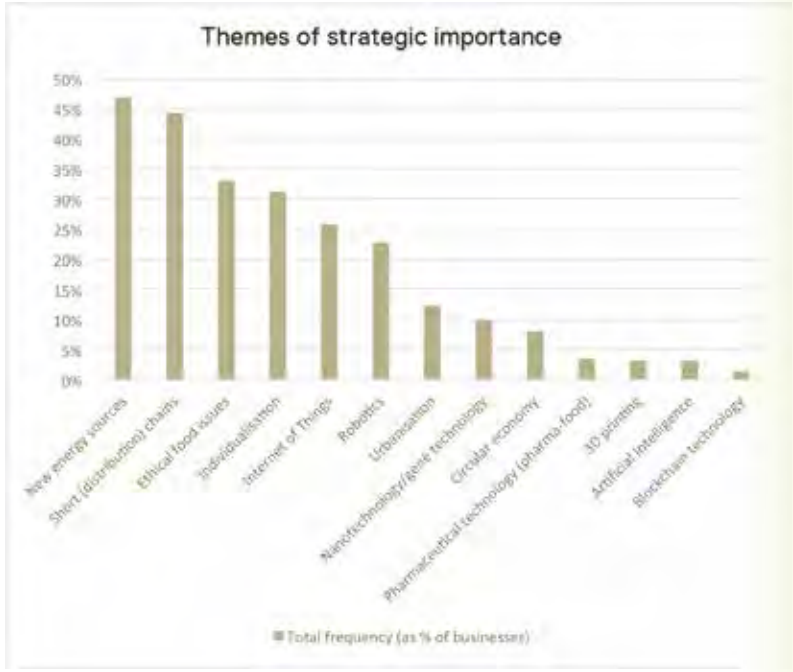

Figure 31 What themes are of strategic importance to companies?

On closer examination, even more striking matters come to light from these outcomes. Large companies have other fundamental focal points, and businesses that are concerned with the circular economy take the lead in terms of innovation.

Table 10 clearly shows that large companies have different focal points than small and medium-sized businesses with regard to a number of themes. This offers potential leads for a differentiated approach in triple helix relationships involving the authorities, knowledge institutions and the business community.

The themes cited frequently by large companies:	
Individualisation	Blockchain
Nanotechnology	3D printing
Urbanisation	Circular economy
Robotics	

Table 10 Strategic themes on the radar of large companies.

10.2 Relevance and distinguishing capacity of innovation catalysts

Businesses almost never innovate in a vacuum. Innovation requires specific resources – in the broad sense – that are not necessarily available in a company. What matters are most relevant for entrepreneurs to achieve their innovation goals? And to what extent can the region provide for them? Proximity to suppliers and service providers appears to be the most important factor (Figure 32). The region stands out in a positive way in this area, according to the respondents in this study. Proximity to sales markets is also a relevant factor in which the region has a clear advantage. The region scores positively across the board: it does not fail in any respects. In fact, with regard to external R&D facilities, training options for employees and access to business networks, the facilities are clearly more than adequate. Entrepreneurs cited the last two points as being particularly important catalysts for innovation.[192]

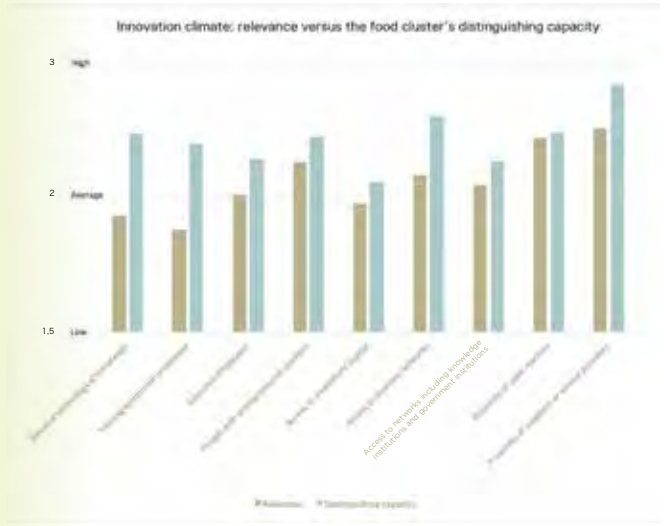

Figure 32 Innovation climate in the region. Scale runs from 1 (not relevant for innovation goals / region distinguishes itself in a negative sense) to 3 (highly relevant / region distinguishes itself in a positive sense).

11 In the spotlight: the food cluster on the ZHE (The islands south of Rotterdam)

Innovation can take various forms, from innovation in a product component to the development of new working methods and the transformation of the business model. In this chapter we specifically examine the business model innovation, the attention businesses on the ZHE (The islands south of Rotterdam) devote to the business model innovation and the strengths that facilitate innovation. These could be internal qualities of the business, but embedding in networks and the region's innovation climate are also scrutinised.

11.1 Two forms of business model innovation

As previously mentioned, we differentiate between two forms of innovation related to a business model. Innovation focused on exploitation aims to improve and expand the existing business model. This form of innovation is characterised by the incremental improvements that are achieved. Innovation focused on exploration strives to develop a new business model, whether through the development of a completely new business model alongside the existing company or by converting the existing business. This form of innovation is also characterised by the radical changes it involves.

11.1.1 Results: Hoeksche Waard and Goeree-Overflakkee take the lead in the food cluster

The attention companies in the food cluster on the islands devote to both forms of innovation is keeping pace with the rest of the business community in the Netherlands. Only the results from Voorne-Putten appear not to be keeping up (see Figure 33). The results for Hoeksche Waard and Goeree-Overflakkee are more or less the same as those of the business community as a whole.[193]

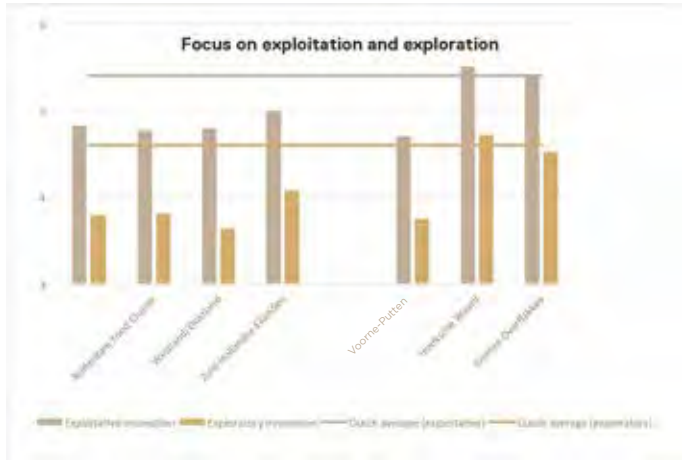

Figure 33 On average, the attention devoted to innovation here is similar to the rest of the Netherlands (the scale used runs from 1=low to 7=high).

11.2 Building blocks of business model innovation

The capacity to innovate a business model does not come by itself. Various aspects of an organisation could help increase its innovative capacity. Naturally, specific technological innovation is usually needed, but without renewal of the organisation (social innovation) the business model innovation only has a limited chance of success.[194] The capacity for exploratory innovation is primarily boosted by:

- Employee autonomy: the extent to which employees are given the room to decide for themselves how they are going to perform their work.
- Adaptive culture: the extent to which the set of shared norms and values can adapt to a changing environment.
- Human capital: the level of quality of the employees (competence, learning capacity, motivation).
- Adaptive management style: the extent to which the coordination and management of employees is adapted to reflect changing circumstances.
- Adaptive organisational structure: the extent to which changes can be implemented in mutual task distribution and decision-making and communication structure.
- Entrepreneurial management: the extent to which managers seek out opportunities and dare to take risks.

11.2.1 Results: employees provide the most fertile soil for innovation on the islands

The building blocks related to the qualities of employees in the organisation (autonomy, culture and human capital) are generally rated as positive. This is fertile soil for innovation. Less prevalent are the building blocks related to management and the 'formal' organisational structure (see Figure 34). In order to stimulate the innovation of business models and increase the chance of success, greater focus is needed on developing adaptive management styles, an entrepreneurial culture among managers and less rigid organisational structures.

We observe little difference between the regions in this regard (Figure 35), or between the islands and the Zuid Holland food cluster.[195] The strengths and weaknesses cited above are thus characteristic of the food cluster as a whole.

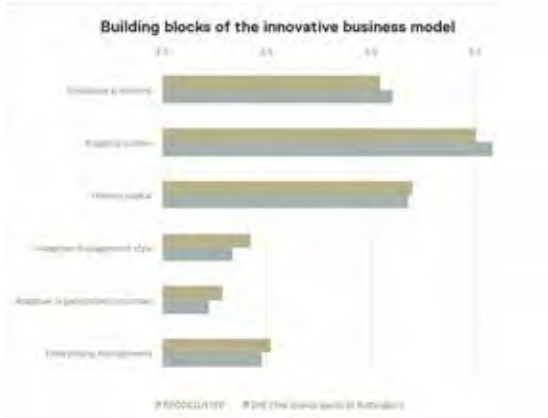

Figure 34 The employees' qualities form a strong basis for innovation. The challenge lies in developing management.

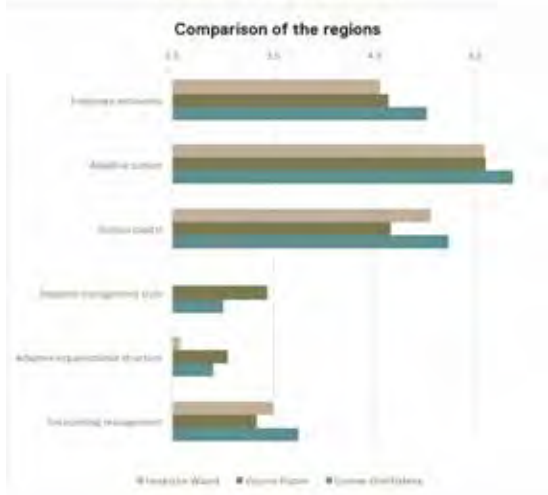

Figure 35 There is not much difference between the regions.

Note: all the regions studied are included under the 'FOOD CLUSTER' heading.

11.3 The innovation ecosystem: collaborating with innovation partners

Businesses do not operate in isolation, but are part of a value chain and participate in networks with diverse parties. We can examine these ecosystems of companies and institutions on three levels:

1 The primary ecosystem revolves around the flow of goods and services from suppliers to customers;

2 The labour and knowledge ecosystem revolves around the inflow and education of (new) employees; and

3 The innovation ecosystem revolves around the parties with which new products, services and working methods are developed.

Companies may collaborate with diverse parties on innovation projects. It is generally proposed that the diversity in a company's innovation ecosystem is positively related to renewal. For exploitative innovation ('more of the same'), it is important to collaborate with parties close to the primary process. For more radical innovations, the input of parties slightly further from the primary process is important. They offer alternative points of view and possess knowledge and technology that a company does not usually have in-house.

11.3.1 Results: people mainly innovate with 'familiar' partners

The diversity of the innovation network looks relatively good, which means that the number of different types of partners with which businesses innovate is reasonably high. Slightly more than half of the entrepreneurs collaborate with two or more different parties on innovation projects (see Figure 36). Entrepreneurs on the islands rival the other regions in this regard (56% compared with 50% in the food cluster as a whole).

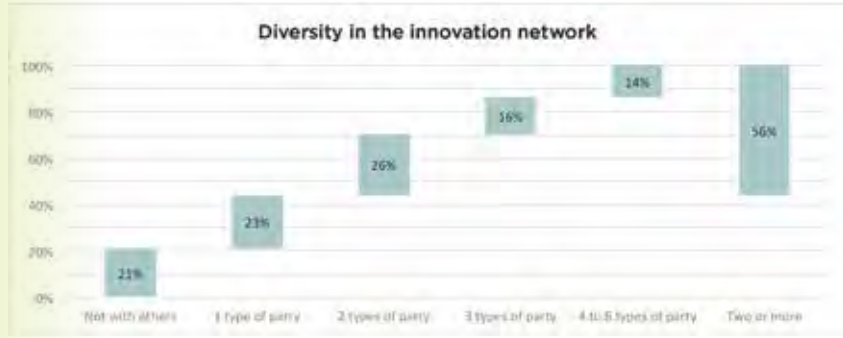

Figure 36 One in five entrepreneurs indicate that they innovate completely independently. More than half involve two or more different types of partners.

We asked entrepreneurs about the different types of parties in their innovation network. Who do they collaborate with, and how regularly? Entrepreneurs on the ZHE (The islands south of Rotterdam) innovate in almost half of cases with partners from the primary process. Fewer than a quarter collaborate on innovation with knowledge institutions, and even fewer collaborate with other types of parties (Figure 37). Moreover, the entrepreneurs on the islands do not differ greatly in this regard from those in other regions in the food cluster.

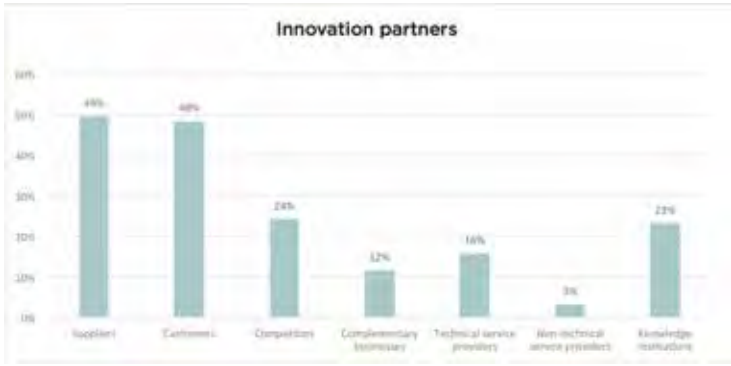

Figure 37 Half of the entrepreneurs studied mainly innovate with 'familiar' parties in the value chain. A quarter involve knowledge institutions in innovation projects.

We asked entrepreneurs whether they collaborate primarily with smaller or larger companies or, for example, with start-ups. The results do not differ greatly from the other regions in the food cluster, although entrepreneurs on the islands opt for structural collaboration slightly more often. Collaboration is most common with SMEs and with large companies. Structural collaboration with start-ups only happens occasionally (see Figures 38 and 39).

Figure 38 Entrepreneurs in the food cluster mainlycollaborate with SMEs and large companies.

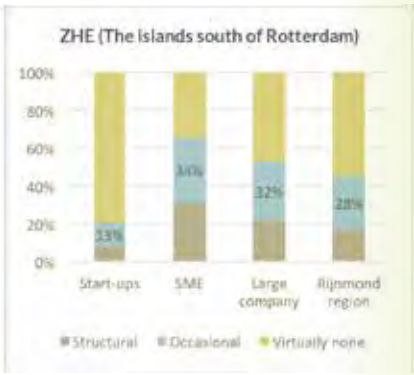

Figure 39 Entrepreneurs on the islands are slightly more likely to work in a structural cooperation partnership.

We conclude that entrepreneurs in the food cluster predominantly look to familiar partners when it comes to innovating. Cooperation partnerships with different types of parties other than primary chain partners seem to be limited to knowledge institutions. To achieve a greater capacity to innovate focused on developing new business models, companies may have to consider actors who are slightly more remote from their core activities.

11.4 The innovation climate of the ZHE (The islands south of Rotterdam)

When innovating their business model, most companies will not be able to rely solely on their own organisation. Whether they want to improve an existing business model or develop a new one, businesses need input from their environment. In a broad sense, this concerns the availability of people with specific knowledge and skills and access to networks (to acquire knowledge or other matters). These are areas that most entrepreneurs cannot influence alone, but for which they are dependent on the policy of government and, for example, sector associations.

11.4.1 Results: a positive innovation climate, with diverse strengths

Entrepreneurs were asked to indicate the matters they deem most relevant for achieving the company's innovation goals. They were subsequently asked to what extent their region is able to distinguish itself in these matters. Combining the outcomes clearly reveals the focal points policy makers should consider.

The results generally provide a positive impression of the innovation climate in the region. There are not really any areas that entrepreneurs deem essential that are not available (see Figure 40).

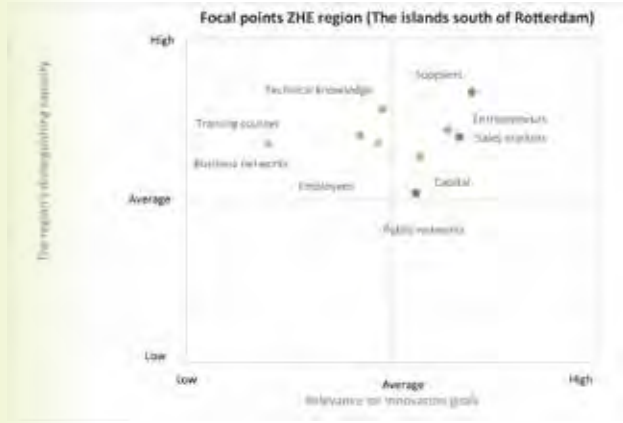

Figure 40 Accessibility of public knowledge networks (government, knowledge institutions) deserves the most attention, according to the entrepreneurs surveyed.

The most important focal point concerns access to public networks with knowledge institutions and government agencies. One area in which the region distinguishes itself in the positive sense, but to which entrepreneurs attach less importance – insofar as it relates to their innovation objectives – is in the matter of training options for employees. The proximity of suppliers and sales markets and people with entrepreneurial qualities is important for innovation and a strong asset for the region.

11.5 The qualities of the regional infrastructure

It is not only the available human capital and the regional networks that are important for innovation; the regional 'infrastructure' for businesses is important too. Qualities of the regional infrastructure include matters such as accessibility (by road, rail, water or air transport), the quality of the digital infrastructure, the room for innovation the current regulations offer entrepreneurs and the changeability of these regulations. Labour costs in a region also play a role.

11.5.1 Results: best rating from the secondary sector, regulation a focal point

In general, the qualities of the regional infrastructure are rated as positive. With regard to the food cluster in the broad sense, ratings by entrepreneurs from the primary sector and from Voorne-Putten are particularly noteworthy. They are significantly more likely to view the regional infrastructure as an obstacle (see Figure 41). When we examine the specific qualities of the infrastructure (Figure 42), it is immediately obvious that legislation, together with the changeability of legislation, is seen as an impediment to entrepreneurship. The average rating for these aspects is significantly lower than ratings for 'hard infrastructure' (accessibility, digital infrastructure). Therefore, these constitute focal points for the regional development agenda.

Figure 41 Entrepreneurs from the primary sector and from Voorne-Putten are more likely to see obstacles in the region's infrastructure.

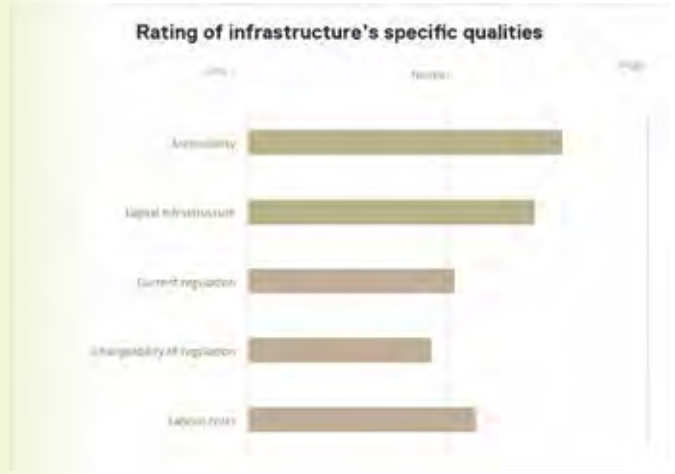

Figure 42 Regulation in particular is viewed as an impediment by entrepreneurs.

11.6 Entrepreneurs' focal points

It is not only the development of the regional infrastructure that deserves attention; the substantive themes on entrepreneurs' agendas also offer possibilities for increasing regional innovative capacity. These are themes that entrepreneurs expect could be decisive in the future. A regional development agenda could respond to them by promoting knowledge related to these themes and bringing parties together.

11.6.1 Results: social themes dominate the agenda

Entrepreneurs were presented with a range of themes and asked to indicate whether they considered that the themes could be of strategic importance for the future of their business (see Table 11 for the full list of these themes and an explanation). The results in Figure 43 show that social themes dominate the agenda, in addition to the almost obvious technological issues such as precision farming and the Internet of Things. The difference in attention to ethical issues in relation to the food cluster in general stands out. The 'precision farming' topic was only presented to entrepreneurs on the islands, and not to urban entrepreneurs in the Rotterdam Food Cluster or greenhouse horticulture entrepreneurs from Westland and Oostland.

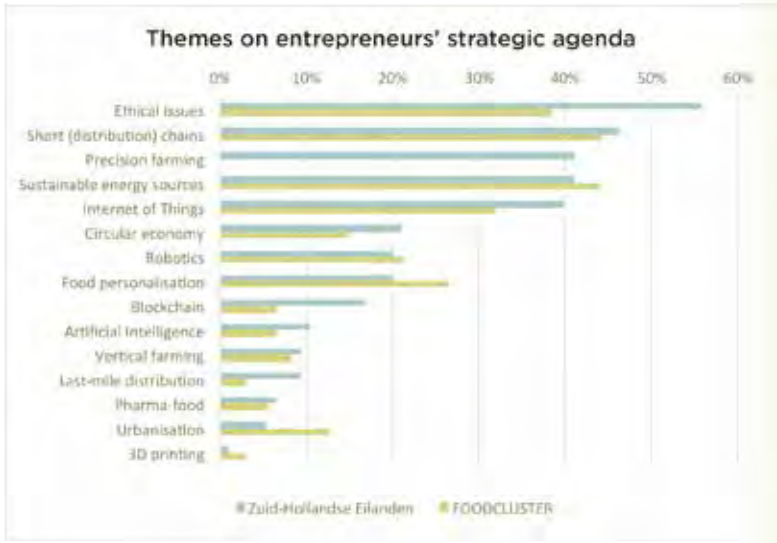

Figure 43 Themes that are on the agenda of at least one in five entrepreneurs.

Themes
Ethical food issues related to food security, sustainability and/or food supply*
Short (distribution) chains - direct sales of products to the consumer*
Precision farming - accurate treatment of agricultural land*
New energy sources - use of sustainable energy sources*
Internet of Things - devices connected to the internet*
Circular economy - recycling, reducing food waste*
Robotics - the practical application of robots*
Individualisation / personalisation of food - adapting food production to meet individual (customer) preferences
Blockchain technology - digital database that maintains and verifies information
Artificial intelligence - self-learning software based on data
Vertical farming - form of farming with stacked growing layers
Last-mile distribution - transport from the distribution centre to the shopkeeper and consumer
Pharmaceutical technology (pharma-food) - developing fruit and vegetables with medicinal properties
Urbanisation - gradual expansion of densely populated areas
3D printing - machine that can produce three-dimensional objects
* Only themes whose relevance was acknowledged by at least 20% of respondents are included

Table 11 Overview of themes that were presented to the entrepreneurs.

11.7 Developing innovative capacity

The capacity of businesses in the food cluster on the ZHE (The islands south of Rotterdam) to innovate their business model is generally equal to those in the business community in the Netherlands as a whole. The focus is more on improvement (exploitation) rather than renewal (exploration), but it is not out of balance as a result. The main building blocks for the business model innovation – besides technology – usually consist of human capital and the enterprise's organisational form. As far as human capital is concerned, there appears to be sufficient potential for innovation among the businesses in the food cluster. However, to further stimulate the innovation of business models, greater focus is needed on developing adaptive management styles, an entrepreneurial culture among managers and less rigid organisational structures.

We draw a similar conclusion with regard to the ecosystem of companies and institutions in which entrepreneurs collaborate to achieve innovation. Basic networks seem to be available, although there is still work to be done to achieve far-reaching innovation. Companies mainly collaborate with their suppliers and customers, and also with knowledge institutions in a quarter of the cases examined. It is precisely the diversity of an ecosystem that promotes innovation. In order to develop more diverse networks, you need new connections between existing companies in the food cluster and actors such as start-ups, business service providers and companies from different sectors.

The regional innovation climate is generally rated as positive, although farmers rate it substantially lower. This large sector faces major challenges, as revealed in Part 1 of this study. Regulation in particular, together with its changeability, is considered an impediment to innovation. The themes on entrepreneurs' agendas are characterised by their social nature. Ethical issues, chain shortening and precision farming dominate agendas, in addition to sustainable energy sources and the Internet of Things. This is where, according to this study's respondents, the starting points lie for renewal in the regional economy.

12 Conclusion: limited use of innovation, despite a favourable climate

Limited use of innovation

Compared with the average business in the Netherlands, the companies studied in the food cluster only focus on innovating their business model to a limited degree. This applies to the business model improvement (exploitation) as well as business model renewal (exploration). The focus is on improving and expanding the existing business model. If this result is representative of the food cluster as a whole, it raises concerns. Joining the Next Economy requires a generous dose of innovative capacity.

Noteworthy results:

- Processing firms perform better than average in terms of exploration and exploitation and have found a balance between these forms of innovation.
- Medium-sized businesses take more advantage of a business model exploitation than do small businesses. Apparently, a certain scale promotes the capacity to innovate.
- Business model innovation is primarily achieved in the food cluster through innovative management. Management is especially important with regard to exploring new forms of value creation. The organisation appears to play a less important role.

Collaboration predominantly takes place within the chain

Moreover, the business model exploitation is mainly achieved in association with chain partners. For fundamental renewal, people also turn to parties outside the chain, such as knowledge institutions and service providers.

Medium-sized companies operate in heterogeneous cooperation partnerships (with multiple types of parties) more often than smaller companies. Fully 74% of medium-sized businesses collaborate with more than two different types of innovation partners, almost twice as often as small businesses. However, we also see that businesses mainly innovate with others in the food value chain, and to some extent with educational institutions.

Focus on social developments in a favourable regional innovation climate

The strategic themes on the agenda of the companies studied are primarily related to social developments. The energy transition, shorter chains and ethical issues take precedence over matters such as digitisation and robotisation.

The region provides virtually all the facilities businesses need to innovate. In particular, the proximity of suppliers, service providers and a sales market plays a role.

Possibilities for interventions

- Give processing companies a positive stimulating role in innovation projects; they are the frontrunners in balanced innovation.
- Help smaller companies which themselves lack sufficient scale to innovate, for instance through bundling resources.
- Support the development of more entrepreneurial managers focused on renewal. Research the extent to which innovative organisational forms could contribute to renewal within the cluster.
- Strengthen cooperation partnerships between chain partners and support the development of new relationships with ‘unfamiliar’ innovation partners for more radical renewal.
- Facilitate knowledge development around ‘social changes’, possibly combined with technological innovations.
- Maintain and emphasise the positive innovation climate in the region.

Appendix: characteristics of respondents

An initial questionnaire was sent to 923 potential respondents. Prior to the questionnaire being sent, respondents were contacted by telephone and asked to provide an e-mail address. This group was made up of a selection of company directors included in diverse databases of the Municipality of Rotterdam and Greenport Westland-Oostland.

A second questionnaire was sent to 480 entrepreneurs on the ZHE (The islands south of Rotterdam). A long list of companies was compiled for this survey, produced using SBI codes and postcodes. Companies with more than ten employees were approached by telephone to ask if they would be prepared to fill in the online questionnaire (104 companies in total). Smaller companies (376 businesses) were approached in writing.

Ultimately, 331 entrepreneurs completed the questionnaire in full. A rough breakdown of respondents by sector – primary or non-primary – and by origin, whether ZHE (The islands south of Rotterdam) or RFC (including Westland-Oostland), reveals a significant over-representation of the horticulture sector in Westland-Oostland (see Figure 44). However, this is also consistent with the region's profile (see Part 1 of this report).

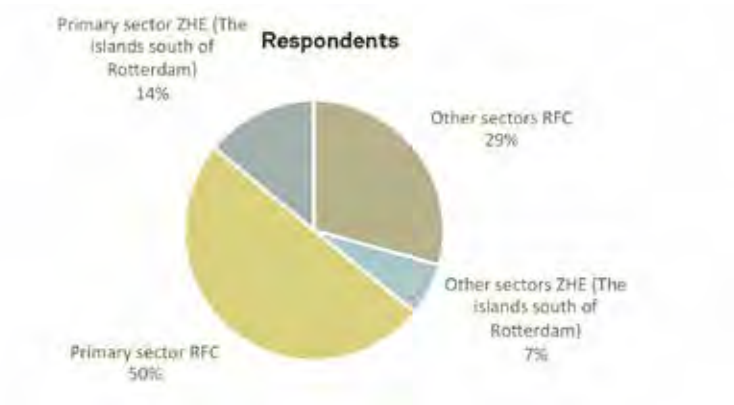

Figure 44 Breakdown of respondents by region and primary/non-primary sector.

A further breakdown by sector and company size shows once more that, in terms of the numbers of premises, small agricultural businesses dominate the sector (see Figures 45 and 46).

A large share of respondents (62%) work in small companies (those with up to ten employees). One third work for medium-sized companies (up to 250 employees).

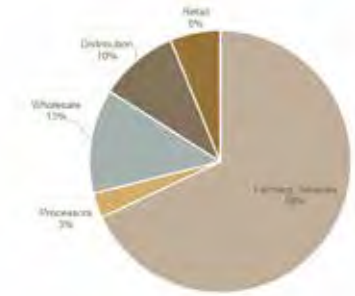

Figure 45 Breakdown of respondents by sector.

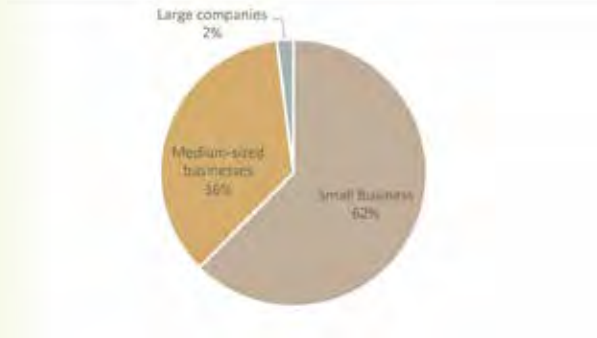

Figure 46 Breakdown of respondents by company size.

Of the respondents, 84% ultimately belong to the 'director' category. The other respondents are operational managers.

Footnotes

[189] The difference in the business model exploitation is only significant with regard to the farming business and fishing. The difference in exploratory innovation is significant with regard to all business sectors.
[190] Since the number of really large companies in the data set (and the food cluster) is limited, we concentrate on the differences between small and medium-sized companies.
[191] We do not formally refer to 'effects' of management or innovation, but to 'relationships between...'. The study does not enable us to demonstrate a causal relationship. In the literature, the causal relationship is often assumed.
[192] This conclusion should be interpreted with a certain degree of caution: the differences are not great enough to be statistically significant.
[193] The differences between Hoeksche Waard and Voorne-Putten are statistically significant.
[194] Research conducted by professors Volberda, Van den Bosch and Jansen in 2007 reveals that just 25% of the success of innovation depends on technology; the other 75% depends on social innovation (smart management & innovative organisation).
[195] Here we include the clusters of Westland and Oostland, Rijnmond, Barendrecht/Ridderkerk and the Zuid Holland islands (ZHE).

Part 4

A glimpse of the future of the Rotterdam Food Cluster

Dr N.P. van der Weerdt, Erasmus Centre for Business Innovation

With thanks to Joep Breurkens, Niko Gang, Kamja Yekta, Jabbari Fumani and Marissa Oude Weernink, students at the Rotterdam School of Management

13 Why and how do the businesses of the future innovate?

In the previous chapters, we examined the innovation climate of the region and the capacity of businesses in the food cluster to innovate. This chapter looks towards the future. We study the business model of particularly innovative enterprises and compare various entrepreneurs, businesses and convictions. We demonstrate the form entrepreneurship in Rotterdam could take in the future. How and why are new businesses created? How are they organised and what do they need? What role does innovation play, and how do they earn their money? In short, what shape will the business model of the future take in the Rotterdam food cluster?

The businesses described in this study were selected on the basis of their innovative business models, using the business model canvas.[196] This model describes an enterprise using nine building blocks (see the explanation in Chapter 14). The businesses eligible for selection all innovated in more than one building block, which allowed them to develop a new configuration of the building blocks, or a new business model. This makes each and every one of them interesting. We can say something about the future by looking at their similarities.

To illustrate these similarities, the businesses first have to be studied individually. To this end, we spoke to the entrepreneurs and used public sources. The insights gathered formed the basis for an analysis of the similarities between the innovators in the Rotterdam Food Cluster.[197]

Businesses have always innovated. What is striking about the businesses of the future is that they do not only innovate as a result of economic motives. Social motives are increasingly playing an important role – sometimes the main role, as at Rotterdamse Munt and Stichting Instock (see graphics). However, we only consider companies to be true pioneers when social and economic motives play an equal role and new technologies form the basis of the new business model. We highlight two businesses in particular: Floating Farm and Duijvestijn Tomaten. We provide detailed portraits of these companies later in this section. They are, respectively, a newcomer and an established player in the food cluster. After all, the future does not only involve start-ups. Established businesses' experience and power to invest provide considerable leverage and can significantly increase the impact of innovation.

Figure 47 includes all businesses featured in this study based on their drivers of innovation (as interpreted by the researchers). The vertical axis shows the extent to which these innovative businesses are driven by economic value creation, by which we mean market-driven innovation. The horizontal axis portrays the businesses on the basis of social motives. Companies that score well here are driven by an idealistic vision. Although both motives for entrepreneurship are ethically sound, each one has its distinctive characteristics. We describe them using four types: 'the Businesspeople', 'the Conservatives', 'the Pioneers' and 'the Benefactors'.

Today's society is seriously impacted by technology, particularly new technologies. This also applies to the Rotterdam Food Cluster. Therefore, in addition to the driving forces, we devote attention to the role of technology in the development of new business models by these businesses. Do they view technology as an objective in itself, or as a means to an end? Technology as a means to an end describes the use of new technology in operational processes. Technology as the objective involves integrating technology into the end product.

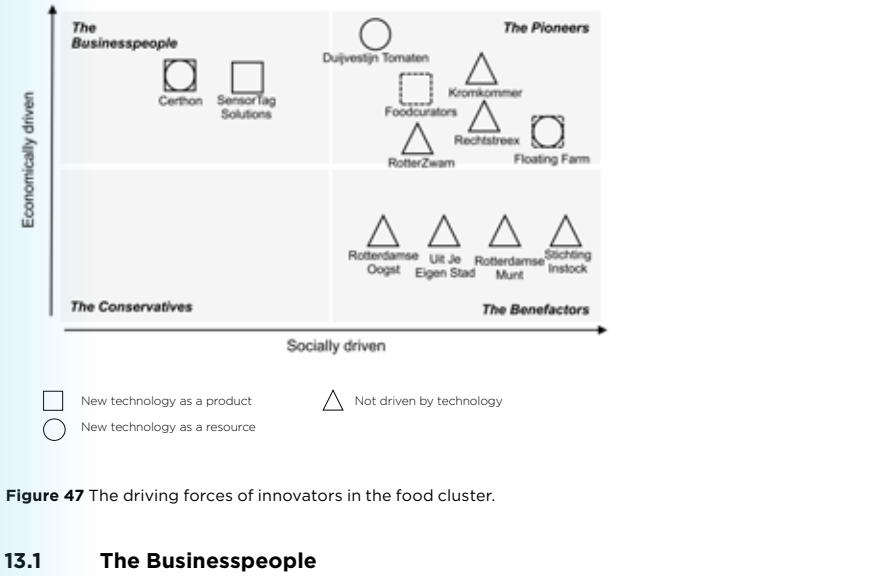

Figure 47 The driving forces of innovators in the food cluster.

13.1 The Businesspeople

The Businesspeople represent companies that first and foremost focus on creating added value for their customers and financial value for the business. This is often accompanied by embracing innovative technology. The Businesspeople create value in different ways with the help of new technology. On the one hand, they use technology to deliver products that are better in qualitative terms or to make a production process more efficient. In this scenario, technology is a resource. On the other hand, technology could be an objective. In that case, technology is integrated into the product and sold to the customer. This usually happens in the form of 'hardware' or 'software', but could also consist of a transfer of technological knowledge.

Innovations produced by Businesspeople often also carry a social benefit. By working more efficiently and thus creating added value for shareholders, fewer raw materials are consumed, although economic gains do take precedence. Potential social benefits are used to acquire a better market position or are viewed as a welcome added bonus. These companies will not invest in socially responsible production if the costs exceed the returns.

This group often makes relatively high investments, in the hope of developing a superior product. Therefore, most Businesspeople enter into cooperation partnerships with knowledge institutions. By acquiring knowledge, Businesspeople hope to be able to evolve into market leaders.

Certhon Greenhouse Solutions *is active in the greenhouse horticulture sector and has a turnover of around €70 million. The firm was founded in Poeldijk in 1896, and is still owned by the family. It is known for its reliable, innovative and sustainable solutions. Certhon describes itself as 'a multidisciplinary whole', given that it is one of the few greenhouse construction firms with the in-house knowledge and expertise to connect climate-water and electrical engineering with agronomy. This knowledge is gathered, for example, through internal R&D and open innovation. Certhon's technology is supplied to horticulture entrepreneurs on every continent.*

SensorTagSolutions *supplies sensors that measure the levels of water and fertiliser in the plugs. The company distinguishes itself through the sensors' low price. Greater distribution means that the final measurement is also more accurate than a single measurement, making it possible to address climate variations within a greenhouse. SensorTagSolutions does not focus specifically on the food cluster. The technology behind the sensors could be developed for use in other sectors.*

13.2 The Pioneers

Businesses generally innovate in order to respond to changing market demand and to profit from technological developments, or out of fear of falling behind the competition. The Pioneers take the lead, and also innovate, out of a sense of social responsibility. They often search for solutions to global food and environmental issues with the help of new technology.

Typically, Pioneers are able to integrate smart combinations of both economic and socially responsible motives into their business model. Duijvestijn Tomaten is a prime example. Thanks to the latest technology, this business is now energy neutral. Consequently, over time, it saves money and adds value to the tomatoes produced using an 'ecologically responsible' approach. At the same time there are obvious social benefits, especially for the environment. This is how Duijvestijn consciously innovates economically as well as socially.

Figure 47 demonstrates that Floating Farm and Duijvestijn Tomaten are two pioneers of the Rotterdam Food Cluster. What the two businesses have in common is that they both use technology as a resource and attach a great deal of importance to sustainability. At Floating Farm, sharing knowledge constitutes a second objective (in this sense technology is thus also a 'product'). Furthermore, both companies operate at the beginning of the value chain and their founders have a vision that is not limited to making a profit. The Pioneers group generates social value and is therefore also able to create economic value and appropriate it. We describe Duijvestijn Tomaten in more detail in section 16.1, and Floating Farm in section 16.2.

rotterzwam *is known for cultivating oyster mushrooms on coffee grounds. By using this waste product, RotterZwam makes sustainability tangible. In association with Banketbakker van der Heijden, the company also produces oyster mushroom croquettes and 'bitterbal' snacks. In addition, RotterZwam provides training courses and guided tours, with the aim of motivating and training entrepreneurs to also do business sustainably and thus combat the plundering of the earth. RotterZwam has also made it possible for private individuals to grow oyster mushrooms at home using the Growkit, which is sold both at home and abroad.*

What makes ***Foodcurators*** *unique in our selection of innovators is their role in the food chain. Instead of staking out a clear-cut position, the business plays a supporting role. It reinforces the chain at several different points. The company first links food, and food-related issues, to image formation. Instead of solving food issues or improving food, Foodcurators is mainly involved in visualising these issues, thereby providing new technology to its customers in the form of knowledge. Although things were challenging in the beginning, Foodcurators has since evolved to become a profitable company.*

Kromkommer *sells soups produced from 'deformed' vegetables that have been deemed unsuitable to be sold normally in the supermarket. The use of these waste flows is sustainable because it combats food waste. Kromkommer is one of the few companies that serve the Dutch market. The business was also founded in Rotterdam, and the Kromkommer brand is fairly well known in the region. The impact made by Kromkommer has developed to such an extent that a number of concerns have started selling deformed vegetables (such as Albert Heijn with its 'Buitenbeentjes').*

Rechtstreex *was founded in 2013 with the mission of bringing local, seasonal vegetables closer to the people. An important step in this process involved linking local producers with their consumers. This means that consumers know where their food comes from, and the producers get a fairer price for their products. The products can be ordered on the Rechtstreex website, after which they can be collected at fixed times from a district collection point. Accordingly, initiator Maarten also describes Rechtstreex as 'a regional, transparent food chain made up of the assortment, the transaction and the logistics'.*

13.3 The Benefactors

The Benefactors category represents businesses (or foundations) whose driving force for innovation is predominantly social in nature. They attach less importance to economic profits. These organisations are idealistic, focusing on areas such as combating food waste, overconsumption and the negative effects of urbanisation. By developing a business model that could contribute to solving these kinds of problems, they make a contribution to society. It is often difficult for them to find a working earnings model, which means that, especially when they are starting out, they frequently depend on other parties or use volunteers.

The strength of these enterprises generally lies in being personal, small-scale and local. There is often little ambition to grow as a business. New technology plays little to no role; it mainly concerns a new concept or a new organisational form. Yet these entrepreneurs prefer to see their ideas and solutions adopted on a large scale, whether with or without their support or brand. As a result of this attitude – and a lack of resources – ideas are sometimes (partly) taken over by large firms that are able to achieve economies of scale and a higher return. This means the Benefactor's goal may be achieved, but the organisation's chances of survival are not improved. We also see this situation among companies from the Pioneers segment (such as Kromkommer).

The Benefactors play a major role when it comes to innovation in the food cluster. They enrich society and provide inspiration for innovation in larger or more traditional companies.

Uit Je Eigen Stad *is an initiative to sow, cultivate and grow food at unexpected sites in Rotterdam such as empty offices, derelict land, or on the roofs of buildings. Cultivating food close to the consumer reduces the distance between the producer and the consumer, whilst increasing appreciation for food. Uit Je Eigen Stad mainly puts customers in touch with producers through catering and hospitality facilities where the products are used. They try to prepare dishes that people would not automatically find appealing, sometimes using products that are less well-known, in order to increase appreciation of them.*

Rotterdamse Munt*, an urban herb garden with several functions, forms a link between the Afrikaanderwijk and Kop van Zuid. In addition to supplying locally-grown herbs with their distinctive value, Rotterdamse Munt focuses on local residents' personal development and tackling problems in the district. The garden serves as an educational meeting place and a place where people who are disadvantaged on the labour market can develop their qualities. Food production thus becomes an interactive exchange in which integration, creating a sense of community and an appealing neighbourhood are key. In this vision, food takes on a new meaning: it becomes a binding factor for the district and the city.*

Stichting Instock *works exclusively in its restaurants with goods that have been written off. Although Instock is not actually based in Rotterdam, it is still included in this study. It is one of the few large enterprises active in the catering and hospitality sector. In addition, it counts Albert Heijn, the largest retailer in the Netherlands, as a major partner. Instock essentially focuses on combating food waste. The organisation's restaurants cook solely using products that have already been written off. Sustainability is key. Its aim in this approach is to make the prevention of food waste tangible and to raise awareness in the Netherlands. In the future it aims to transfer this concept to other forms of catering and hospitality.*

Stichting Rotterdamse Oogst *is a platform that organises events and markets at which food is sold that comes from within a radius of 50 kilometres of Rotterdam. Through these events, Rotterdamse Oogst strives to inform people about and connect diverse food initiatives in the region to reduce the distance between farm and fork. Events that (almost) exclusively involve genuine local products are rare, even though consumers are demonstrating increasing interest in the origin of their food. This is clearly illustrated by initiatives such as Rotterdamse Oogst, which is often jam packed with people right from the first day and which is positively welcomed.*

Fruitleather *began as a school task assigned to two students at the Willem de Kooning academy in Rotterdam. Koer Meerkerk and Hugo de Boom noticed that a lot of fruit was thrown away at the market. The entrepreneurs wanted to use the surplus fruit to create something of value: fruit leather. Due to the sustainable process involved, Fruitleather hopes to be able to compete with leather and other artificial leathers. Fruitleather is currently focusing on the challenge of making the leather more robust so it can be used in more areas. Until then, Fruitleather mainly participates in art exhibitions and stays in touch with its potential future customers.*

13.4 The Conservatives

Businesses in the Conservatives category do not appear in this study. Put simply, they were not selected because we were looking for innovators. Nevertheless, many companies would fit into this category. There is nothing wrong with this on its own: their reason for being is the current market demand and the jobs they currently provide. However, these businesses have little intention to renew their business model, neither as a result of economic motives nor because of social drivers. Consequently they run the risk of missing the boat in the transition to the Next Economy. Companies that can apply new technologies will have a competitive edge over them. Customers and new employees who demand more social commitment from businesses will pass them by. This means businesses in the Conservatives category will ultimately become superfluous and will disappear. There is nothing wrong with that, as long as they are replaced with new activities. The fact that this does not always happen is demonstrated in the previous chapter 'Business dynamics in the Rotterdam Food Cluster'.

rotterzwam: strives to give a useful purpose to as large a proportion as possible of the coffee grounds that are thrown away in the Netherlands.

Kromkommer: combats food waste and is putting wonky vegetables back on our plate. Images: https://www.kromkommer.com

Photography by: Antim Wijnaendts van Resandt

Foodcurators: is concerned with all aspects involved in putting a meal together.

Reefer Service Center: boosts the position of Rotterdam Cool Port as a European hub for logistic flows of refrigerated loads.

13.5 Similarities between innovators in the Rotterdam Food Cluster

This section discusses the various aspects innovators in the Rotterdam Food Cluster have in common. We examine their position in the value chain and their intentions with regard to sustainability.

13.5.1 Position in the chain and the role of the customer

First, there is a clear difference in pattern between companies that occupy a position at the beginning of the chain and those that operate at the end. Businesses that are found at the beginning of the chain usually serve price-conscious customers (in a business-to-business market). These customers primarily focus on lowering their costs and increasing efficiency. Moreover, customer contact is based on co-creation. Co-creation is the joint development and/or production of the product, and it means that the producer is better able to satisfy the customer's requirements.

(Technological) innovation also plays a major role in companies that operate at the beginning of the chain. They can satisfy customer requirements by using and/or selling innovative products and technologies. They achieve this innovation through a major focus on acquiring knowledge. In practice, this results in high investment costs and engaging in cooperation partnerships with knowledge institutions.

The companies studied that operate at the end of the chain often serve environmentally-aware customers. These customers are prepared to pay a higher price as long as the product is produced in a sustainable manner. The entrepreneur plays a major role in the day-to-day activities. Employees help communicate the story about the ecologically responsible production to the customer.

These businesses generally invest less money in research, with the largest cost item being operational in nature. A striking trend is the fact that businesses are shifting their focus from mass communication to personal relationships, in order to communicate their message to the consumer more effectively.

13.5.2 Sustainable intentions

We can also divide the businesses on the basis of the intentions of the founders and the administrators. Some set up a company with the aim of making the world a better place. This group wants to produce in a mindful way, and places sustainability at its core. The second group is focused on economic growth and achieves this by creating value for the customer. Surprisingly, these businesses often do this by embracing sustainability. By operating more efficiently and recycling, the producer and/or customer can save money, which translates into higher profits. On the other hand, environmentally responsible products also offer added value: both consumers and corporate clients increasingly prefer a product or supplier that meets the criteria for corporate social responsibility. Another difference between these two groups is that the first group is often still looking for an effective earnings model, while the second group usually already has a clear vision in this regard.

Lastly, companies are operating more and more in the circular economy. By recycling each other's waste substances they create added value for the supplier, the producer and the customer. The supplier no longer needs to process the waste substances itself, and may even be able to charge for them. The producer develops the waste substances and creates an end product, which it sells to the consumer at a profit. The consumer benefits in two ways. In the first place, the price is lower if the producer passes on the reduced costs to the customer. Secondly, customers know they have contributed to making the world a better place.

There were lots of connections between the companies in the business cases discussed. These companies are well aware of the need to support each other in order to minimise costs or increase value for the end consumer. The 'green' collective business premises 'BlueCity', occupying the former Tropicana swimming pool on the Maas, physically brings diverse businesses together and fulfils a connecting role in the process.

14 Business models of the future

A business model sets out the choices a company has made concerning the way it creates value and how it benefits from this value. The business model canvas is a resource for illustrating this schematically. It comprises nine building blocks, including customer segments, value proposition, core activities and the earnings model. Here, we discuss these elements one by one and describe the main similarities between the innovators in the Rotterdam food cluster. We describe the integral business model adopted by two companies: Floating Farm and Duijvestijn Tomaten (discussed in more detail later in this chapter).

14.1 Customer segments

A business model specifies the selection of one or more customer segments: groups of people or organisations with more or less the same requirements.

We differentiate customer segments with a different attitude regarding sustainability. One type of customer segment appears to be willing to pay a premium for sustainably-produced goods (or for not simply opting for the easiest solution). These are usually consumers with above-average incomes or entrepreneurs at the end of the chain (catering and hospitality and retail) who serve these consumers and distinguish themselves through a 'sustainable offering'. Customers who buy RotterZwam's mushrooms are an example of this. Another type of customer segment is found in the business-to-business (B2B) market. These customers focus primarily on costs and the actual added value (in contrast to the perceived value) of the 'solution' on offer.

One example of this type of customer segment involves customers of Certhon, SensorTag and also largely of Duijvestijn Tomaten. In addition to their attitude towards sustainability – principled or economic – we also see a difference in the geographic scope of the innovators' customer segments. The dividing line is largely equal to that of the two segments described: the customers of the

innovators who pay a premium or make additional effort to 'participate' in the innovator's concept mainly come from the local region. The innovators who focus on customers in the cost-motivated B2B market are characterised by an international focus.

14.2 Value proposition

A value proposition consists of a bundle of products or services and describes the specific and distinctive value of products that are supplied to the selected customer segments.

With regard to the innovators' value propositions, we can differentiate between two patterns that are consistent with the requirements of the different customer segments. The first value proposition is based on efficiency: these companies claim to produce their product and introduce it to the market in the most efficient manner.

The second value proposition is more ideological in nature: these companies' products satisfy customer demand to change the way we think and consume. Higher in the chain, these companies base this proposition on sustainable production methods (such as Duijvestijn Tomaten and Floating Farm), while lower in the chain sustainability is made tangible through the qualities and characteristics of the products themselves.

14.3 Channels

A business model also describes the channels used to communicate the message to customer segments and the distribution and sales channels.

One important pattern relates to the use of social media. Social media form an important channel for communicating with customer groups, but not all innovators use it intensively (such as Floating Farm during this study).

14.4 Customer relations

The business model canvas describes the type of relationship created with different customer segments: short or long-term, a remote or close relationship.

One important pattern identified concerns the type of relationship with the different customer segments. B2B enterprises are often based on personal relationships, whereas business-to-consumer (B2C) companies mainly place the emphasis on mass communication and are therefore less intimate. The business cases analysed reveal a shift in this relationship, with B2C companies increasingly using a more personal approach with regard to their customers, as in the case of Stichting Instock.

A second pattern is related to a development called 'community building'. Especially at the bottom of the value chain, increasing use is being made of a community to reinforce the ideals and basic principles of the company concerned. In other words, personal incentives to take action such as combating food waste can be boosted when there are others who share these incentives.

14.5 Revenue flows

Revenue flows are created when the value proposition is offered to the customer segment. These flows may consist of a price paid per product or, for example, for a subscription to be able to use a service for a certain period of time.

First and foremost, it is apparent that the diversity in types of income sources increases the closer businesses are to the end consumer.

In addition, businesses that are market driven often seem to have a clear-cut earnings model in mind. The socially-driven innovators are often still looking for the right model.

14.6 Core activities

The core activities that receive most attention in the canvas model are those that form the basis for achieving the distinctive aspects of the value proposition. What does the company do to create this distinction?

The great diversity of companies described here means that there are few similarities in their core activities. What does stand out is the fact that innovation – by definition – represents an important activity. Businesses higher up the value chain mainly focus their innovation activities on improving existing business activities (exploitation of the business model). In contrast, businesses closer to the end user, at the bottom of the value chain, focus primarily on discovering possible alternatives (exploration).

14.7 Essential company resources

These company assets are the most important for implementing the core activities and achieving the value proposition. These are the assets available to the company itself (in contrast to assets obtained from partners).

Human capital is especially important for socially-driven innovators, with the efforts of the initiators (entrepreneurs) being essential. For the other innovators, technical expertise is often a distinguishing factor and less dependent on a single person or a small group.

14.8 Partnerships

Key partners are understood to be suppliers that supply resources or carry out activities that are essential for the company to achieve its value proposition.

Partnerships have been shown to be extremely important, not least for processing waste flows. Floating Farm is no exception. The business collaborates in a chain of partners in which cow dung is used to generate power. Most of the (crucial) partnerships between innovators in the food cluster seem to predominantly come from the entrepreneurs' personal networks. The city of Rotterdam is also viewed as a partner, although the call is often still heard for a more proactive attitude by the municipality, for example by putting companies in touch with each other.

Moreover, it emerged that the idealistic enterprises in the cluster are well connected to each other. The businesses know each other, know where to find each other and view each other as partners on a mission. For example, Duijvestijn Tomaten is an important supplier to Kromkommer. They collaborate extensively with educational institutions too, especially with Delft and Wageningen universities: Delft because of the technical knowledge available and Wageningen because of their knowledge in the field of food technology.

The range of partnerships is highly diverse and includes large corporations such as Philips and Albert Heijn as well as individuals such as students and professors.

14.9 Cost structure

The cost structure is used to describe the main cost items necessary to exploit the business model.

Human capital is essential for the innovators, and this is also apparent from the costs. For the facilitating companies upstream, this translates into activities such as maintaining the level of knowledge. Retaining people who possess specific expertise can make substantial demands on the budget. For these companies, many costs are also related to R&D projects, while this is less the case for the other innovators.

For the processors in the value chain the emphasis is more on increasing awareness among their target groups about issues such as food waste. Consequently, marketing and communication consume a lot of time and energy. Developing economies of scale represents a challenge here, and the Municipality of Rotterdam may have a role to play in this respect. Achieving economies of scale in production also plays a part, for example, in the production of Kromkommer's soups or in developing sufficient mass to process waste flows more efficiently, such as the waste flows of coffee grounds that are used by RotterZwam.

15 Ecosystems and alignment with the Next Economy

Businesses are not viewed as part of a sector, but as part of a 'business ecosystem'.[198] In such an ecosystem we find a separate network of distributors, suppliers, outsourcing companies, competitors, customers and many other organisations.[199] Due to the flexible boundaries and relationships between these groups, an ecosystem goes further than a traditional value chain, partnerships or outsourcing. By using a business ecosystem, companies can provide complex solutions and focus on their own activities at the same time.

Figure 48 illustrates the main elements of the ecosystems of the innovators studied. The businesses are plotted on two axes. The semicircle stands for the traditional value chain, namely production, processing, distribution and the customer as the last step. Some of the businesses can be divided into these categories. The companies on the horizontal axis represent the facilitators. They do not have a permanent position in the value chain, but encompass several steps or are involved in related activities. Around these companies are the principal and most frequently cited partners who collaborate and provide support for innovation and other activities. This is done in several ways, including by sharing funding, knowledge and information, goods and services.

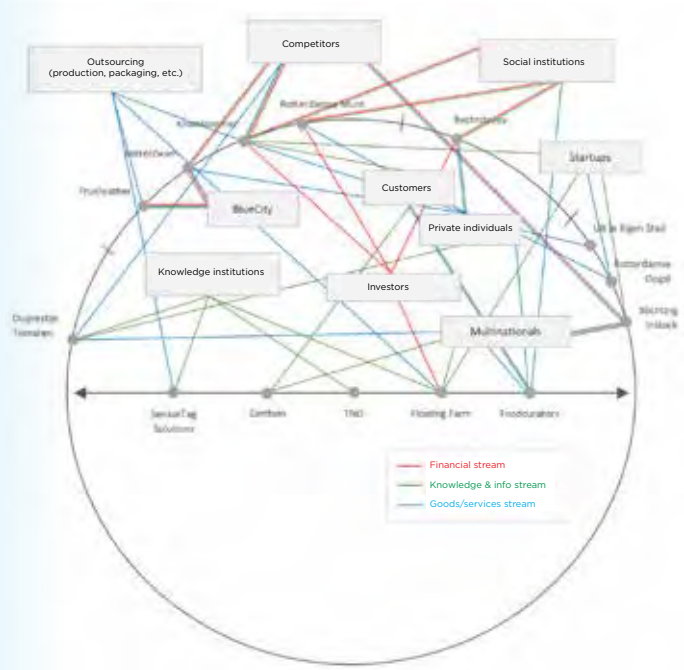

Figure 48 The innovators' ecosystems.

A number of observations can be made based on this figure. We see that the smaller, idealistic businesses at the bottom of the chain are usually connected. This takes place, for example, through BlueCity, as well as via similar social enterprises or through direct links. There are connections between Rotterdamse Munt, Rechtstreex and Rotterdamse Oogst and Uit Je Eigen Stad. They support each other with information, funding and activities.

There seems to be less of a network among the larger companies at the beginning of the value chain. This is logical, because they have more resources and are thus less dependent on other parties. In order to innovate, they mainly collaborate with knowledge institutions or parties that bring in customers. The role of start-ups and multinationals appears limited; neither is there much collaboration with competitors. Connections are often obvious and mainly arise as a result of practical considerations. This indicates that, apart from a few exceptions, collaboration and support aimed at innovation is limited in the current ecosystem.

15.1 The food cluster and the Next Economy

The plan for the transition to the Next Economy is based on five pillars: smart digital delta, smart energy delta, circular economy, entrepreneurial region, and next society. Below, we describe how the innovative businesses in the food cluster contribute to these transition paths.

Smart digital delta

Surprisingly enough, in the selected businesses we see relatively little investment and innovation in the field of data infrastructure. The use of data could deliver considerable value, especially for growing crops. It could enable efficient cultivation, which provides savings in all kinds of areas over time. Although the selected businesses cases do not focus specifically on this point, with a few exceptions (such as SensorTag), the food cluster plays a major role in creating a smart digital delta.

Smart energy delta

Searching for smart systems for energy, heat exchange, water and other systems is the order of the day. This primarily occurs at the beginning of the chain, where the crops are grown. Duijvestijn uses its own geothermal system to heat the greenhouses. Whether the focus is on sustainability, efficiency or cost savings does not really matter; it all contributes to a smart energy delta.

Circular economy

This theme cropped up repeatedly during the study. Today, mainly small businesses are looking for opportunities to process waste flows to produce new products. This is achieved using surplus food to make new edible products, as well as with food leftovers that are used for other purposes. In addition, we see initiatives at large companies to use waste flows in a sustainable manner in society. This means that the food cluster actively contributes to a circular economy.

Entrepreneurial region

It is encouraging to see that innovation is taking place in so many areas, in small and well as large companies. These innovators are the first movers and they have the disruptive potential in-house to make a difference for the cluster. This will also spur on others in the cluster to innovate in certain areas, depending on their resources and possibilities.

The people and initiators behind the innovations are valuable and must be stimulated to achieve the very best from themselves and their business.

Next society

This aspect focuses on creating an inclusive society. This recurs in a large number of businesses concerned with involving citizens and other parties in producing food in a completely new way. Citizens are made aware of the origin of their food and how it can be improved. Over time, this inspires large companies to come up with new innovations.

We can conclude that most of the pillars of the Next Economy are visible within the innovative businesses in the food cluster. Consequently, the innovations produced are consistent with the Municipality's vision, and businesses and the Municipality can support and motivate each other to move forward along this path.

15.2 Are these really the businesses of the future?

In relation to the disruptive potential of the thirteen innovators described, major differences can be observed. If we follow the definition of strategy guru Christensen,[201] that it concerns a simpler product for a different target group with the potential to turn a market upside down, there appear to be few disruptive innovations in the Rotterdam food cluster. So, are these really the businesses of the future?

According to Christensen, a disruptive innovation is further characterised by the fact that existing businesses do not immediately view the newcomer as a competitor. The innovation and/or business models of the newcomers initially trigger the impression of inferiority, predominantly due to the lower quality of the product. Once the new suppliers improve their quality, the middle segment soon takes notice, but by then it is often too late for existing players to stop the newcomer.

Globally, we talk about two disruptive trends in the food industry. The first one is smart food. This means that companies use technology to combine existing ingredients and develop new food products. Thus technology helps to combat hunger and food waste in the world. TNO is an interesting example of this, with its 3D food printers.[202]

The second global disruptive trend in the food industry concerns the urbanisation of food production. This arises from the need of consumers to know what they are eating and where their food comes from. Vertical farming, a form of farming that uses stacked layers of cultivation, is a possible solution for producing food on a large scale in the vicinity of major cities. Other businesses in the food industry respond to this by increasingly shortening the

value chain. Rechtstreex is a well-known example in Rotterdam. Scalability issues do play a role in this regard. The concept of Floating Farm has the potential to be scaled up and change food production (with a global impact).

Yet it appears that the potential of the businesses described to fundamentally disrupt their markets is limited. One explanation for this is that the companies labelled as non-disruptive are usually not driven by technology either. This reduces the possible scalability and thus the potential impact. Moreover, although it has been demonstrated that idealistic ideas and solutions could be disruptive, the scale of the businesses in the Rotterdam food cluster is too small and they are dependent on people (founders, volunteers) or investors. These companies do identify the underlying problems and are aware of them, and this often serves as a source of inspiration for business model innovations at established businesses. If the Rotterdam Food Cluster wants to have a disruptive impact on the worldwide food industry, it would be worthwhile examining whether greater emphasis on the development of scalable technology and concepts could contribute to this aim.

16 Pioneers in the spotlight

16.1 Duijvestijn Tomaten

Duijvestijn Tomaten has been run by the Duijvestijn family for over ten generations. Brothers Ted, Peter and Ronald Duijvestijn took the company over from their father in 1988. They built a new greenhouse in Wateringen and later on a completely new complex in Pijnacker, which made the company a stronger player on the tomato market.

The firm cultivates dozens of tomato varieties, with annual production amounting to approximately ten million kilos. Tomato products, including oven-dried tomatoes, are also produced under the brand name Frezta.

Together with fellow growers, in 2001 Duijvestijn Tomaten founded the LogiFour tomato cluster, a flexible form of collaboration in which growers jointly align their supply to demand. LogiFour takes care of the packaging and distribution of the cultivated tomatoes. Duijvestijn Tomaten fulfils a leading and facilitating role in the cluster.

Duijvestijn Tomaten is an innovative business. It is one of the few growers to use geothermal heat to make the growing process more sustainable. The company also sells green energy, and is currently working on developing medicines derived from vegetables. The firm also plans to produce food with the help of 3D printing.

16.1.1 Business model

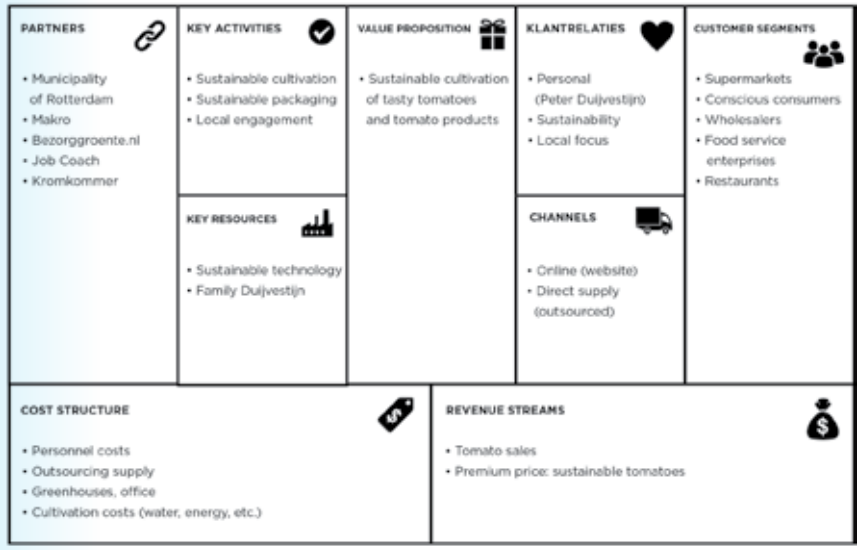

Figure 49 Duijvestijn Tomaten's business model canvas.

Customer segments

The many applications available for tomatoes provide a diverse customer portfolio. Duijvestijn's tomatoes find their way to supermarkets, wholesalers, restaurants and production firms, among others. Kromkommer, which makes soup from 'deformed' vegetables, also uses the company's tomatoes. The focus on sustainability and innovation provides Duijvestijn Tomaten with a competitive advantage: the company's innovative growing processes and sustainable energy policy appeal to many customers.

Value proposition

Duijvestijn Tomaten is known for the high quality of its tomatoes and the diversity of the tomato varieties it grows, which include Silky Pink, Prunus, Elanto and Arvento. The innovative and sustainable production method also adds value. Moreover, Duijvestijn has taken over the packaging process itself and the company implements a sustainable personnel policy, of which training courses and a job coach are important components.

Duijvestijn Tomaten is the only grower that processes its own products to create oven-dried tomatoes and tapenades. This is done under the Frezta brand name. These ready-made products are also produced sustainably. They can be purchased from online stores and wholesalers.

Channels

The cultivated tomatoes are sold to various cooperatives, such as The Greenery. In recent years these channels have consolidated considerably. The cooperatives first operated regionally; now there are much larger players resulting from mergers. The smaller cooperatives that remain focus on specific markets. Partly due to the (compulsory) mediation of the cooperatives being relaxed, more customers are placing orders directly

with Duijvestijn Tomaten, thereby shortening the chain in the tomato sector. Duijvestijn Tomaten's products are packed and transported by LogiFour, a company in the tomato cluster in which Duijvestijn Tomaten participates.

Customer relations

Since the chain is shorter, Duijvestijn Tomaten is getting closer and closer to the end consumer. The introduction of the Frezta brand has also reduced the distance to the end consumer. As B2B is still the core of the business, social media is not extensively used for customer communication.

Revenue flows

The main source of income originates from tomato sales, both pure and processed. Prices are currently under pressure from serious competition from across Europe, and the economic crisis has taken its toll. By collaborating with, for example, Spanish growers, Duijvestijn also managed to build up a market share during the winter season.

Income partially originates from innovative products. One example is the ID Kas®, which is controlled using a variety of modern technologies. Duijvestijn Tomaten aims to use this innovative greenhouse to stimulate sustainability in the sector. The earnings model lies in knowledge transfer and implementation.

Innovative food concepts can generate extra revenue flows. The LogiFour cooperation partnership has evolved to become a powerful player that packs and transports not only Duijvestijn's tomatoes, but also those produced by other businesses.

Power generated by Duijvestijn Energy provides another source of income: power is sold directly to consumers. According to expectations, the medicinal branch of the business will start to generate revenues in the foreseeable future.

Company resources

The fact that the business is run by the Duijvestijn brothers provides a 'brotherly' atmosphere. Great importance is attached to togetherness, enabling the brothers' unique individual qualities to thrive. Innovative technology plays a major role. The company has replaced fossil fuels with bio-energy and the ID Kas® uses an innovative climate control system.

Core activities

Duijvestijn Tomaten's core activities focus on the cultivation process (sowing, cultivating, harvesting). Other functions in the business involve personnel and organisation, stock/sales, processes and energy. Apart from Teelt & Energie, for which Ad van Adrichem is responsible, all roles bearing ultimate responsibility are fulfilled by Duijvestijn family members.

The company has always felt the urge to develop new concepts and ideas. Part of the land is dedicated to developing medicinal solutions. One example is the bitter melon, originally from Vietnam, which can be used to produce medicine for diabetes. This secondary activity is not (yet) profitable and is carried out on a relatively small scale, together with other organisations.

The firm has its own energy branch: Duijvestijn Energy. This idea arose during the transition from fossil fuel to bio-energy. This subsidiary generates so much power that a surplus can be sold.

Partners

Due to its size and innovative character, Duijvestijn Tomaten has a large number of partners. A lot of technological knowledge is acquired externally. The collaboration with Technokas, largely responsible for the development and implementation of technology for the ID Kas®, is a prime example. Other institutions provide knowledge and subsidies for the development of sustainable methods. The ID Kas® is mainly financed by the Ministry of Economic Affairs' Market Introduction for Energy Innovations (MEI) scheme and the Rabobank.

Although Duijvestijn Tomaten is increasingly doing more itself, the business is still dependent on a few important partners. For example, it does not develop the seeds in-house, instead purchasing them from specialist companies such as Monsanto and Rijk Zwaan. With regard to knowledge and research into new crops, Duijvestijn Tomaten often collaborates with Wageningen University. Research is under way with Erasmus University into healthy food and the company collaborates almost constantly with Inholland University of Applied Sciences on study programme assignments. Automation of the process is partly made possible with the help of HortiMax. Partly due to the large cultivation area (over 100,000 m²) and the expansion with the new ID Kas®, the company has a lot of contact with the Municipality. Ted Duijvestijn is closely involved with research into the food cluster in Rotterdam. This illustrates the close relationship.

Cost structure

Even though Duijvestijn Tomaten makes considerable cost savings on energy and water consumption thanks to its sustainable cultivation, that cultivation still constitutes its highest cost item. Greenhouse construction and maintenance involve major expenditure. Personnel costs not only concern growing, harvesting, packing and transporting the tomatoes, but also increasingly sales and marketing, bookkeeping and process management.

16.1.2 Ecosystems

Primary ecosystem

Seed selection is managed by specialist firms such as Monsanto and Rijk Zwaan. The seeds are sown by specialist growers, where they grow into small plants without fruit. After between four and six weeks they are planted in Duijvestijn's greenhouses, where the tomatoes can be harvested twelve weeks later. The process begins in December, and tomatoes are harvested from March to the end of October. During this period, approximately 90 people work at Duijvestijn Tomaten; this figure falls to around 25 in November and December. LogiFour packs the tomatoes in various packages and transports them to the customer. A significant amount of sales are determined even before the seeds are planted. Duijvestijn participates in various programmes that involve experimenting with new developments such as the use of new seeds and faster cultivation.

Labour, support and innovation

Despite the high degree of automation, a workforce is still needed. External knowledge is primarily sought from universities, universities of applied sciences and specialist firms that focus, for example, on new cross-breeds of tomatoes. The actual work is mainly performed by migrant workers from Eastern Europe. The competition consists of growers from all over Europe.

16.1.3 Disruptive potential

Dutch tomato exports amounted to $1.8 billion in 2013, which makes our country the world's largest tomato exporter. Many people consider tomatoes to be the calling card of horticulture in the Netherlands.[203] Duijvestijn Tomaten is a frontrunner in the field of innovation and sustainability in the cultivation sector. The techniques and methods applied could be expanded in the sector to reduce its ecological footprint. This generates not only a positive image, but also jobs and cost savings, contributing once again to Dutch tomato growers' competitiveness. The techniques and processes applied by Duijvestijn Tomaten could also be used in other horticulture sectors, such as cucumber cultivation or for other vegetables. As far as developing the medicinal branch is concerned, Duijvestijn Tomaten is in touch with students/researchers and the medical sector. This offers the potential for study programmes that focus on the link between cultivation and medicine, which could also lead to the creation of new jobs. According to the company, the first medicines could already appear on the market in the near future.

Duijvestijn Tomaten believes the current market has a high level of abstraction. Everyone knows that something has to change, but only a few players are actually taking action. A great deal of pioneering work is being done, and supply and demand are poorly matched. In the next five years, Duijvestijn wants to improve the energy distribution network to be able to supply the consumer with power more efficiently. In addition, the firm aims to reduce dependence on the seasons through year-round production.

16.1.4 Rating the business climate

Duijvestijn Tomaten is extremely satisfied with the economic climate of the Metropolitan Region of Rotterdam The Hague. The company received effective support from the Province and from universities and universities of applied science, but believes the relationship with the Municipality of Rotterdam could be improved. More information is required from the medical sector in order to be able to implement the plans outlined. This could be achieved through better collaboration with hospitals. The Municipality of Rotterdam could play a role as facilitator between the technology sector and businesses.

16.2 Floating Farm

The Floating Farm will be the world's first water-borne dairy farm. The first prototype will be established in the Merwehaven in Rotterdam. It will be a self-sufficient farm, where milk production, milk processing and sales of milk products will all be handled under one roof. The cows will be housed in a park-like setting, but will also graze on land.

Image 9 Artist's impression of the Floating Farm.

The concept is being developed by a consortium consisting of Courage, Uit Je Eigen Stad and Beladon. The initiators are aiming to make the city more self-sufficient, bring dairy farming closer to the end consumer and reduce the pressure on the limited available space.

Since the Dutch have lived on and with the water for centuries, a floating farm is a logical step. The best of the Netherlands, of maritime technology and of agri-knowledge will be united in an innovative, animal-friendly and economic manner. The farm has also been affectionately referred to as the 'new Rotterdam theatre on the water'.

But the Floating Farm has also been the subject of debate. The animal rights-focused political party Partij voor de Dieren publicly questioned whether the cows would get seasick. The party accused the initiators of a lack of realism. Nevertheless, on 28 November 2016, Rotterdam's city council decided that construction of the first floating dairy farm could begin.

According to Peter van Wingerden, one of the initiators, the water is the ultimate place to innovate, discover and combine, and the water will have to accommodate world expansion. In his view, urban migration, the global population increase and corresponding climate issues provide an excellent breeding ground for Floating Farm.

The idea for Floating Farm came about after hurricane Sandy paralysed goods flows to Manhattan. In response, the idea emerged of shortening the food chain and bringing production to the city. Van Wingerden says many parties are attracted to this innovative concept and want to be involved from the outset.

16.2.1 Business model

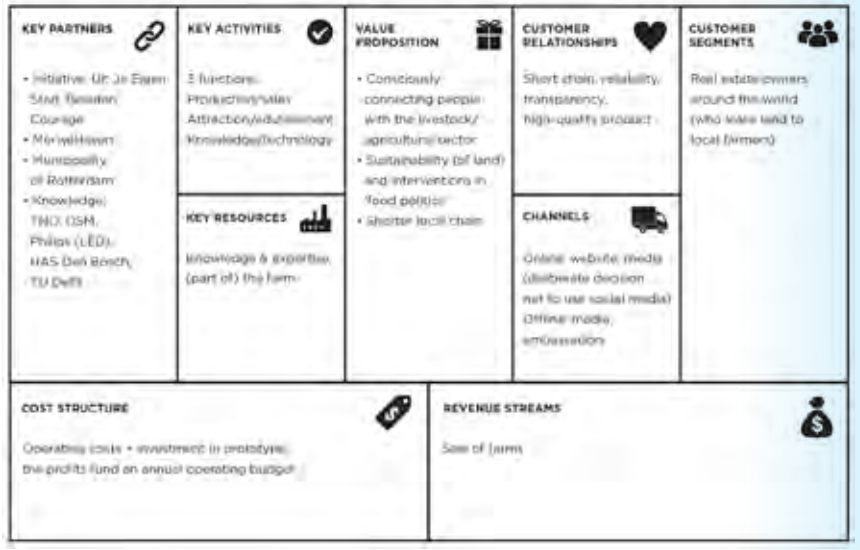

Figure 50 Floating Farm's business model canvas.

Customer segments

The prospects of Floating Farm are primarily real estate owners from around the world. The farm could be set up anywhere where there is water with adjoining land, and then leased by a local farmer. The latter does not fall under the responsibilities of Floating Farm. Municipalities could be major customers of Floating Farm. Now that urban farming is on the rise, Floating Farm is attracting a lot of attention, especially from world cities.

Value proposition

Floating Farm could help solve the global food issue at a time when agricultural land is becoming ever scarcer. The floating farm provides cows with fresh grass 365 days a year, which leads to an increase in Omega 3 fatty acids in the milk. The customer can be supplied with fresh food every day, all year round. The aim is to feed 25,000 people with a single floating farm.

Moreover, Floating Farm puts people in touch with agriculture and dairy farming. The initiative responds to the need expressed by consumers to know where their food comes from. The local ecosystem with a short chain is consistent with the concept of the circular economy.

Channels

Floating Farm is a business-to-business concept in which customers are reached through online and offline channels. The initiators deliberately do not use social media. However, they are busy setting up a community, a so-called fan network, with the aim of acquiring worldwide fame for their concept. Even during the current prototyping, a lot of interested parties are already finding their way to Floating Farm. Customers are primarily found through international networks.

Customer relations

Floating Farm positions itself close to the customer, in line with the current trend in the food industry. The initiators are trying to establish a name that stands for reliability, transparency and high product quality.

Revenue flows

Floating Farm's biggest and most important source of income is the sale of floating farms. Although it is sometimes assumed, it is not true that Floating Farm also aims to generate income through its 'edutainment' aspect.

Company resources

Innovation plays a major role at Floating Farm. The concept originated from cooperation with several organisations and educational institutions. Knowledge and expertise are Floating Farm's most important resources. According to the initiator Peter van Wingerden, Chinese clones will undoubtedly appear, but they will find it hard to match the knowledge and expertise Floating Farm possesses.

Core activities

Floating Farm firmly believes that the space for growth and innovation in the world lies on the water. This approach could prevent problems originating from long chains or a disrupted food supply. Peter van Wingerden is convinced that Floating Farms contribute to a better world.

Partners

The initiators are constantly looking for new partners. The requirement is that, in association with Floating Farm, prospective partners want to tackle the food issue and that their expertise offers added value. To date, partnerships have mainly been concluded with knowledge institutions in the Netherlands, and the company also collaborates with innovative small businesses and suppliers.

Cost structure

The main cost items consist of the building and the necessary materials. No profit is being made at the moment. A major cost item would be represented by the patent for the technology, but Floating Farm is not currently using it. The initiators' philosophy is that if you want to do something good for the world, you shouldn't prevent others from doing the same. However, the brand is patented, primarily to make it a quality label.

16.2.2 Disruptive potential

Floating Farm has great disruptive potential because the concept is very easy to scale up. The related plans are set out in Floating Farm's vision book. The only thing that still needs to happen is that more floating farms have to be rolled out. Real estate owners or businesses such as FrieslandCampina will subsequently lease them to local farmers. One floating farm, possibly combined with a poultry farm and food strip, should be able to feed a city district with 25,000 inhabitants.

Floating Farm expects to be cloned by Chinese companies, but according to Peter van Wingerden it has armed itself with a major technological advantage. A patent application was recently submitted.

Van Wingerden hopes Floating Farm will become an indispensable business concept that also represents non-economic added value for humanity and for the world.

16.2.3 Rating the business climate

Van Wingerden believes the Municipality of Rotterdam is not providing enough support for Floating Farm. 'There are lots of words and few deeds.' If the city were to showcase the project to the rest of the world, that could be fantastic PR for Rotterdam. Floating Farm is on good terms with the port companies, but this was achieved without the Municipality's help.

17 Frontrunners of the ZHE (The islands south of Rotterdam) food cluster

To supplement the statistical studies in Parts 1 and 2, portraits of twelve businesses from the food cluster on the ZHE (The islands south of Rotterdam) were provided (see Table 12). These businesses were selected because of their unique role within the food cluster and their innovation challenges. The portraits describe the businesses' innovations, insofar as the business model includes innovations. In addition, attention is specifically devoted to the innovation network and the role of the Rotterdam food cluster in particular.

17.1 Similarities: stewardship and evading pressure on margins

One striking similarity between many of the companies showcased is the importance they attach to conducting business in an economically and ecologically responsible manner with a long-term focus. The term 'stewardship' is explicitly or implicitly embraced. The close relationship businesses have with nature and the fact that many companies are family-run seem to explain this. Stewardship means that the company will be transferred at some point to the next generation: because of this, people continuously strive to create a healthy business and to prevent farmland or fishing grounds from being overexploited. We identify a major incentive to be innovative in the stewardship concept. After all, an innovative business is also much more interesting for the next generation.

In addition to the more ideological perspective, we also see a common focus with regard to technology: precision farming and optimising yields or fish catches without depleting the source – nature. Here too we see the power of regional collaboration. Suppliers and partners complement each other in the primary production chain, as well as in collaboration related to innovation. Part 2 of this report concluded that companies in the southern food cluster collaborate with knowledge institutions fairly often. These portraits reveal that they mainly do so with Wageningen University & Research and universities of applied science outside of Zuid Holland. Overall, relationships with the Rotterdam food cluster are relatively limited. It goes without saying that a great deal is done through the Port of Rotterdam, but collaboration in the field of product and market innovations and technological innovation seems quite rare. Nevertheless, the entrepreneurs interviewed see possibilities, especially for developing a circular chain, for new applications of information technology and to construct an experimental garden and a growth base of customers.

Company	Municipality	Sector	Core activity/activities	Relevance to the study and/or food cluster
Novifarm	Hoeksche Waard	Arable farming	Cultivation of potatoes and other crops.	Collaboration between growers leads to (1) Acceleration of scale and (2) innovation and increased added value of the basic product. Collaboration with chain partners leads to mutual innovation.
Hoeksche Hoeve/Hoeksche Crisps	Hoeksche Waard	Arable farming, processing industry	Potato cultivation and production (on a relatively small scale) of crisps.	Collaboration between growers leads to innovation and increased added value of the basic product. Collaborating with chain partners leads to further growth and innovation.
Van Iperen	Hoeksche Waard	Supplier	Sale of products for optimising cultivation. Providing advice to farmers.	Disseminating high quality knowledge between sectors within the food cluster and agriculture.
Den Bakker	Voorne-Putten	Diverse	Diverse: agricultural contractor and transport company. Drone survey. Dust control.	Exploration of new technology and business models.
Interfaste BV	Hoeksche Waard	Processing industry	Purchasing, processing and marketing herbs and spices.	Challenges in filling staffing needs.
Nedato	Hoeksche Waard	Wholesale/distribution	Potato trade and logistics.	Represents the link between the producer and the market. Develops new concepts (packaging).
Fisheries innovation centre Zuidwest Nederland	Goeree-Overflakkee	Services	Research and development of fishing techniques.	Contributes to innovative capacity (exploitation) of fishing businesses.
Nederlof's Vishandel BV	Goeree-Overflakkee	Wholesale	International fish purchases and sales.	Besides sales of the basic product, also involved in developing ready-made products.
Bioriginal	Goeree-Overflakkee	Supplier to the food industry	Production of nutrients for the food industry.	Provides high quality components and major R&D efforts.
TTW	Goeree-Overflakkee	Services	Provides advice on optimisation based on data collected.	Contributes to the innovative capacity (exploitation) of arable farmers.
Van Peperstraten	Goeree-Overflakkee	Arable farming / project developer	Sugar beet cultivation. Arable farm real estate agent. Develops circular projects.	Leader in the development of a sustainable chain in which (waste) products are converted into energy and sold to the end user.
Tuinderij Vers	Voorne-Putten	Processing industry	Purchases and processing (washing, slicing, packing) of fresh AGF products for supermarkets.	Purchases locally and forms a chain to the market for growers.

Table 12 Portraits of twelve businesses were provided due to their role within the food cluster and their innovative capacity.

Table 13 includes a brief summery of the main innovative characteristics of the businesses profiled.

Company	Innovation (partners)	Sustainability	Added value	Role of technology
Novifarm	Innovation follows after scaling up. Collaborating with (new) partners in the primary process.	In relation to stewardship: making the primary process more sustainable. Searching for possibilities related to a circular economy.	Pressure on margins forms the rationale for developing concepts that offer greater added value. Quality remains a distinguishing factor.	Precision farming, in association with TTW, Van Iperen.
Hoeksche Hoeve/Hoeksche Crisps	Innovation follows after scaling up. Collaborating with (new) partners in the primary process. International exposure leads to growth.	In relation to stewardship: making the primary process more sustainable. Not profitable without subsidies. For market position (crisps), sustainability must be afforded a key role (developing the most sustainable crisp factory).	Pressure on margins forms the rationale for developing concepts that offer greater added value. Quality remains a distinguishing factor.	
Van Iperen / Mol Agricom	Innovation through cross-pollination of sectors (greenhouse, livestock, arable farming). Collaboration along the entire chain and national and international knowledge institutions. International growth based on knowledge advantage.	Mastering an 'ecological system' leads to higher returns and less pollution. Precision farming is essential in this endeavour.	Works on increasing yields. Optimal management of the ecological system increases returns in the short and long term.	Precision farming: insight into soil composition (camera images), mechanisation (fertiliser injection).
Den Bakker	Mechanisation innovation. Exploration of new business models.			Automation and digitisation are becoming increasingly important, in addition to mechanisation.
Interfaste BV	Market-driven product innovation (flavours). Process innovation driven by legislation. Organisational innovation in relation to personnel.			
Nedato	Scaling up/efficiency as the reason for being. Research upstream (cultivation, Wageningen) and downstream (market developments).	Tension between ecological and economic motives among growers. Investing in sustainable business activities based on good entrepreneurship (such as solar panels).	Pressure on margins forms the rationale for developing concepts that offer greater added value. Quality remains a distinguishing factor.	Precision farming: role as a knowledge centre. *Internet of Things*: collecting and unlocking data for cultivation.
Fisheries innovation centre Zuidwest Nederland	Creating a network for innovation (core activity).	In relation to stewardship: making the primary process (fishing) more sustainable leads to improved fishing grounds and long-term operating results.		Precision fishing, in association with an entire network of partners. Share of IT in technology is growing fast.
Nederlof's Vishandel BV	Innovation with (international) chain partners.		Pressure on margins forms the rationale for developing concepts that offer greater added value. Quality remains a distinguishing factor.	
Bioriginal	Product innovation and market development.		Proposition focused on increasing the added value of food.	Scientific knowledge of possible applications.
TTW	Valorisation of knowledge from Wageningen. Works with Delft on better technology data collection (cameras), also with Novifarm, among others.		Works on increasing yields. Food quality and food value increasingly important. More added value in the future due to a combination with, for example, pharma.	Precision farming: data supplier. Data quality is still insufficient (90% entered manually). Calculation rules development is the core activity (still performed by people).
Van Peperstraten	Creating a network for innovation. Collaboration with 'old' and new chain partners, knowledge institutions.	In relation to stewardship: making the primary process more sustainable and developing its own business model/network for a circular economy.	Generating revenues from a circular business model; maximising yields from the 'farm and fields' and valorisation of waste flows.	Precision farming, possible with TTW, Van Iperen, Den Bakker. Developing new energy sources (waste from sugar beet, hydrogen).
Tuinderij Vers	Innovation in processing techniques (costs, hygiene) and composition of the product (market driven).		Constant pressure on margins from major retailers necessitates efficiency improvements and product development.	Improved slicing techniques and automation to increase efficiency and quality (hygiene).

Table 13 The motivation to innovate, together with the role of technology in innovation, varies from one company to another. The pressure on margins and stewardship are recurring themes.

17.2 Novifarm

17.2.1 On scaling up, precision farming and culinary chip fryers

Five arable farming businesses united to create Novifarm. Five families with a long history in Hoeksche Waard operate under the flag of a single enterprise in which each one retains ownership of the farms and land that have been in their family's possession for generations. The development of Novifarm, named Best Agricultural Entrepreneur 2017, serves as a model for developing a modern agricultural business model.

Most of the families behind this company set up their farming businesses centuries ago, as long ago as the early sixteenth century. During the twentieth century they evolved from general farming businesses to become specialist arable farms, without livestock. Novifarm, a name compiled from the family names Noordam and Visser, was founded in 2007 with the aim of sharing capital-intensive production resources. An initial step towards large-scale, efficient and innovative arable farming was taken by combining construction plans and operational management and jointly investing in mechanisation and precision farming technology. Three more families joined them within a few years: the De Bruijne family in 2009, the Kruijthoff family in 2010 and the Verhoeven family in 2012. These five families jointly manage an arable farming business with 750 hectares of land on which they grow several crops including potatoes, as well as grains and sugar beet.

Image 10 Novifarm was founded in 2007 as a cooperation partnership between the arable farming businesses owned by the Noordam and Visser families. Another three families joined later.

17.2.2 The business model

The essence of Novifarm's business model is fairly simple: farmland is worked to supply high-quality crops to wholesalers and the processing industry. However, the details reveal that this arable farm cannot by any means be called simple or old-fashioned. We describe the different elements of the business model one by one, and we highlight the cohesion that makes Novifarm a modern and innovative enterprise.

The value proposition: sustainable, high quality, supplied in accordance with customer demand

Novifarm supplies traditional varieties such as potatoes, sugar beet and wheat and first-year crops such as onion sets, celeriac and alfalfa.

The company distinguishes itself through the high quality of its products and the capacity to deliver this quality all year round (potatoes). It also devotes considerable attention to sustainable production – partly because the families

attach great importance to good stewardship of the land that they have owned for generations, but also because this allows the business to satisfy expectations from the market. The excellent quality of the fresh products is important for customers so that they, in turn, can distinguish themselves from the competition, such as with fresh chips. To achieve this, it is important to be able to deliver constant quality all year round, including during the six to eight weeks before the new harvest.

Customer groups, distribution channels and customer relations

The entrepreneurs themselves refer to their sales as 'glocal'. Novifarm produces for the local market as well as for export companies worldwide. The products find their way to the consumer via supermarkets, wholesalers, the processing industry and catering and hospitality establishments. The latter category is not a regular customer of arable farmers; Novifarm has independently explored and opened up this budding market. We return to this in more detail in the paragraph about collaboration with Rotterdam's Bram Ladage chain. Although they account for marginal sales, the culinary chip fryers form a unique distribution channel in which Novifarm is able to distinguish itself effectively. This is a channel which, with sales in Poland and France, also appears to be acquiring an international dimension.

The nature of the activities means the relationships the business maintains are usually B2B and there are diverse links between the company and the consumer. The entrepreneurs are aware that higher added value can only be delivered if specific customer requirements can be met. An increasing amount of processing is carried out for customers – such as washing and packaging – and in association with Bram Ladage the business organises an annual potato harvesting day for consumers.

Image 11 Novifarm organises an annual potato harvesting day in association with customer Bram Ladage. Children learn about the origin of their bag of chips and about working on the farm (source: Twitter @BramLadage).

Company resources and core activities: scarce management time for specialisation and innovation

The most eye-catching company resources are represented by the 750 hectares of farmland with buildings and agricultural machinery. The elements that promote ecological sustainability are also visible: solar panels and 25 kilometres of field margins.[204] As the companies merged to form a VOF partnership, the machinery can be efficiently used and fitted with high quality technological resources. Moreover, bundling five enterprising families in a single company means that management tasks can be shared out, promoting specialisation and creating space for innovation. This innovative capacity manifests, for example, in the use of GPS for precision farming[205] and the development of cube crates to supply potatoes all year round. But the collaboration also creates space to seek out new markets and optimise the internal organisation.

Naturally, Novifarm's core activity is still the cultivation of food products, though the business is extensively integrated. To guarantee excellent quality, the business manages its own propagation material. This means seed material is kept as disease-free as possible. Storage is also under the company's control in refrigerated warehouses with a capacity of 5,600 tons. Lastly, diverse processes such as washing and packing potatoes are carried out for specific customers. All these activities require new knowledge and the application of new technology: thus innovation has become an important 'second' core activity with which the arable farming business is able to strengthen its position on the market.

Novifarm's collection of partners is not limited to the 'familiar' links in the primary process (such as the specialist seed selection companies Monsanto and Rijk Zwaan). To obtain the necessary knowledge, the company collaborates with diverse service providers and knowledge institutions. It worked with Wageningen University & Research and Smart Farming to develop the GPS system, partner TTW provides support for analysing crops and data analysis, and it collaborates with Van Iperen and Bayer to identify new crop protection agents.[206] Another unusual collaboration for many arable farmers involves the relationship with the Rotterdam chip producer Bram Ladage (see below).

The earnings model: looking for a margin

Cultivation costs and direct personnel costs (for cultivation, harvesting, packing and transport) constitute the main item on the profit and loss account. However, automation and overheads are always substantial cost items that have to be recuperated. The pressure on margins, mainly exerted by large industrial processors and supermarkets, means that the company has to continuously build not only on extremely efficient business operations, but also on a position that is able to provide a higher margin. This means innovation plays a major role on the modern arable farm.

17.2.3 Innovation

Since the development of Real Time Kinematics (RTK) GPS, it is possible to work on the land with a very high degree of precision. It is now possible to plough, sow and plant with a deviation of just one or two centimetres, and to administer manure and crop protection agents with an unprecedented degree of precision. Novifarm is actively involved in developing this technology, in which it collaborates with local partners, such as Van Iperen, and renowned research institutes. Due to the mutual distribution of tasks between the five families, it is possible to free up the time needed for this.

Image 12 The entrepreneurs behind Novifarm: task distribution facilitates specialisation. Leon Noordam (third from right) focuses on precision farming.

BRAM's: how a new connection can lead to mutual innovation

At Kop van Zuid a new variety of the tried and trusted bag of chips with mayonnaise, with which Rotterdam locals are more than familiar, has been launched by Bram Ladage. The snack bar chain sells 'gourmet chips' here, with the skin left on, in black containers. Instead of serving them with mayonnaise, the chips are accompanied by a beef stew to a recipe developed in association with TV chef Herman den Blijker. The potatoes originate from local farmers – from Novifarm – who select and wash them and ensure they deliver the same quality all year round.

The collaboration with Bram Ladage was the result of market research conducted by entrepreneur Dik Kruijthoff. Originally, the intention was to supply the largest snack chain in the region with potatoes from the region. However, existing supplier relations already satisfied demand from Ladage, so the channel remained closed, although Ladage was open to collaborating on developing a new, high-quality chips concept. To achieve this, both parties had to develop various elements.

Ladage developed the concept as described. Novifarm was expected to be able to make meticulous selections, perform preparatory activities (washing the potatoes so they could be delivered peeled for processing) and to supply all year round. The company developed cube crates to achieve this: storage crates that can store a limited quantity of potatoes. This made it possible to open up and deliver small batches.

Image 13 Gourmet Frites at Kop van Zuid: collaboration between entrepreneurs leads to innovation and a shorter chain.

17.2.4 The circular economy: where the relationship with Rotterdam can grow

One of the pillars of the Next Economy Roadmap is the development of a circular economy. According to Dik Kruijthoff from Novifarm, this offers diverse possibilities for boosting the collaboration with 'the Rotterdam element'. For the arable farmers behind Novifarm, striving for a circular economy is perfectly in line with the stewardship that is one of their core values. Ecologically-responsible arable farming techniques are essential if they want to pass on the land, which has been in the families' possession for many generations, to the next generation in good condition. Conducting business sustainably is in the DNA of these arable farmers, so the step towards a circular system is not a big one for them. Nevertheless, bio-based production requires substantial investment to process the waste flows from the arable farm. It will be necessary to make major investments in infrastructure, as well as knowledge, partnerships, trust in the future and stable government policy: matters in which the City of Rotterdam could play a significant role.

17.3 Hoeksche Hoeve

17.3.1 A 'simple' tale of combination, inspiration and innovation

In the winter of 2002, three arable farmers from Hoeksche Waard decided to switch from individual potato growing to joint potato cultivation and sales. To do so, they set up a combination under the name of Hoeksche Hoeve. The objective of this combination is not only to achieve cost savings, but also to work on higher added value for the potatoes they grow. The artisan crisps produced by this combination are currently available in over 1,000 stores in the Netherlands, and the international market beckons. This is a tale of real entrepreneurship: it may be simple, but it is truly extraordinary nonetheless.

The step towards scaling up

The first step on the road to the current combination of arable farm business and crisp producer was quite straightforward. It began with the finding that it would be considerably more efficient to share the costly machinery with two or three neighbouring arable farmers. To avoid any disputes about the use of the machinery during the optimal harvesting periods, it was decided to combine the yields of the three businesses in the combination. A simple overview, in Microsoft Excel format, demonstrated what each entrepreneur brought to the combination in terms of acreage and machinery. The calculation of how to subsequently divide the joint yield was quickly made, and the 'Hoeksche Hoeve' combination was born. Without any legal hassle, based on mutual trust.[207]

The birth of a new product: Hoeksche Crisps

From the moment Hoeksche Hoeve was founded, the intention was to look for higher margins for the potatoes they cultivated. The first real steps were taken in 2003. One day, after working on the land, they decided to fry some chips made from the potatoes they had dug up. This led to the idea of experimenting with their own home-made crisps. First they tested the concept in a simple domestic fryer and with their own potatoes, and later with a slightly larger fryer and various other varieties of potatoes that did not come from their fields. Potatoes were acquired from neighbouring farmers for a 'secret project'. In retrospect it appears that secrecy was more of a hindrance than a necessity: vital knowledge and ideas were obtained precisely by involving others in the experiments.

Image 14 Arable farmers on the road to innovation: potatoes from Hoeksche Waard deliver more as artisan crisps or vodka (René de Zeeuw (l) and Henk Scheele (r). Source: De Hoeksche Hoeve).

Nine months of experiments later, a product was developed that had enough potential to be introduced to the market. A representative was given the job of offering the crisps to 200 small retailers as a high-quality alternative to supermarket crisps. The production facilities were scaled up and elevated to a high food security level (remarkably, this firm had no experience whatsoever in this field!). Volumes have since grown so much that 50% of the potato acreage (25 hectares) is now used for producing their own crisps. The entrepreneurs' goal? To expand to 100%, so that no more potatoes are supplied to wholesalers or the processing industry.

Growing and innovating

HMS Host is a major customer of the crisp products made by Hoeksche Hoeve. HMS Host provides catering services at Schiphol and at more than 70 other airports worldwide. The crisps from Hoeksche Waard are supplied by HMS Host under a private label ('3 Dutch Farmers') to travellers at the airport and in KLM business class. This means the crisps reach an international audience, who not only place orders for their own consumption but sometimes see the trading possibilities too. The first export contacts have now been made. All the different contacts give rise to queries, which in turn lead to other product innovations. Hoeksche Hoeve has developed truffle crisps for an Italian importer, and the arable farmers-turned-crisp manufacturers developed a beer-flavoured variety for a large Dutch brewery.

Image 15 New varieties result from contacts with Italian purchasers.

While on the one hand the success of Hoeksche Crisps leads to new contacts and possibilities, on the other the entrepreneurs also actively seek inspiration and partners for innovation. One morning in 2009, Henk Scheele checked in his suitcase at a local airport, heading to an unknown destination. As a participant in a trend tour by Syntens, he subsequently flew to Sweden, Milan and Marrakesh. There he discovered how a chef was able to create a high-quality dish from the 'lowest-quality' pork, the belly, and subsequently command a high price for it. He also learned how cheap wine is turned into exclusive balsamic vinegar. In the Moroccan desert, expensive oil is produced from the droppings of goats that live in Argan trees. These examples of revalorising low-quality products inspired the entrepreneurs. On his return, contact was made with The Hague University of Applied Sciences. The objective? To research how the scraps that are left over after packaging the crisps could be used as the basis for new products.

Sustainability: intrinsic and economic motives

The revalorisation of waste flows is consistent with the entrepreneurs' philosophy. The term 'stewardship' regularly crops up in discussions at Hoeksche Hoeve, as with other arable farmers and the fishermen from Stellendam. But in contrast to investments in ecological production, there must also be an economic return. Sometimes this is relatively easy and obvious: an investment in solar panels is recuperated in a decade. But if the return is not evident, it is not as straightforward. Should the entrepreneurs carry on with the ecological field margins if no subsidies are available for them? Field margins cannot be used for cultivation, and this leads to a loss of income of roughly €10,000. And although there are savings on insecticides (€1,000), there is still a shortfall that has to be borne directly by the business with no subsidies available. Sustainable production is also important for

Hoeksche Hoeve in terms of the products' capacity to stand out from the competition. For example, Jumbo supermarkets require all products on the AGF shelf to comply with the environmental label by 2020.

17.3.2 Innovating in Hoeksche Waard (and beyond)

In the immediate vicinity of Hoeksche Hoeve, both the local government and local entrepreneurs play a role of some significance. The growth of the production facility to its current size – a medium-sized warehouse in the yard of one of the farms – required a certain understanding from the municipality. A factory cannot be condoned in a rural area, but by treating Hoeksche Hoeve as if it was a cheese-making farm the necessary space was created to facilitate the first growth phase. The municipality also gives away the bags of crisps as a corporate gift. This is a modest contribution in terms of volume, but it does signify a willingness to support the arable farmers' entrepreneurship. Other local entrepreneurs are willing to act collectively as Hoeksche businesses. These kinds of close relationships between entrepreneurs from adjoining sectors build on mutual trust, which is usually vital if small-scale entrepreneurs want to innovate and experiment with new business models.

Image 16 To celebrate the collaboration between local businesspeople, the Van der Mark transport firm from Oud-Beijerland stuck stickers on two of its lorries.

The relationship with the food cluster in Rotterdam is still in its early days, but Henk Scheele believes it offers interesting possibilities for promotion. Fenix Food Factory – a port warehouse converted into a catering and hospitality hotspot for local producers – is a stunning location for showcasing Hoeksche Crisps to consumers, and the bags are ideal for including in a box of local products ('Rotterdam in a box').

This enables the city to act as a springboard for further expansion, and a local artisan product can help promote Rotterdam as a unique food cluster.

17.4 Van Iperen

17.4.1 From grain seller to frontrunner in precision farming

The history of this family-run business dates back to 1921, although it only acquired its current name in 1962. Begun as a grain trading firm, the company has transformed into a 'growth specialist': a leading supplier of fertilisation and crop protection agents for a wide range of growers. The development of the current business model could well serve as a model for the technological spurt experienced by arable farming. We also find an intrinsic sense of responsibility at this family-run business, known as 'stewardship' (in which the balance with healthy economic development also plays a role). 'For generations, Van Iperen, a Dutch family-run business, has ensured the growth of healthy and profitable crops together with its customers, in a way that is good for people, animals and plants. The love for all that grows and flowers is in our veins. We act and do business with respect for nature and strive for a future-proof sector.'

This development began when Hendrik Groeneweg founded a grain trading firm in Oud-Beijerland. After Willem van Iperen joined the firm and took it over in the 1950s, the company's growth led to diverse moves and plans for new construction in the 1980s. In 1987, Van Iperen started selling liquid fertiliser to growers and constructed a tank farm for this purpose in 1993. Liquid fertiliser thus formed the main pillar of the firm, and the tank farm was expanded in 2007 and 2010. Another vast 4,000 m² warehouse was also built in 2004, for the grain trade. Over the years, various construction plans were developed, including for the office-related activities. Today the firm occupies modern premises where its international activities have also been based since 2010. The last 'growth spurt' was kicked off with the takeover of suppliers Mol Agrocom, De Witte Agro and Gebr. Dijke. As of this year, the group of six companies profiles itself under a single name and with a new logo.[208]

The business model

The Van Iperen business model has evolved over the years from a grain trading firm to a cultivation optimisation partner. Knowledge is a vital element of this business model: the cross-pollination within the ecosystem of partners, employees and customers makes continuous innovation possible.

Image 17 The Van Iperen business model revolves around innovation based on state-of-the-art knowledge and cultivation optimisation.

Value proposition: precision work for cultivation

Van Iperen supplies growth-promoting products to a wide range of farmers. This broad orientation, from horticulture to fruit growing and from flower bulbs to arable and even livestock farming, facilitates the cross-pollination of knowledge and innovations. The products supplied by the company range from grass and flower seeds, fertilisers, substrates, crop protection agents, potting soil and soil improvers to ground coverings, plastic and drainage material: everything involved in nourishing, strengthening and protecting crops. The Netherlands still constitutes the largest sales market, but Van Iperen's distinctive proposition has also caught the interest of international customers.

The business distinguishes itself by 'giving customers peace of mind with sustainable and innovative solutions that respond to technological and social changes. […] We support our customers in an integrated approach to feeding, strengthening and protecting crops. With our unique knowledge, we serve as a leading knowledge database for the farmers of the Netherlands.' This positioning requires continuous efforts in terms of knowledge development, innovation and building long-term relationships with customers. To manage these relationships and support them with the necessary knowledge of cultivation and the market, the field service employs technical and commercial specialists. The organisation has a K&D (Knowledge and Development) department to ensure continuous knowledge development and to conduct research.

Core of the business model: an ecosystem of innovation employees and partners

In addition to sales activities, Van Iperen also advises customers and carries out detection and development activities. For this purpose, the internal organisation includes specific departments responsible for environment & quality, ICT and knowledge and development. The sister company Van Iperen International, based at new premises in Westmaas, was founded in 2010 to shape international growth. This international business unit serves customers from North America to the Middle East.

A great deal of knowledge is acquired from its network of partners. Van Iperen has developed a diverse innovation ecosystem in which knowledge institutions, multinationals, sector associations and customers all play a role.

- The firm collaborates with Philips to develop LED lighting;
- Van Iperen carries out research projects in association with Wageningen University & Research, Utrecht University and Groningen University and Aeres University of Applied Sciences in Dronten, as well as the Italian Land Lab (scuolo superiore);
- With mechanisation firms, software suppliers and retailers such as Albert Heijn;
- With lobbyists from crop protection agent suppliers Agrodis and from arable farming businesses (BO Akkerbouw);
- And not least with farmers themselves and with suppliers, such as crop protection agent suppliers, and trading partners.

Image 18 Since the summer of 2016, the tomato sector has been turned upside down due to an explosion in numbers of the tomato gall mite. Van Iperen has joined forces with Demokwekerij Westland to search for suitable solutions.

17.4.2 Innovation: profit comes from managing the system

One important fundamental principle of Van Iperen involves promoting the growth of healthy and profitable crops in an ecologically responsible manner. To achieve this, management of the field's entire ecological system is necessary. This requires knowledge, and above all: information. The soil composition of one parcel of land can vary considerably (as a result of previous land re-parcelling). This can be identified by performing an analysis of the soil using cameras and drones. Fertilisation can subsequently be adjusted with great accuracy – even down to the level of an individual plant (precision farming[209]). To develop this innovative technology, Van Iperen collaborates in the 'soil' knowledge consortium,[210] as well as with Wageningen and data supplier Eurofins Agro. Naturally, the most important party is the farmer. In Hoeksche Waard, Van Iperen finds the pioneering spirit and idealism required to take on this role.

Broad use of commercial and public parties is needed to advance this smart farming technology in the future. This could take the form of public-private pilot businesses, where scientific institutes and commercial parties can perform joint research, but educational institutions will also have to prepare to educate future employees in plants and cultivation methods, as well as the diverse modern technologies used by the agricultural business and its suppliers. Some of the major developments on the radar of technical director Dirk Bakker, besides smart farming, are vertical farming and global issues such as the availability of water. The innovative ecosystems of companies like Van Iperen form an important key in the quest for solutions to these kinds of technological and social problems.

17.5 Den Bakker Bedrijven

17.5.1 From hard labour to high-tech

Den Bakker is increasingly transforming from an agricultural contractor and transport company, which began with the purchase of a number of tractors, into a technologically-driven enterprise. In 1948, the heaviest jobs on the farm were still performed with a horse and cart. Mechanisation alleviated this to a certain extent: use of an agricultural contractor meant that high investment costs could be spread across multiple customers.

The current owner, Dirk den Bakker, took over the business from his father in 1989. The agricultural contracting and transport firm still form the backbone of the company, but a passion for technology and entrepreneurship have also led to the development of new business activities and to the first steps outside the agricultural sector and onto the international market.

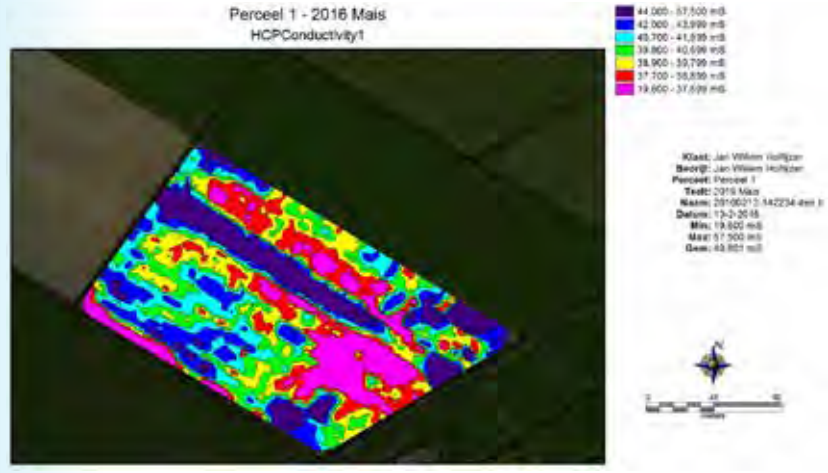

Image 19 The use of fertilisers and crop protection agents can be optimised using drones and a soil scan. Den Bakker Bedrijven is becoming a business that is driven more and more by technology and is developing a diverse network of R&D partners. (photo: Den Bakker Bedrijven B.V.)

An innovation ecosystem is developing

Two new products contribute to the company's diversification outside the traditional focus on 'heavy' machinery for the agricultural business: DroneSurvey and DustCruster. DroneSurvey is a new business unit that provides services – still to farmers – with the help of drone technology. Using small, unmanned planes fitted with sensors and cameras, plots of land can be analysed and diseases and pests signalled early on, up to 14 days earlier than would normally be the case.

DustCruster was originally developed for farming businesses. Large quantities of the harvest and waste products are often stored on a farm. To prevent the dust from these materials from being spread around by the wind, the stockpiles are covered with a crust of a paper-like material. It soon became apparent that dust formation was a problem not only on farms, but also in ports at ore and coal transshipment companies. The step from Voorne-Putten to the ports was soon made and the international exposure of the Rotterdam ports subsequently led to Den Bakker receiving requests from abroad. DustCruster is now a patented product and Den Bakker Global serves terminal operators from all four corners of the world.

Image 20 A crust of paper-like material is applied to prevent dust being spread around by the wind. The (patented) product consists of pellets made from a mixture of cellulose fibres, which are mixed with water and then sprayed on to the 'dusty' stockpiles from specially-designed lorries. (photo: Den Bakker Bedrijven B.V.)

The development of these services and products based on technological innovation originated partly from the organisation itself, and partly from collaboration with third parties. DroneSurvey was developed together with a fellow company from IJmuiden and knowledge institutions from the Netherlands (including Wageningen University & Research) and Canada. Den Bakker partners with the agricultural college in Dronten for research and internships. The relationship with educational institutions is important, because the company anticipates that the level of knowledge required from employees in the agricultural sector is set to increase substantially. Electronics and software already represent the main components of the machines used; with the expected arrival of self-driving cars, sustainable energy systems and the circular economy, the need for knowledge of technology will continue to increase. This means that the development of an ecosystem in which companies and knowledge institutions participate in research and education is crucial for companies like Den Bakker.

17.6 Intertaste

17.6.1 In search of new flavours and solutions for sustainable employment

At the company's premises in Puttershoek, Intertaste processes herbs and spices with a wide range of ingredients and semi-finished products for the Western European food industry. Subsidiaries in Nijkerk and Utrecht are responsible for producing liquid flavourings, such as sauces, and packing them in consumer packaging.

Taste innovation

Tastes change over time, so product development is an essential activity for Intertaste. But it is not only eating habits that evolve; changing legislation also requires the company to continuously improve its products and processes. Intertaste developed herb mixes with less salt (by adding other ingredients) in response to new government policy. Stricter legislation related to the use of ingredients containing E-numbers also demands constant adjustments and innovation, and customers frequently impose new requirements on the quality of products. Nevertheless, developing flavours continues to be the main driver for innovation. To do this, the company sometimes collaborates with large customers. At the request of Albert Heijn, for example, a new herb mix was developed to add a 'fruitier' flavour to steak tartare. However, much of the product development takes place in-house, where people seek out new flavours and applications. To achieve this, employees visit trade fairs and conduct Internet research. Current examples of trends to which the company has responded are the development of mixes for halal meat and vegetarian dishes.

Image 21 Changes in the composition of the population and eating patterns require continuous innovation in herb and spice mixes.

Organisational innovation

A challenge of a completely different nature is presented by the organisation. The average age of the employees at the Puttershoek site is 46. Some employees joined the company when they were as young as fifteen years old, and if they want and are able to work until they turn 67, an effective policy for sustainable employment is a must. Attention usually turns to Rotterdam to revitalise the workforce with new, young staff members. Dependence on large cities like Rotterdam as a supplier of new employees is growing, especially as the required level of education increases. But this also produces concerns: access to the site in Puttershoek is not optimal and this makes the company less appealing to candidates.

Intertaste has built up a network of diverse institutions to attract knowledge and educated staff. The company is involved in the Food Innovation Academy and engages interns from study programmes at various levels, ranging from Zadkine (pre-vocational secondary education) to Hotelschool The Hague and Wageningen University & Research. Research is conducted with Wageningen into, for example, the possibilities of reducing allergens. In the

future, Intertaste sees opportunities for closer collaboration with Rotterdam. For a business like Intertaste, the city offers interesting potential with regard to its workforce. The lack of a study programme focused on food technology means that both knowledge and employees still have to be sought elsewhere.

17.7 Nedato

17.7.1 From cold store cooperative to knowledge centre for potato growers

Since Nedato was founded in 1963, the company has grown to become a major player in the international potato trade. The name Nedato originates from 'Nederlandse Aardappel Telers Organisatie' (Dutch Potato Growers' Organisation) and the company was created as a collaboration of arable farmers from Voorne-Putten and Hoeksche Waard to organise cold store potato storage. Today, around 500 growers from all over the country are affiliated with this cooperative and it processes and sells around 750,000 tons of potatoes every year. Besides sales and exports, the company also focuses on developing new packaging (under its own label and a private label) and positions itself as a knowledge centre for the affiliated growers. This knowledge concerns technological know-how and insight into developments on the market, as well as knowledge about sustainable production.

Knowledge centre for the potato grower

An ecologically responsible chain from the grower to the consumer is consistent with the core values of the Nedato cooperative. Nedato prefers to supply exclusively Dutch potatoes to the Dutch market (short chain). However, being able to supply potatoes all year round will always necessitate imports. In order to reduce as far as possible the period during which potatoes from Holland are not available, Nedato gives advice about the choice of varieties and develops better storage techniques. Consequently, the bridging period can be shortened to around five weeks. Following through in the development of alternative distribution networks – 'local for local' – still appears to be difficult because retailers are supplied from large, centralised distribution centres.

As a knowledge centre, Nedato is working with the IT company AppsforAgri to develop a digital weather station. The station supplies data at the parcel level, which means the potato growers' operations can be coordinated with weather conditions with increasing accuracy. Other precision farming-related themes are also on Nedato's agenda. Like many organisations, Nedato also collaborates with Wageningen University & Research to improve cultivation techniques. The company has set up cooperation partnerships for internships and training placements with pre-vocational secondary schools and universities of applied sciences in Rotterdam.

17.8 Fisheries' Innovation Centre Zuidwest Nederland

17.8.1 High-quality, practical knowledge for sustainable and profitable fishing

The Fisheries' Innovation Centre Zuidwest Nederland, based in Stellendam, acts as a hub in a network to promote the application of innovative technology to fishing. To achieve this, it has an experimental basin that can be used to experiment with innovative fishing gear and networks. The company was founded in 2015, after the example of the innovation centres in Denmark and France. The investment in the physical facilities was financed by the European Fisheries Fund and the Stichting Verduurzaming Visserijsector Voordelta. Other income originates from fishing companies that commission experiments and tests. The Fisheries' Innovation Centre collaborates with diverse scientific institutions, non-governmental organisations and educational institutions, including the Shipping & Transport College (STC) that has opened a new fisheries school in Stellendam.

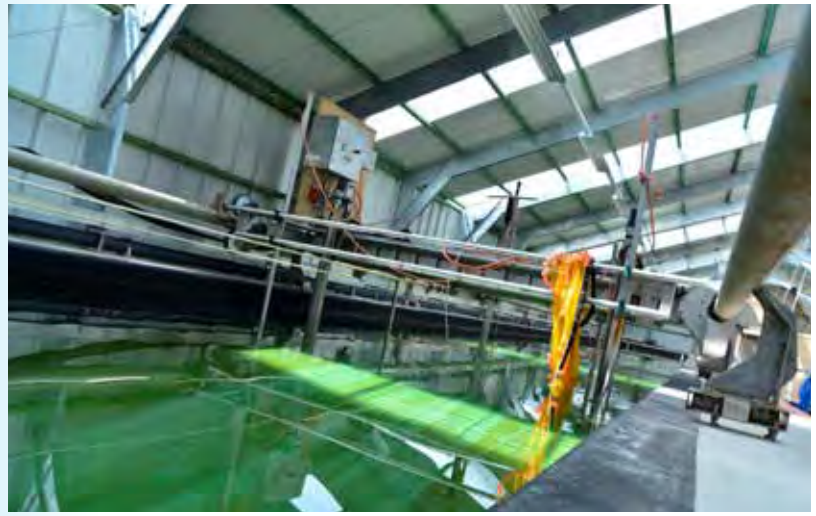

Image 22 Underwater cameras produce video recordings that enable researchers to study how fishing gear behaves.

Innovation and the relationship with Rotterdam

The centre was founded to promote innovation in fishing, and during the centre's brief history several concrete innovations have already seen the light of day. In association with Zeevisserijbedrijf Brinkman, a new technique was developed to fish using air. This innovation produced a saving on fuel and reduced wear and tear on the materials. Another eye-catching innovation is 'fluff-free fishing'. The use of material that sheds is up for debate due to the impact on the environment (plastic soup, waste washing up on beaches, etc.). In 2015, the Fisheries' Innovation Centre conducted a number of tests to asses the wear-resistance of various materials.

The best alternative materials were subsequently tested in practice on a small scale. With the support of the Stichting Verduurzaming Visserijsector Voordelta, VisNed and Project VisPluisvrij, the Fisheries' Innovation Centre is currently researching the most promising alternatives on a larger scale.

Image 23 With regard to alternatives for replacing the current (relatively cheap) lint used in fishing, it is necessary to demonstrate that on the one hand the cost is at least equal to the current lint, and on the other that the new lint is at least as easy to use.

These technological developments are starting to prove their value. A few decades ago, the fishing sector was hit hard by the imposition of fishing quotas. In Stellendam, the fleet shrank from 40 to just eight vessels! Improved fishing techniques limit the damage to flora and fauna considerably. Whereas in the past a kilo of fish was damaged for each kilo of marketable fish caught, this ratio has now been reduced by a factor of ten. Fishing grounds are flourishing once more, and sustainability also appears to be economically profitable.

Image 24 Stewardship in the fishing sector: sustainable fishing techniques also appear to be economically profitable over time.

In addition to practical support for technological innovation related to fishing gear, the centre also contributes to a broader development of the fishing sector, including by engaging young people's interest in the profession and contributing to the development of education. Knowledge of ICT is becoming increasingly important in fishing to keep the vessel and the fishing gear operational. With this in mind, the centre collaborates with the STC Group, which was founded in Rotterdam. Not least for the further development of the Stellendam food cluster, the centre sees possibilities for connecting with the Rotterdam Food Cluster, such as in the form of joint international promotion.

Image 25 Educational institutions can benefit from practical lessons at the innovation centre. The centre offers interesting opportunities to put the theory related to net designs and fishing gear into practice at scale.

17.9 Nederlof's Vishandel

17.9.1 In pursuit of higher margins using ready-made fish dishes

Nederlof's Vishandel was founded in 1977 by the Nederlof brothers and taken over by Maarten Buitendijk in 1990, when he was working in Naples as a partner of the largest fishing company in Italy.

This trading firm distinguishes itself through a wide assortment of high-quality products. To achieve this, employees make purchases at the nine Dutch auctions and perform on-site quality inspections. The fish is then sorted and repacked before being delivered. The company also imports fish from countries such as Vietnam and Spain. The firm mainly sells fresh fish to Southern European customers (wholesalers) and supermarkets in Belgium, France, Germany and Italy. Just four percent of sales are destined for the Dutch market. In addition to its sites in Stellendam and IJmuiden, the firm also has an Italian branch.

Image 26 The Dutch fishing sector specialises in flatfish. Nederlof's Vishandel also imports fish from diverse parts of the world, such as pangasius from Vietnam.

Innovation and the relationship with the Rotterdam Food Cluster

Although the economy in Western Europe is picking up, margins on the international fish market are still small. Things are not expected to change as long as the economies in Southern European countries do not improve substantially. Nederlof's Vishandel tries to maintain its profitability in two ways. On the one hand, the business does this by looking for new fish species for the Western European market. In this vein, the company has experimented with importing fresh pangasius from Vietnam. Ultimately, frozen transport proved to give the best results and Nederlof's Vishandel was able to build a position with this fish, which is relatively new to the Western market.

On the other hand, the company has developed ready-made fish dishes for the oven together with its Spanish supplier. With a broader range of higher-quality fish than is available in standard supermarkets, it expects to appeal to consumers who value convenience. Large customers from the Rotterdam region, such as hospitals and company canteens, could achieve the volumes necessary to get it off to a flying start. The main challenge currently involves identifying these large potential customers, although Nederlof's Vishandel is an active sponsor of Feyenoord, Excelsior and Sparta, so the company name is not unknown in Rotterdam.

Image 27 Maarten Buitendijk from Nederlof's Vishandel, which sponsors Excelsior, among others.

17.10 Bioriginal

17.10.1 In search of new possible applications for omegas

Bioriginal's current branch in Den Bommel was originally a grower and seed trader. The desire to operate internationally led to a merger with the originally-American Bioriginal around the turn of this century. Bioriginal profiles itself as a supplier of high-quality omega components for the food industry. Scientific knowledge and product development facilities are also essential resources for this company. Personnel possessing high-quality substantive knowledge form the backbone – and perhaps also the Achilles heel – of the firm. The current employees of Bioriginal come from both the surrounding area and further afield, but the psychological distance between Den Bommel and Rotterdam could represent an obstacle for knowledge workers from Rotterdam in the future. Whereas in the past the fields around Den Bommel were important for supplying specific seeds, these seeds are now obtained worldwide and the strategic added value of the Goeree-Overflakkee site is currently limited, as is the number of cooperation partnerships for R&D.

Image 28 Omega 3 components are obtained from a variety of natural products. The purple flowers once grew on the arable farms around Den Bommel (photo: Bioriginal B.V.)

Innovation and the relationship with the Rotterdam Food Cluster

Product innovation and market development are extremely important to Bioriginal. There are also interesting opportunities for engaging in collaboration with the food cluster in Rotterdam, such as finding potential new customers in medical nutrition, bread producers or producers of innovative products (such as healthy chewables for youngsters). Bioriginal strives to promote the consumption of omega and possesses the necessary in-house knowledge of components and their processing in food products to achieve this. A broker who can put them in touch with Rotterdam businesses that could also effectively integrate the components into consumer products may offer a solution.

One example of the possibilities for medical nutrition is the study conducted with Abbott Nutrition (a US company with a branch in Zwolle). Patients in

critical care are tube-fed with borage oil, resulting in them gaining weight instead of losing it, thus increasing their chances of survival. The market for nutrients for the elderly is also considered a potential growth market, now that there is an ever-greater focus on the medical qualities of food.

At Den Bommel they are constantly looking for knowledge and partners to increase output. The region's innovation ecosystem is still insufficient in this regard. Although the company regularly participates in innovation projects with knowledge institutions (such as Wageningen University & Research), growers, technology suppliers, etc., according to the management, that is where the main development options lie for the region, both in terms of technological innovation and for developing and exploiting the market.

17.11 TTW

17.11.1 Optimising cultivation yields: knowledge is power

TTW advises farmers about optimising their cultivation and harvesting processes. To this end, it has been gathering data from farmers for all of thirty years. The father of the current owner searched for possibilities to combat disease and pests and so improve the yield per acreage. In the belief that decisions are better if they are based on facts, Mr Struik started recording all the process steps and yield data from various farming businesses. This data and the experiments conducted formed the basis for fine-tuning decision-making rules. The database containing cultivation data and decision-making rules still forms the backbone of the business. By continuously analysing the data from previous years, and drawing lessons from it, the advisers can provide TTW farmers with optimal support.

In 2013, the company was taken over by Jacob Struik and the number of employees tripled to 15 in less than five years. Today, TTW not only provides advice about chicory growing; its services also cover diverse crops, from potatoes to onions and grains.

A value-driven earnings model

TTW makes recommendations to farmers about crop optimisation. The underlying data forms the source of these recommendations and also constitutes the distinguishing capacity of TTW. Collecting high-quality data is also crucial and is the reason why a lot of data is still collected manually (in association with the farmer). There are also diverse possibilities for gathering data using drones and sensors, though this method still seems insufficiently accurate to actually use as the basis for advice. '80% of the data collected by the drones is unusable!' Jacob Struik explains. The decision-making rules based on the data collected must deliver actual yield improvements for the farmer. This promissory is translated into the firm's earnings model, which is based on a percentage of the yield improvement.

TTW's innovation network: improved connections to accelerate innovation

Farmers are important partners for TTW: they are not only customers who receive recommendations, but also data suppliers. TTW works closely with farmers, such as on Jan van der Bonen's farm, the largest arable farming business in the Breda region. Wageningen University & Research forms another important source of knowledge. TTW regularly collaborates with Wageningen to interpret new data and develop calculation rules. When the researchers in Wageningen are 'overcome' with knowledge, it is TTW that can apply this knowledge directly with farmers. TTW also hopes to be able to work with TU Delft to develop drones that can deliver the desired quality data. The company occasionally collaborates with other entrepreneurs such as Wouter Bak, developer of tomato picking machines. Absent from TTW's innovation network – and greatly missed – are technology start-ups that could help automate data collection and analysis tasks or help the business on its way 'to the cloud'. Previous experience with large companies like IBM has not always proved to be positive. The management expects better innovation results with other 'small-scale' entrepreneurs.

Better connections in both the literal and the figurative sense could help the company reach its innovation goals. Better, faster data connections are vital for a data-driven business model, especially if the Internet of Things becomes a reality in the near future and the number of sensors and data connections grow exponentially. However, improved connections to the innovation ecosystems in the region and the City of Rotterdam are also important. A major challenge for the primary sector lies, for example, in improving food quality (higher nutritional value). Medical knowledge and the research facilities of medical faculties are needed to achieve this, as well as product knowledge and farmers' testing grounds in the countryside. According to Jacob Struik, farmers on the ZHE (The islands south of Rotterdam) are leaders in productivity and innovation and the conditions for a productive collaboration are available in abundance.

17.12 Van Peperstraten Group

17.12.1 Circular economy from the synthesis of an arable farmer and a real estate agent

In this Flakkeese arable farming business we see many similarities with other business portraits in this report, such as stewardship and entrepreneurship, high-quality technology and the circular economy, and the development of a network of more or less self-evident partners.

Tonnie van Peperstraten is the fifth generation of the Van Peperstraten family to work the fields around the farm in Oude-Tonge. In addition to growing traditional products like potatoes, onions and sugar beet, in 1967 the company began an agricultural real estate agency. At the end of the 1990s, the current owner took the business over from his father. Since then, the focus has been increasingly on precision farming and the development of a circular business model. A passion for farming goes hand in hand with the realisation that the business must not only continue to have fertile land but must also continue to provide a challenge, if the next generation is to carry on the activities. The use of precision farming and the development of Greenpoint, the circular enterprise of the Van Peperstraten Group, responds to this.

Maximisation with no drawbacks? Innovative technology makes it possible

To prevent the land being depleted by intensive use, Van Peperstraten adopts an extensive construction plan and a wide rotation of crops. Since machines are fitted with GPS, it is possible to drive across the fields extremely efficiently and apply fertiliser with great accuracy. To achieve this, the plots of land are accurately mapped out to within a few dozen centimetres with the help of drones. The focus is therefore shifting ‘from the plot to the plant’.

The products grown in the fields are currently still stored by third parties. In the future they will be stored at the company’s own premises in the ‘storage barn of the future’. This plan, currently in development, forms a major component of a larger plan to build an entirely circular business. ‘The roof surfaces of our warehouses are ideal for installing solar panels and capturing rainwater. Once it has been treated, the water is suitable for spraying crops with fewer protection agents and for cooling or heating the storage areas without the use of fossil fuels.’

Image 29 The Greenpoint multi-fuel stations will be powered by energy generated, for example, from the solar panels on the roof of the farm’s storage barn.

In association with four other farmers, Van Peperstraten has developed and is running a windmill farm with eight windmills on the island. The combined energy yield from the storage barn (1.6 megawatts) and the windmills (3.6 megawatts) far exceeds the energy requirements of the businesses involved. The surplus is supplied to a chain of ‘multi-fuel’ stations which are also jointly developed by Van Peperstraten. The refuelling stations are not only intended for supplying green energy to electric cars, but also biogas (LNG) and hydrogen. These products will also originate from the storage barn. The beets that come from the land will be stored there to subsequently be processed by SuikerUnie. One use of the waste will be to produce the biogas that will be sold in the Greenpoint refuelling stations. The storage barn will be made suitable for transforming surplus energy that is not used immediately in the regional network into hydrogen, which will also be sold at the refuelling stations. Van Peperstraten, in association with the local authorities, intends to have 20 public transport buses running on hydrogen by 2020.

An ecosystem of plans and partners

These are plans that have been partially achieved and that are partially still being developed. The larger plan is exceptionally ambitious and admirable:[211] if it is a success, Van Peperstraten will succeed in setting in motion an economically and ecologically responsible circle of products and energy. Products from the land will be stored in a storage barn, which will in turn generate and store energy and provide water for the fields. The products will be processed and produce waste flows from which energy and minerals can be extracted, which can then be used as raw materials for fertilisers for a new harvest. And all the surplus energy will be supplied to vehicles through a new chain of refuelling stations in the form of alternative fuels.

Image 30 Tonnie van Peperstraten (second from left) presents his plans for a circular arable farm-annex energy company at the Climate Summit in Paris. (Photo: Municipality of Goeree-Overflakee)

For all these projects, Van Peperstraten has built up a network with a wide range of partners.

- For research into the possibilities of storing electrolysis energy in hydrogen, the company collaborates with the energy network company Stedin and energy firm Eneco.
- Van Peperstraten also works with Eneco for the management of the windmill farm (Van Peperstraten holds a stake of about 25% in the windmills).
- The company works with SuikerUnie to research the development of biogas from sugar beet.
- To develop the Greenpoint refuelling stations, Van Peperstraten has joined forces with the oil trader Van Kessel.
- The company is working with the Goeree-Overflakkee authorities on the project to have public transport running on hydrogen by 2020. Van Peperstraten is complimentary when talking about the space local authorities provide to achieve the plans.
- Technological knowledge is obtained from Wageningen University & Research and TU Delft.
- Opportunities for collaboration and similarities also exist with diverse other companies on the ZHE (The islands south of Rotterdam) that are profiled in this report, such as the drone technology by Den Bakker Bedrijven, data collection and analysis by the crop advisory agency TTW, the opportunities for precision fertilisation by Van Iperen and the interest in the circular economy we encountered at Novifarm.

However, the Rotterdam Food Cluster is still largely absent from this ecosystem. Nevertheless, there are possibilities, such as in the development of training institutes that educate operators for alternative energy systems, and of course in the sale and storage of alternative energy, such as biogas. In this regard, the ambitions of the Port of Rotterdam are totally consistent with those of Van Peperstraten.

17.13 Tuinderij Vers

17.13.1 Evolving from a barn into a high-care vegetable cutting firm in thirty years

Since Tuinderij Vers was founded by Jan Varekamp in 1986, the vegetable cutting firm has expanded to become a modern business that has seriously outgrown its original premises. A second associate, Cor Noordermeer, joined the company in 1990, and in 2000 it was taken over by a new generation of entrepreneurs. Simone Varekamp, Edwin Noordermeer and Rob Witmer divided the management tasks between them into the focal areas of quality management, process improvements and general management. This specialisation enabled the company to continue to become more professional, and in 2016 the high-care room for extra-strict hygiene measures doubled in

size. A recent growth spurt made the construction of a new production hall – planned for delivery in 2018 – all the more urgent.

Image 31 From its humble beginnings in a barn, it has grown into a substantial production site featuring a high-care room.

Collaboration for innovation

The cut vegetable market has not always been the most dynamic. One of the main innovations that has been of great importance to players such as Tuinderij Vers was the emergence of salad meals in supermarkets. Nevertheless, Tuinderij Vers also needs to constantly keep pace with changes in the market, where seasons and ‘trend fads’ necessitate adjustments in the composition of the product range. Superfoods have become popular with consumers in recent years, and the business has therefore included them in its range. The product developers conduct research into consumer preferences with the help of supermarket consumer panels, or ‘just’ internally with their employees. The collaboration with Albert Heijn is especially important to Tuinderij Vers, not only for the development of new products but also because these supermarkets involve their packaging material producer (Hordijk) in innovation projects. This combination of knowledge about the product, process, packaging and market increases the chance that innovations will succeed.

Last but not least: Albert Heijn offers a certain degree of security with regard to the possibility of recuperating investments in new products and processes.

Image 32 New vegetable mixes are tested in consumer panels, or simply in-house.

Tuinderij Vers develops vegetable and salad dressings with Verstegen Kruiden & Specerijen, a familiar player from the Rotterdam Food Cluster. Other players from Rotterdam could play a role in the future development of the company, which, with an annual growth target of five percent and constant pressure on margins from major retailers, will have to continue to innovate. One issue that occupies a prominent position on the Hoeksche entrepreneurs' agenda is the improvement of cutting techniques; the knowledge and resources partners bring are also useful for improving efficiency with the help of ICT, waste reduction and quality improvements.

Image 33. In 2017, Tuinderij Vers won the Rotterdam Entrepreneur Award. 'Tuinderij Vers has proven it is able to weather storms, though we say so ourselves. The company is not simply based in the region; it forms a combining and enabling link in this region.'

Footnotes

196 See the book by Alexander Osterwalder 'Business Model Generatie; een handboek voor visionairs, game changers en uitdagers' (Business Model Generation: a manual for visionaries, game changers and challengers), published by Vakmedianet in 2010.
197 We used the guidelines as described by professor Kathleen Eisenhardt in the article 'Building Theories from Case Study Research', published in 1989 in The Academy of Management Review.
198 Moore, James F. 'Predators and prey: a new ecology of competition.' Harvard business review 71.3 (1993): 75-86. 199
Iansiti, Marco, and Roy Levien. The keystone advantage: what the new dynamics of business ecosystems mean for strategy, innovation, and sustainability. Harvard Business Press, 2004.
201 Bower, J.L., & C.M. Christensen (1995), 'Disruptive technologies: Catching the wave', Harvard Business Review, Jan-Feb, pp. 43-53.
202 See https://time.tno.nl/en/articles/this-is-how-it-s-done-3d-food-printing/ (2018)
204 On the edges of the plot boundaries are margins 3.5 metres wide, which are sown with grass or a mixture of plants and flowers. They are not sprayed, which reduces emissions to the environment. The field margins form an ecological corridor, offer shelter to animals and stimulate the natural enemies of pests.
205 Novifarm uses its own base station that sends corrections to the mobile GPS receivers on the tractors. The GPS control on the tractor and implement is used in ploughing, sowing and planting, spreading fertiliser and crop protection. This enables the company to align potato beds or planted rows with great accuracy so that a plot can be worked in the most efficient manner.
When fertiliser is spread or crop protection agents are applied, the GPS ensures that there are no overlaps and this seriously reduces waste and emissions into the environment.
206 The portraits of TTW and Van Iperen appear separately in this report.
207 To produce Hoeksche Crisps, a private company was set up to limit the entrepreneurs' liability. Recall actions in particular could potentially involve very high costs.
This is an unacceptably high risk and would otherwise threaten the future of the arable farming businesses.
208 Van Iperen now comprises: Van Iperen, Mol Agrocom, De Witte Agro and Gebr. Dijke. Van Iperen, along with Van Iperen International, TTW and Euroliquids, falls under Thesis holding.
209 Van Iperen has developed its own total concept for precision farming, called TT+ (ten ton plus): by optimally using the growth potential in the soil, it is possible to produce ten tons more in five years.
210 The Soil Knowledge Centre (Kenniscentrum Bodem) was founded in 2017 by 11 partners from education, government and the business community who share a single goal:
to develop and disseminate knowledge about sustainable soil use.
211 The Ministry of Infrastructure and the Environment approached Van Peperstraten to present the combination of projects related to farming and alternative energy at the Climate Summit in Paris in 2015.

Food for the Future

Have a question, comment or suggestion in relation to the content of this book? Want to be kept informed of the progress? Want to jointly reflect on the interpretation of the research lines or the implementation? Have a case in your company that could be tackled by a team of students?

If so, please contact Sharon Janmaat at sj.janmaatbouw@rotterdam.nl.
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