A future vision for the Westland Greenhouse Horticultural Industry in 2040

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Abstract

This graduation project looks into the Netherlands’ horticultural industry as well as the people with the power to change it. This endeavor is a graduation project for the Industrial Design Engineering course at The Hague University of Applied Sciences conducted with RegioRegisseur. This RegioRegisseur and HHS project will look into the needed overlap of agriculture, education and technology to create a roadmap for future policies. The goal of this research is to find what the likely scenarios for the Netherlands horticultural industry in 2040 are, and how the education system, particularly the technology and green schools, should prepare for it. It will involve doing co creation with stakeholders in agriculture and technology to find and better understand their views and aims for the future. Looking into the perspectives of greenhouse entrepreneurs, schools, teachers, companies, students and the government to possibly learn from their experiences, both successes and failures a realistic view of the possible future of the horticultural industry was developed and will hopefully help bridge the gap between the green and technical universities in the horticultural industry. Using desktop and empirical research, interviews and questionnaires the research highlighted areas the target group of students, schools and company’s felt were in need of improvement to bridge the perceived gap between the two disciplines. The research also provided ways the gap could be overcome.
1. Introduction

The Agricultural industry is a hidden bedrock of society. It determines what we eat as well as the world around us. In The Netherlands, a large proportion of the agricultural sector consists of greenhouses. In these greenhouses both edible and ornamental plants are grown for domestic and foreign markets.

The Netherlands has over 10,000 hectares of greenhouses which employ some 150,000 workers. These workers efficiently produce €4.5 billion worth of vegetables, fruit, plants, and flowers, around 80% of which is exported. In the ever-changing world of climate change and efficiency, it will be the role of greenhouses to produce enough food to sustain society. However this is woefully taken for granted. This research paper will look for ways to create and/or foster multi-disciplinary crossovers to keep the Netherlands’ horticulture a world leader (Greenport Training & Technology, 2014). This process will start with awareness in the educational institutes of The Netherlands.

1.1 Assignment

This endeavor is a graduation project for the Industrial Design Engineering course at The Hague University of Applied Sciences conducted with RegioRegisseur. The RegioRegisseur is a ‘one-stop shop’ where small and large organizations, students, teachers and entrepreneurs can go and be helped further. They are the middlemen with who work with companies, students and other parties. Their efforts frequent result of jobs that are suitable to address as a student. They deal with diverse tasks and the questions in the area of knowledge, innovation, training, research, projects, partnerships, internships, graduation projects, visiting lectureships and company presentations. They are able to answer hundreds of these questions professional annually.

The project originates from “Geslaagd in Het Vak”, who under the direction of the local government began the investigation into the desirability and possibility of linking greenery and
technical training in November 2011. Almost three years later, there are many developments within the green/technical sector. During the exploration the following were discussed, ‘Labor market data, State of play / education numbers, Bottlenecks education labor Greenport’s, Current trends and approaches’.

In the next phase, using futuring tools, a sketch of possibilities for future activities and related forms of cooperation will be developed. Following this directive RegioRegisseur and The Hague University project looked into the needed overlap of agriculture and technology, with a focus on the Westlands greenhouses, to create a roadmap for future policies. The goal of this research project is to determine what the scenarios for the Netherlands horticultural industry in 2040 and how the education system, particularly the technology and green schools, should prepare for it.

This research focused on co-creating with stakeholders in the agriculture and technology industry to better understand their views for the future of both sectors and their potential interactions. These were to be done both in stakeholders’ workplaces for a better understanding of the problems and difficulties they face, and on neutral ground (the BetaFactory or in TIS Delft in cooperation with the Expertise center) to create the openness co-creation would need.

Today’s greenhouses are high-tech farms that promote innovation and co-creation (Bras, 2014). They are innovative areas where science, farming and technique have come together to create better stronger and more attractive plants.

This project centered on gathering insights and the experiences of agriculture and technology with a focus on Dutch greenhouses. It focused on how everyday tasks are accomplished. It looked at the trends and predictions for the future. The research was conducted through desktop research and empirical research. Based on the information gathered. A comprehensive overview was created to show what the possible futures of this sphere is, and how they could be approached.
1.2 Goal

The goal of the project is to find what the likely scenarios, for the Netherlands horticultural industry in 2040 are and how the education system, particularly the technology and green schools, should prepare for it. Additionally, it tried to discover, the current state of the industry, uncover the level of collaboration in the greenhouse industry, and identify the gaps and opportunities for further collaboration between the agricultural, technological and educational sectors.

The design report builds on the research report to find and create a vision, in the form of a roadmap for the future of the greenhouse industry in 2040.

1.3 Target Group

Establishing Key Stakeholders

The Greenhouse Growers, these are the modern farmers who work in the greenhouses. They are experts in their fields and with their experience, know best what competences are needed to thrive in their field.

The Teachers in green universities (HAS InHolland, WUR Wagening University) and in the technical universities (The Hague University). They train and prepare the future work force for the horticultural industry. They know where the weaknesses are and they also know the students. This makes it easier to see what the important developments for the future.

The Support Companies who work in the sector. These companies know how to thrive in the sector and it takes from a practical standpoint. Since they are constantly looking to the future to stay relevant and competitive they know what is likely to be needed by the indusry in the future. This includes companies and exporters who sell the products abroad. These are the companies who make the actual structures of and in the greenhouses. The companies are able provide the trends the Greenhouse growers are going towards as well as the reasons for the changes. This helps strengthen the projection for the greenhouses of the future.
The Students, who are the potential employees of the sector. They are the primary target
group because they will be the sector of the future. They have to feel competent enough to enter
the sector.

The Government. They are the ones who issue patents and help sponsor innovation in
the horticultural sector by funding it or through policies. They want to maintain and improve
the level the industry is at.

2. Research Objective

The objective of this research is to get a better understanding of greenhouses and what
it takes to make them successful. To develop a future vision and methods to translate the
visions in initiatives with multiple stakeholders. To use futuring methods to develop several
scenarios and visions of the future of the technology agricultural developments relevant for
the Westland region. To present these scenarios to stakeholders and the stakeholders align
their own future visions with one or more scenarios and results in ideas/proposals for steps to
take now that will lead to the desired scenarios. Stakeholders will be invited to take
responsibility for starting up the proposed steps through co creation sessions and interview.

Research Questions

The questions are:

1. What is the current state of the greenhouse industry?
2. How can the level of collaboration between the green and techniques stakeholders be
   increased to yield the desired output for the horticultural industry?
2.1 Methods

There are various research methods that were used for this project.

**Desktop Research**

Using the existing information, literature search, efficiency, and structure primary research. This kind of research will be used because of the access to books, news articles, movies, videos, documentary, photos, images, scientific papers, magazines, and online information and databases. This is one of the best types of research that can be done for this project to gather background information. This will provide initial insights to the topic of greenhouse farming as well as create an overview of the trends that could impact the industry.

At the completion of the desktop research, it was clear that more focused research was needed on the Netherlands and the Westland. To achieve the deeper insights the research would require, field research was undertaken.

**Empirical Research**

This empirical research builds on the findings of the desktop research. Some empirical research was done because the collection of direct or indirect observations/experiences was useful when it came to experiences of people working in the horticultural sector. This provided some insight to what some unmet needs are to change the mindset of prospective students and professional for the agricultural sector.

**Triangulation**

Triangulation was used because it would give a clearer unbiased view of the current situation as well as the views for the future. When the different methods are combined a clearer view of the respondents’ views and wishes becomes clear.

By interviewing people who are related to the sector, like growers and their logistical partners, as well as people interested in joining the sector, it should be possible to gain some insight from the different perspectives and get a better understanding of greenhouse farming.
and the competences it needs. This method brought together the desktop research and empirical research to find.

**Interview / Questionnaire Sites**

The three preferences on interview sites are, educational sites, where it is easy to approach instructors who know nearly everything related to greenhouse gardening. The plan involved contacting schools in The Hague who have students interested or who could be interested in the sector to be interviewed. These interviews will took place in libraries and cafeterias to find students who are not in a rush and have time for interviews.

The other location to conduct the research at is the universities. This location will grant access to young adults, who are considering their futures and are open to being interviewed about their views on the future and what the young adults feel they lack in their current education. These schools include HAS INHolland, HHS the Haagse Hogeschool, and WUR Wagenning University.

The third location is the greenhouses of the Westland’s. There it is possible to collect data about the statistics, common problems and what popular views are among the experts. At this location, interviews can also be conducted with professionals to gain insights on their experiences with newcomers to the sectors and more. This will give an idea on how people behave and think of the sector. However, this will be a challenging location as appointments will have to be made early on and there could be confidentiality issues.

**Participants**

Experts, young people, and professionals involved in every aspect of horticulture will be participants of this research project. The questions asked can be found in the appendices.

**Observation**

The aim of the observation is to find out ‘what the bottlenecks in the greenhouses are and how they are handled’, as an outsider. The observation was done in greenhouses.
3. Desktop Literary Review

The greenhouse industry of the Netherlands is among the most sustainable and innovative industries (land-en Tuinbouw, p. 1-50). The Netherlands was once thought of as the greenhouse of Europe. With increasing competition from countries like China and Russia, The Netherlands must focus itself on finding a distinctiveness to survive in this new world. The Netherlands excels in producing genetically modified seeds and in the production and running of efficient greenhouses. Situations like an aging workforce and increased government funding the greenhouse businesses have turned the industry to new directions to make up the difference (Human capital agenda, p. 1-59). The following are major trends that industries utilizing and considering they go forward. The trends below are general trends that look at possible solutions for the big problems (e.g., scarcity of resources like water). The decision to focus on the general themes and problems, was made because of the sheer amount of sub-problems (e.g. closed systems) the industry faces. The trends selected cover the themes the sub-problems look at.

3.1 Modernization

The modernization of the greenhouses as they shift from physical to automated labor is causing the industry to train more and more of its staff in the handling and working of these machines to get the optimal and results (Lun, 2014). With this in mind greenhouses are hiring people who have been with the companies from the beginning. These laborers may start with part-time jobs working in the gardens and doing routing and largely unskilled work in the companies, where they learn under experts and become proficient in the use of the tools and machines available to them. They become experts at what they do, despite not being highly educated (Nijhuis & Punselie, 2012).

3.2 Greenhouse Setup
The greenhouses today are very different from the greenhouses of the past, which were basically gardens indoors. These new greenhouses have advanced to the degree that, in a few years, they will require little to no human intervention in menial, everyday tasks. The changes include the replacement of soil with substrate and the exchange of multiple green-fingered employees by a computer that notes the discrepancies between the plants and what is expected and few ‘analysts’ being on hand to correct the discrepancies. For this, the industry needs more experts to diagnose and make decisions at a higher level.

3.3 Vertical farming

Vertical farming is another emerging trend to be considered. With a lack of space in the Netherlands, which excels at the production of plants like tomatoes and cucumbers, a greenhouse could easily make a loss in its market due to the revenue lost by the space the plants take up. By utilizing vertical farming the greenhouse growers can multiply their produce and increase their profits.

Vertical farming is increasingly efficient in use of space and resources. Greenhouses are also combining this technique with stage cropping where they plant crops in varying stages of growth to allow for season or year round harvest.

3.4 Urban gardening

Urban gardening is a growing trend in sustainable and organic farming. This trend seems driven by the need for sustainability and a healthy life style. People are returning to nature (Scenarios in a Nutshell, 2014), wanting fresh produce, straight from the branches (Drotleff, 2013). They also want cheap, quality produce. More than ever they want a say in what is produced for them. This can be seen in the rise of prosuming; companies are asking the consumers to take part in the production decisions.

3.5 Scarcity of Water
Scarcity is a major issue, specifically with the cost that companies face with the loss of resources in runoff. The availability of water is a major concern for the industry that consumes so much of it (Kjaer, 2014) but is in competition with other water-heavy industries like Information Technology (Greenport Training & Technology, 2014). The scarcity refers to the amount of clean and fresh water available for agriculture. Water is used in every step, from the nourishment of the plants to the cooling of the machines and the cleaning of the produce. With this in mind, companies are investing more and more fund into creating a closed system that would allow them to be autonomous (Human Capital Agenda, p. 1-59). By creating a closed system in the water-flow in the greenhouses, the companies would be able to conserve the nutrients that is lost in runoff when watering the plants, which would reduce the waste incurred and the costs of replacing them (Nijhuis & Punsie, 2012). Closed systems would also reduce the costs stakeholders and the company would have to pay in the event of the runoff water contaminating natural water sources.

3.6 Technology

There is a large amount of technology involved in greenhouse farming (Nijhuis & Punsie, 2012). It ranges from the machines that pick the crops, to the machines that plant the seeds and regulate the internal climate. The industry is borrowing more and more technology from other sectors. An example of this is the infrared cameras that were designed for nightclubs that are now being used to count the exact amount of yield on each individual plant. There is constant innovation in the greenhouse field, for instance, there is the development of hanging conveyer that moves the plants constantly so that they take advantage of sunlight and allow the pickers to harvest the yield easily.

3.7 Conclusions from Desktop Research

The desktop research created a strong background into the innovative world of greenhouse farming. It created a better understanding of the early innovation adaptors and
showed the progress from the traditional view of farming that most people recognize to the high-tech innovation centers they are now. Looking at these emerging trends helps create a forecast of the issues that could arise from them. However there is not enough insight from this to successfully answer the research questions of what the current problems in greenhouse gardening and how the educational system should prepare for it.. The identification of the trends made it possible to understand the developments coming in the industry and what innovations and steps the greenhouses are taking. It did not however provide enough insight in to the research question of what is causing the gap and how the gap should be closed. Therefore field research in the form of empirical research was undertaken to attain the missing insights.
4. Process of Research

1. Desktop Research
   Using existing information to gather background information on greenhouse farming as well as create an overview of the trends that could impact the industry. It will target the agriculture, technology, education, urban lifestyles and business sectors and practices of the future.

2. Empirical Research
   Direct and indirect observation or experience. Through interviews, questionnaires and observations to combine qualitative and quantitative forms to get insight into horticulture and share ownership of the research.

3. Character Profiles / Personas of Target Group
   The different mentalities different parties have regarding greenhouse farming are seen. Creating individuals from the clusters found in the target group. Each has their own views and ways of thinking. With this, there is more familiarity with the target group and a clearer picture of the target group.

4. Triangulation
   Triangulation to attain a clearer unbiased view of the current situation as well as the views for the future. By gathering information from a variety of sources related to the sector, it should be possible to gain some insight from the different perspectives.

5. CoCreation sessions
   This will bring the stakeholders into the project to make them more involved with the project. The sessions will help share ownership of the project between the researchers and stakeholders.

6. Scenario Testing
   Scenario testing is another research method that will be useful to because by creating future scenarios it is possible to see what the stakeholders want to go towards and see what others think of it. This will ultimately help with ideas on how to bridge the gap between the two.

Results in

With the ideas and results from the CoCreation session tests will be conducted with the target groups to discover their feasibility, viability and desirability to ensure that the project is as successful as possible.

A session will increase ownership and introduce the stakeholders what an outsiders view on their sector. From the base the last four steps have created, the stakeholders can then develop paths to the futures open to them.

Results in

The result is a better understanding of greenhouse farming and the competences it needs. These can then be put with the personas to find the best way to find solutions the bottlenecks in the path.

The different depictions makes it possible to update the scenarios and also focuses the research on the main target groups. This makes it possible to find solutions to best fit each target group.

Results in

A clarification of the future form the eyes of people actually in the industry. Further clarification of the 4 themes and focusing on the research in general.

Results in

A general overview of what is likely to happen in the future. 4 themes created by looking at the overlapping predictions of the future. A base for the project going forward, they will be adapted and adjusted by the stakeholders.

Figure 4. The Process of Research Visualized
5. Current State of the Industry

The Netherlands are market leaders in everything related to greenhouse farming, from construction, to innovation, and maintenance. For those who want the very best in seeds and greenhouses the Netherlands is the place to go.

The industry has an ageing workforce (Nijhuis & Punsenie, 2012). This means that the current worker will have to work longer or the industry will face severe changes because there is not enough emerging high level workers coming to take their place.

The majority of workers in the greenhouses are the seasonal workers who come from all around to pick the produce (Nijhuis & Punsenie, 2012). However these workers are financial drains on the economy because when they leave, they return home with the money earned.

The industry needs more training, more technology, and more innovation for the sector to remain a thriving industry. The people working in the greenhouses need training to handle the translation of machines with economies of scale (Chang, 2013). Research has shown that this technical knowledge is missing. The current style of training is not enough to support the industry, but with the decline of manufacturing jobs in the Netherlands there will be even more intense competition.

There is a growing need for higher educated people even while the definition of education is changing. The industry’s image and marketing is also becoming more important as it moves more towards consumerism and positioning (Nijhuis & Punsenie, 2012).

Interviews

Different questions for the different respondents we planned on interviewing and surveying.
General questions: these questions are designed to understand the respondent’s general view on the state of things and future. For each of the target groups there are questions to specialize the interviews to them while building on the general topics listed below.

<table>
<thead>
<tr>
<th>General questions for all the respondents.</th>
<th>Topics to discuss</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Views on the future of the industry</td>
</tr>
<tr>
<td></td>
<td>- Views on The Netherlands in 2040</td>
</tr>
<tr>
<td></td>
<td>- Interactions with other stake holders like schools, students, growers, and companies.</td>
</tr>
<tr>
<td></td>
<td>- Ideas on direction the industry should be going in.</td>
</tr>
<tr>
<td></td>
<td>- Jobs and competences needed for the future</td>
</tr>
<tr>
<td></td>
<td>For each of the topic there will be a slightly different phrasing for each situation</td>
</tr>
</tbody>
</table>

*Figure 5a Table of Research Questions for all the Respondents*

Questions for Greenhouses Growers: the aim is to know the feelings or insights of the professionals on greenhouse farming and what could inspire new directions by making the participants co create with the researcher.

<table>
<thead>
<tr>
<th>Group</th>
<th>Topics to discuss</th>
</tr>
</thead>
<tbody>
<tr>
<td>General interview with Greenhouses</td>
<td>- What needs do you anticipate for the future?</td>
</tr>
<tr>
<td>Representatives</td>
<td>- What needs are not currently being met?</td>
</tr>
<tr>
<td></td>
<td>- Methods and techniques in use</td>
</tr>
</tbody>
</table>
For each of the topic there will be a slightly different phrasing for each situation

**Figure 5b  Table of Research Questions for the Greenhouse Respondents**
Questions for Students (the aim to know the feelings or insights of students on the horticultural sector that may inspire direction on the creation of future steps):

<table>
<thead>
<tr>
<th>General interview with students</th>
<th>Topics to discuss</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Interest in the industry</td>
</tr>
<tr>
<td></td>
<td>- perception and view of the industry</td>
</tr>
<tr>
<td></td>
<td>- what shaped the perception and views</td>
</tr>
<tr>
<td></td>
<td>For each of the topic there will be a slightly different phrasing for each situation</td>
</tr>
</tbody>
</table>

Figure 5c  Table of Research Questions for the Student Respondents

Questions for Companies (the aim is to know the general situation of horticulture in the Westland’s’ is and the professionals’ insight on how to increase the crossover between disciplines to motivate innovation and success in the sector):

<table>
<thead>
<tr>
<th>General interview with Company Representatives</th>
<th>Topics to discuss</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-What needs are not being met now</td>
</tr>
<tr>
<td></td>
<td>What needs do you anticipate of the future</td>
</tr>
<tr>
<td></td>
<td>- Methods and techniques in use</td>
</tr>
<tr>
<td></td>
<td>For each of the topic there will be a slightly different phrasing for each situation</td>
</tr>
</tbody>
</table>

Figure 5d  Table of Research Questions for the Company Respondents

Questions for schools: (the aim is to understand how the schools adjust to the changing times and to better understand what their views on the future of education is.):
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**Topics to discuss**

| General interview with Schools Representatives | - How is education preparing to meet the new world  
- Learner centered teaching vs. teacher centered learning  
- Jobs and competences needed for the future  
- Methods and techniques in use  
- How can changes be implemented to increase co creation  
For each of the topic there will be a slightly different phrasing for each situation |

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**Figure 5e  Table of Research Questions for the School Respondents**

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**Greenhouse visits**

The greenhouse visits resulted in a more detailed outlook on how greenhouses are run. Insights into the industry and environment resulted from the visits. These add to the interview by gaining first hand insights into how the greenhouses function. They are conducted in a natural setting so the respondents are not pressured and move about in a natural manner. This allows the possible bottlenecks in the operating system to be seen.

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**Observational Scheme for Greenhouse Visits**

| Tasks | What is being done?  
Who is doing it?  
How are they doing it? |

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### Table of Observational Scheme for Greenhouse Visits

<table>
<thead>
<tr>
<th>Appearance</th>
<th>What is the layout?</th>
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</thead>
<tbody>
<tr>
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<td>What are the reasons behind this layout?</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Machines</th>
<th>What machines are in use?</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>How are they used?</td>
</tr>
<tr>
<td></td>
<td>Who operates them?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Laborer</th>
<th>Who is working in the greenhouses?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Where do they work?</td>
</tr>
<tr>
<td></td>
<td>What do they do?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Innovation</th>
<th>What are interesting occurrences?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Why are they interesting?</td>
</tr>
<tr>
<td></td>
<td>What is surprising?</td>
</tr>
</tbody>
</table>

*Figure 5f  Table of Observational Scheme for Greenhouse Visits*

**Questionnaire**

Questionnaires were sent out via email to respondents who were too busy to be interviewed. The aim of the questionnaire was mainly to understand how the respondents viewed the industry. How they saw the technology and methods being used and what the technology means to them. The following were guiding questions for the questionnaires.

1. How do you see the horticultural sector?
2. What do you think is involved in greenhouse farming?
3. Would you be interested in participating in a project with the sector?

   If yes, what kind of project would you be interested in and why?

4. What do you think you could bring to the sector?

5. Do you think you have been thought enough to succeed in the sector?

6. Thinking out of the box what do you imaging the future of greenhouse farming or farming in general to be like?

7. Are your family in anyway related to greenhouse farming?

   a. How has the answer to question 7, influenced your views on the industry?

   From the questionnaires it was clear that unless there was a family link or former relation with the industry, very few people were willing to enter the industry. People who are studying an agricultural course were willing to join the sector to gain experience.

6 Results

Greenhouse visits

   The three greenhouse visits resulted in a more detailed outlook on how greenhouses are run. Insights into the industry and environment resulted from the visits.

6.1 Observations

Tasks

   Maintenance of the plants and crosschecking of the machines. Securing of plant branches in the vertical farms. Young people do the work age 18-24. It is done with simple tools and requires little training.

Appearance
The crops are planted in rows just under a meter wide. The rows have raised parallel bars on the outsides that act as tracks for wagons when the produce is being harvested; or maintenance is being done.

They are also suitable for holding the automated ladders used in vertical farms. In some greenhouses instead of the raised bar as tracks there are in ground tracks that have hooks to pull the wagons automatically.

**Machinery**

Automated tracks in the floors are used to pull the wagons and other machines throughout the greenhouses thereby allowing the workers to focus on other activities.

Specially designed wagons for the greenhouses have provisions made for the kind of produce. For example for flowers the wagons are fitted with nets to avoid bruising the petals and allow the pickers to keep them in certain formations.

**Labor**

A range of people work in the greenhouses.

There are the young people aged 16-20 who usually work part time picking the produce and doing menial work.

Young adults aged 20-24 are the next group. They are usually looking to gain experience in the sector. They have more responsibility than the first group.

The third group are the adults, 24 and older. They are people who work professionally in the industry. They rarely work at the same levels as the first two groups. Instead they focus on the managerial side, keeping the business competitive.

**Innovation**

Shopping crates were first used in the industry to store bulbs in a way that allowed for ventilation. Albert Heijn was among the first to take the crates out of the industry.
Seed are machine planted, up to 100000 at a time.

The greenhouses rarely plant their own seeds anymore. Due to the fact that quite a few seeds fail, the industry has sub-suppliers for plants.

1. The first of these make the seeds. They genetically modify or adapt them and then sell them to the next step up the ladder.
2. The second group buys the seeds and plants them. They then nurture the plants up until they are strong young seedlings.
3. The seedlings are then sold to the third buyers who raise the plants until they are strong young plants. Depending on the plant they can be up to 20 cm or more at this point.
4. The last buyers are the greenhouses that buy and transplant the young plants and raise them to adulthood where they are harvested and sold to the consumers.
5. These stages allow the industry to be competitive because they can have plants of different stages in one greenhouse. This allows for year or season round harvest.

6.2 Respondents insights from Questionnaires and interviews

The following are summaries of schools insights.

Schools insight summaries

Respondents from 3 schools replied, Haagse Hogeschool, HAS InHolland, WUR Wagening University. The universities want to train successful employees of tomorrow, while building sustainable relationships with companies in their sphere. They do this through projects, lecture and internships. A major bottleneck is providing enough training to suit all the sectors which are stakeholders of the universities.
The school representatives were asked the school representatives to brainstorm ways of increasing the crossover between the green and technique. The majority felt that the best way to increase the crossover was to show the students the potential by having them collaborate with companies. Projects with schools to allow them to explore the possibilities with the support of the teachers are next. A significant number of the respondents cited the unattractive image as a deterrent for student. They suggested updating the image to change the unlikable connotation of dirtiness and difficulty that the industry has now.

The school representatives were also asked to look ahead to 2040 and forecast the competences they felt would be needed for that future. The majority of them cite inquisitiveness, as a major requirement because as students and professionals they will face even stiffer competition. The next requirement was innovators. The respondents
felt that these are the people who would be able to combine different disciplines and adapt most readily. The respondents also felt that critical thinkers would also be valuable in a world where nearly all natural resources would be very scarce. Proactive workers were nominated a competence because the level of competition would ensure that only the dedicated would succeed.

Company’s insight summaries

10 Respondents from various companies replied, the companies want to build a successful future and a stronger connection with their consumers. They do this by searching for the best possible employee to help them achieve their goals. Amongst the obstacles in this is the level of training the company would have to invest to prepare the employees.

57% of the companies said they worked with schools and almost all of them had positive experiences with the students. They felt that the students had the time to devote
to the research that they often could not spare and brought in new ideas. 29% said they did not work with students. 14% were planning on working with students.

The companies provided the following methods as ways to prepare the students better: Changing the education style was among the strongest suggestion though few had any ideas on what to change it to. Projects were suggested to allow the students to build their social skills and learn at the same time. An increase in the amount of content the students are exposed to was suggested by 14% of the respondents.

The respondents selected the need to recognize shifting paradigms as the largest area in need of change. An increase in collaborations with companies was the identified next, followed by the need to adapt the content being taught to students.

When asked if there was enough crossover in the industry, 0% of the respondents replied yes. The majority of the respondents stated that there was not enough crossover in the industry.

The companies suggested projects with schools as the most efficient way of promoting crossovers in the industry. They also suggested that the image of the industry would need to change in the eyes of the public. Minors in universities and advertising the sector took equal share at 11%. The remaining respondents suggested that time would promote the crossover as other professions become less attractive.

Student’s insight summaries.

Information form 9 student respondents. The students want good futures, and experience while they study. They want as

<table>
<thead>
<tr>
<th>Students Views on the future of the Industry</th>
<th>Students Views on the Sufficient Amount of Crossover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Veritcal farms 33%</td>
<td>Yes 20%</td>
</tr>
<tr>
<td>Farming in Urban areas 50%</td>
<td>No 80%</td>
</tr>
</tbody>
</table>
much exposure as possible with companies and sectors during their study to build a reputation and portfolio. This is what the schools offer them. It is what they expect from the schools.

**Students Views of Methods to Increase Crossover**

With a largely negative view on the industry, students see the industry as a combination of dirty while vital. Hard and requiring basic skills and overprotected by the government.

The majority of the student respondents see farming in urban areas as the most likely future of the industry. Vertical farms were suggested because of the presumed space constraints of 2040. 17% of the respondents expect instant deliver due to advanced logistical systems.

The student respondents see technology in the greenhouses mainly as a means of maintaining the climate in the greenhouses. They also see it as a way of minimizing operational costs. There was no mention of the internal logistics of a greenhouse.

80% of the student respondents felt that there was an insufficient amount of crossover in the industry with respect to the green and technical schools. Only 20% felt that there was enough crossover.

The students felt that a change in the image of the industry to a more modern one rather than the image of dirty farmers was required. They also suggest exposure as
a means of increasing crossover in the industry. The sponsoring of events, part time jobs and advertising were suggested in that order as a way of increasing the exposure of the industry.
7. Discussions

There were many similarities between the wishes of the target group and what the results found. The results of the desktop research largely matched that which was provided by the empirical research. Though the insight into how people view the industry and what their level of knowledge about the industry were surprising. Gaining insights into what competences the people of The Netherlands felt would be important for their future provided a good comparison to those projected for the world.

The research by Gerard W.J. Nijhuis and Klaas F. Punselie pointed out that labor is a major issue and it is at the root of the problems. It proposes that somehow collaboration and stimulation must be brought together by the stakeholders to transfer knowledge amongst the stakeholders.

The Land en Tuinbouw Sector Beschrijving of February 2013 by the UWV addressed workers. It looked into trends like the increasing competition and The Netherlands’ shifting focus from exportation of goods to distribution of agricultural knowledge. The research suggested that the agricultural industry needed to specialize. On page 17 of the report, it said that the industry needed the knowledge of other sectors like the high-tech systems experts, water management, energy management, logistical systems and more to be able to do more with less. They need experts to help the industry innovate to remain competitive, to replace quantity for quality (p.18). The industry is growing and they will need help.

The June 2012 Gementee Westland agenda supports this. The agenda highlighted directions like the closed systems in water management as well as energy management that the industry will need to support its future.
The verkenningen: Technische Groene Opleidingen in de Metropool Regio by Marcel van Wijk makes it clear that the industry is here and it is growing. The Netherlands boasts a lot of market leaders but the students enrolling in the industry are decreasing. The report suggests that the industry needs innovation and a change of image to show the possibilities available in the sector. Things like the Greenport Horti-campus are helping but there needs to be a collaboration between all the stakeholders to bring this together to achieve actual growth.

The (10) companies that participated in this research suggested that more crossover was required. The majority of the company respondents worked with schools, and suggest that projects and a new image are among the two of the best ways to increase crossover. These crossovers will help the areas they have highlighted as in need of change. These areas are, the knowledge content, collaboration/experience with companies and paradigm shift. From the company respondent’s point of view, this would be the preferred way to increase crossover and the preparedness of students in the long run.

The (3) schools that responded via multiple representatives felt that the best way to increase crossover was with more collaboration with the companies through side projects. They also noted that the image of the industry would have to change for any real progress to be made.

The (9) students who responded to the research agreed that more crossover was required in the industry. They highlighted the image of the industry as one of the more substantial impediments of crossover between the green and technique schools.

In conclusion, the main objective of this research project was to find What the current state of the greenhouse industry today and How the level of collaboration between the green and techniques stakeholders could be increased to yield the desired
output for the horticultural industry’, for the assignment giver RegioRegisseur. The desktop research suggested that there was not enough crossover in the industry. From the empirical research supported this and generated possibilities for increasing the crossover between the green and technique training schools. It also yielded new insights into other/external ways of increasing crossover. With the findings above, the research questions which were, what is the current state of the greenhouse industry today?’ and ‘How can the level of collaboration between the green and techniques stakeholders be increased to yield the desired output for the horticultural industry?’ are answered.

8. Recommendation

The recently published 21st century competences highlight civic literacy, global awareness and cross-cultural skills, critical and inventive thinking as well as communication, collaboration an information skills as the relevant competences for the coming years. The research above shows that there is quite some distance between the competences that the target group wants and the competences believed to be necessary for the future. The research suggested that innovation, optimization skills, explorers, critical thinker, proactive workability and ICT literacy as necessary competences for the future. There are overlaps with areas like ‘critical thinking’ and ‘innovators’ and ‘critical and inventive thinking’ but there is quite some distance between the competences of today and the competences believed to be necessary for the future. To this end the following recommendations are based on the insights resulting from desktop research, and the first hand insights gathered thought the research.

There should be a change in the education style. Some of these will happen naturally as time progresses, like ICT competences that the businesses will likely demand as well as the critical and inventive thinking. The change needed is not likely to be radical change, but more collaboration between stakeholders through projects and
the like to expose the students to the industry and also foster growth in an efficient and sustainable manner.

The industry needs to communicate better. If people know what is happening are doing they are more likely to want to help achieve it. This will also improve the way people see the industry. This means communicating their success with the general public, and need on a forum of some kind. To avoid confusion in an already complex sector, it would be best if this were done with the industry as a collective unit rather than as a myriad of companies.
9. Appendices

Example interview questions for greenhouses.

1. How do you see greenhouses? - What do they do and how do they do it?

2. What roles do you play in the running of this one?

3. What role does technology play in this greenhouse?

4. What role will technology play in the future of this greenhouse?

5. How do you see the future of agriculture and technology in general?

6. How do you see the future of greenhouses?

7. How do you see your future in horticulture?

8. Are you excited about these futures?

9. What are the needs that greenhouses need to address to go forward?

10. How do you think the industry should go about getting people involved in greenhouse farming?

11. How much personal contribution would you be willing to contribute into bringing new people into the industry?

Questions for Students (the aim to know the feelings or insights of students on the horticultural sector that may inspire direction on the creation of future steps):

Example interview questions for students

Questionnaire questions

1. How old are you?

2. Which country are you from?

3. What are your hobbies?
4. How do you see the horticultural sector?

5. What do you think is involved in greenhouse farming?

6. Would you be interested in participating in a project with the sector?

   If yes, what kind of project would you be interested in and why?

7. What do you think you could bring to the sector?

8. Do you think you have been thought enough to succeed in the sector?

9. Thinking out of the box what do you imaging the future of greenhouse farming or farming in general to be like?

10. Is your family in anyway related to greenhouse farming?

   a. How has the answer to 10? Influenced your views on the industry?

Example interview questions for companies

1. Do you work with schools?

2. What are your impressions of the students?

3. How prepared are the students joining the sector? Why do you think they feel so?

4. Do the young people feel adequately prepared for the industry?

5. What do you think could be done to make the new people joining the sector more prepared?

6. How do you see the future of greenhouse farming?

7. What roles/jobs will be necessary in this future?
8. What’s your best method for dealing with school or promoting crossover between the sectors/industries?

9. Other comments

Questions for schools: (the aim is to understand how the schools adjust to the changing times and to better understand what their views on the future of education is.):

Example interview questions for schools

1. How do you see the horticultural industry?
2. What do you think that you as an organization could bring to the industry?
3. How does this school see the changing times?
4. How do you adjust to these changing times?
5. Are you/do you believe in, a teacher centered educational institution or a learner centered educational program?
6. What do you see is the difference between these?
7. Which is the future and why?
8. How is the education engineered to meet the new world?
9. How do you enable student co-design and goal setting?
10. In a world full of demands for more transparency, how do you provide greater transparency?
11. What forms of evidence do you use or do you think could be used for a student to successfully demonstrate mastery of the competences?
   a. Use an example in your experience to illustrate this please.
12. What competences do you think students should graduate with in general?
13. What competences do you think the horticultural industry will need in the future?
14. Do you think the students here feel or are the students here well prepared for the work force after leaving your care why?

**Full Results overview**

<table>
<thead>
<tr>
<th><strong>4.1 Observations</strong></th>
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</table>
| **Tasks**            | Maintenance on the plants and crosschecking of the machines.  
                        | Securing of plant branches in the vertical farms. Young people do the work age 18-24. It is done with simple tools and requires little training. |
| **Appearance**       | The crops are planted in rows just under a meter wide. The rows have raised parallel bars on the outsides that act as tracks for wagons when picking the produce or doing maintenance.  
                        | They are also suitable for holding the automated ladders used in vertical farms. In some greenhouses instead of the raised bar as tracks there are in ground tracks that have hooks to pull the wagons automatically. |
| **Machines**         | Automated tracks in the floors are used to pull the wagons and other machines throughout the greenhouses thereby allowing the workers to focus on other activities.  
<pre><code>                    | Specially designed wagons for the greenhouses have provisions made for the kind of produce. For example for flowers the wagons are fitted with nets to avoid bruising the |
</code></pre>
<table>
<thead>
<tr>
<th>Laborer</th>
<th>A range of people work in the greenhouses.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>There are the young people aged 16-20 who usually work part time picking the produce and doing menial work.</td>
</tr>
<tr>
<td></td>
<td>Young adults aged 20-24 are the next group. They are usually looking to gain experience in the sector. They have more responsibility than the first group.</td>
</tr>
<tr>
<td></td>
<td>The third group are the adults, 24 and older. They are people who work professionally in the industry. They rarely work at the same levels as the first two groups. Instead they focus on the managerial side, keeping the business competitive.</td>
</tr>
<tr>
<td>Innovation</td>
<td>Shopping crates were first used in the industry to store bulbs in a way that allowed for ventilation. Albert Heijn was among the first to take the crates out of the industry.</td>
</tr>
<tr>
<td></td>
<td>Seed are machine planted, up to 100000 at a time.</td>
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<tr>
<td></td>
<td>The greenhouses rarely plant their own seeds anymore. Due to the fact that quite a few seeds fail, the industry has created sub suppliers for plants.</td>
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<tr>
<td></td>
<td>The first of these make the seeds. They genetically modify or adapt them and then sell them to the next step up the ladder.</td>
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</tbody>
</table>
The second group buys the seeds and plants them. They then nurture the plants up until they are strong young seedlings. The seedlings are then sold to the third buyers who raise the plants until they are strong young plants. Depending on the plant they can be up to 20 cm or more at this point. The last buyers are the greenhouses that buy and transplant the young plants and raise them to adulthood where they are harvested and sold to the consumers. These stages allow the industry to be competitive because the industry can have plants of different stages in one greenhouse. This allows for year or season round harvest.

<table>
<thead>
<tr>
<th>Menial work Automated</th>
<th>Closed systems that save resources</th>
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</thead>
<tbody>
<tr>
<td>75%</td>
<td>25%</td>
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</tbody>
</table>

School's Views on the Future of the Industry

The school representatives were asked what they felt was the single most important change coming to the industry. As the chart above shows they felt the most important change would be the automation of the menial jobs that part time and
seasonal workers now perform. The other change they sited was the closed systems that would have to be created due to the scarcity of resources and increasing regulations.

**Schools Views on How Students View their Readiness to Join the WorkForce**

When asked to place themselves in the position of the students and review their readiness to join the workforce after graduating; the school representatives largely stated that they we mainly ready. 60% said that they felt ready with the exception of the adjustment period needed at the beginning of each job. 40% of the representatives felt that the students would feel under prepared. The 40% cited the reasons for this as largely confidence based.
The companies were asked to describe their views of the future. A new energy source led with 25% because they felt that the current energy sources would be insufficient for the future. In second place with 19% was that idea that greenhouses would be exported outside the Netherlands likely to Russia or China where the cost of labor and operating would be lower. Relocating the greenhouses to urban areas to decrease logistical cost and carbon emissions, tied for third with the greenhouses achieving the ability to create their own energy. Talent based employment as opposed to degree based were among the five ideas with the lowest certainty with the companies. They include quality products over the mass production of today, a focus on water management to reclaim resources cause by waste and runoff, the industry’s shift to seed production where they already excel, and a new focus on marketing in the industry.
The majority of the contacted companies felt that the students that they encountered were motivated friendly and well prepared, though in need of a little adjustment period. 29% felt that the students we in need of some more training before they would be ready for the industry. Only 14 percent of the respondents felt that the students were ready for the industry.

Company's Views on Jobs for the Future
Companies cited ICT as the most promising jobs industry for the future due to the increasing amount of automation the future will bring. Judicial roles will continue to be important to secure the developments being made. Resource translators and marketing will be among the newer jobs. They will have to sell the products while ensuring sustainability. Designers to create, logistical experts to transfer and banking systems to fund the change all tied for 6 percent of the future jobs according to the respondents.
<table>
<thead>
<tr>
<th>Insights into the Future of Agriculture &amp; Technology</th>
<th>Results from students Interviews</th>
<th>Jobs and roles for future?</th>
<th>Is there enough crossover in the industry?</th>
<th>Best method for promoting interest and crossovers</th>
</tr>
</thead>
<tbody>
<tr>
<td>View of greenhouses</td>
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<tr>
<td>Impressions of horticultural sector</td>
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<tr>
<td>Role of technology in greenhouses</td>
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<tr>
<td>What is involved in greenhouse farming</td>
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<tr>
<td>Interest in doing projects with the industry.</td>
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<tr>
<td>Could you be interested in the sector</td>
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<tr>
<td>Do you have enough knowledge to survive in the sector</td>
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<tr>
<td>Future of greenhouse farming</td>
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<tr>
<td>Family background in greenhouse farming and its impact</td>
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<tr>
<td>Jobs and roles for future?</td>
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<tr>
<td>Is there enough crossover in the industry?</td>
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<tr>
<td>Best method for promoting interest and crossovers</td>
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1. Basic. Trapping light in a building to create warmer temperature so plants can grow in unfavorable temperatures. Vital but overpriced but to lack of comparative advantages. They are also overprotected. Minimizing the costs and maintaining internal conditions of greenhouses. A greenhouse, seeds, sunlight, growing material. Only in outsourcing. And allowing countries with comparative advantages take the lead. Vertical small scale farming near cities to reduce transport costs meat demand will fall so more farming will be needed. No, all I know of farming is the traditional ways. I do not think so. Make jobs more available for younger people as part time jobs doing more than picking. Integrate it into the educational systems and sponsor events to get the new image out.

2. They create climates friendly to flowers. Mostly for vegetables. They keep humidity and temperature. Many work with light. Over modified I don’t think the ‘technological food’ tastes as good. Better technology makes the plants grow faster and that means more income for the industry. Temperature, humidity, uv light, water control. Yes, creating a homey feeling for vegetables without modification. I suppose No Instant delivery No ICT will be very important unsure Make people more aware. Let visitors see. I have never been inside an industrial greenhouse so I don’t know its advantages.
| 3 | They grow flowers and some crops | It’s the same as the agricultural sector just with less animal. Not exciting. They just water and harvest plants | Watering plants, providing nutrients. Maintaining the temperature | A greenhouse, soil and experts | Maybe. But not in actual greenhouses. | The greenhouses will be exported to other countries where they can be run for cheaper. | No | Marketers, designers, grower… the basics needed for normal life | Not between energy transition and anything to do with Agriculture. | Advertise to build interest by showing people the real industry |
| 4 | They are very important inventions that provide most of our food efficiently | Hazy, unsure about what is required | To maintain the climate | Photosynthesis, genetic modification. | Yes | Yes | No | Rooftop farming | In fish farming with tilapia | No |
| 5 | Efficient, well run and technologically advanced | Clean, scientific, innovative | Climate control, pest control, building control, produce maintenance | Logistic, efficiency, technology, sunlight, chemicals, greenhouses | Yes | Yes | Yes | 100 percent efficiency in light and space use | No | Some but it could be more |
| 6 | Places where food is grown indoors | Dirty, a lot of work. Long and early hours | Climate control | People, seeds, plants, sunlight, heaters, artificial light. | It would depend on the project | Yes | No | More technological advancements | No | Projects and collaboration with schools |
| s | Advanced farms with really innovative people | Hard but rewarding. Vital, fun | Climate control, harvesting, planting, pest | Experts, pickers, technology, | Yes | Yes | At a lower level yes | Urban farming to make the produce even cheaper. | I grew up around greenhouses | No really, only if you are already interested. | Projects, and internships. |
# Insights into the Future of Agriculture & Technology

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>control, and maintenance.</th>
<th></th>
<th></th>
<th>like lawyers and doctors</th>
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<tbody>
<tr>
<td>8</td>
<td>Places that grow food indoors</td>
<td>Dirty, unskilled, hard.</td>
<td>Climate control</td>
<td>Sunlight, glass, plants, farmers</td>
<td>None</td>
<td>On a managerial level maybe</td>
</tr>
<tr>
<td>9</td>
<td>New age farms, more technologically advanced than most know</td>
<td>A booming industry with a bright future if properly managed</td>
<td>Everything except diagnosing plants</td>
<td>Greenhouses, sunlight, logistical experts, sellers, marketers</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Recordings available on request
<table>
<thead>
<tr>
<th>General future in 2040</th>
<th>Horticulture future in 2040</th>
<th>Work with schools</th>
<th>Types of projects done with schools</th>
<th>Professional impressions of students</th>
<th>Preparedness of students in sector</th>
<th>Students view on their preparedness to join sector</th>
<th>How could students be better prepared?</th>
<th>What changes are needed</th>
<th>Jobs and roles for future?</th>
<th>Is there enough crossover in the industry?</th>
<th>Best method for promoting interest and crossover?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy will be more expensive</td>
<td>Will be intertwined with the building industry for energy</td>
<td>Yes, because I want to transfer knowledge to renew education because he finds the current content taught in most schools quite old.</td>
<td>They could be better prepared but what we have today is a vast improvement from 20 years ago.</td>
<td>Mechanical engineering students probably are because of the high demand</td>
<td>The government policy of education needs to change to include companies</td>
<td>Relevant content needs to be introduced.</td>
<td>The government policy of education needs to change to include companies</td>
<td>Relevant content needs to be introduced.</td>
<td>Jobs and roles for future?</td>
<td>Is there enough crossover in the industry?</td>
<td>Best method for promoting interest and crossover?</td>
</tr>
<tr>
<td>NL will import gas from USA or Russia as theirs' will be gone</td>
<td>Greenhouses as energy producers</td>
<td>Tutoring in the energy transition course.</td>
<td>Graduated in social aspects are more sort after</td>
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<td>Shell and coal are used in industrial processes</td>
<td>Cheaper greenhouses</td>
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<tr>
<td>Smaller government and social welfare is all but gone</td>
<td>Holland continues in seed production and genetics domination</td>
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<tr>
<td>Energy will come from the sea: the technology will come from the US or China</td>
<td>Lees meat more vegetables; Greenhouse type houses for energy conservation</td>
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<td>Old buildings will be torn down rather than transformed</td>
<td>Big cities and floating cities</td>
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1. Tutoring in the energy transition course.
### Insights into the Future of Agriculture & Technology

<table>
<thead>
<tr>
<th>2</th>
<th>Increased population.</th>
<th>A shift to local rather than international exports</th>
<th>Yes, in the area of research and technology.</th>
<th>They are enthusiastic and motivated master students</th>
<th>They should be, they are well trained and think critically but not do a profession. They are thought to learn quickly so that they can adapt to almost any job.</th>
<th>They are likely insecure about what will happen.</th>
<th>The students decide to come here for the masters so they come motivated because it is their choice.</th>
<th>A shift from the classical teaching style. Hybrid teaching of text, lectures, discussions, field trips, and collaborations.</th>
<th>Securing technological developments Funding systems Policy makers</th>
<th>No students go where their interests are. Forced collaboration is okay but the students but do the rest themselves.</th>
<th>Generate interest. Collaborations with industry at earlier stages through courses</th>
</tr>
</thead>
</table>
| 3 | Large population clusters with a focus on monocultures. Freshwater access is low Production of food for exportation is less and less viable One world market mentality Optimal communication Jobs are talent based | More focus on local and more variety per company Most companies will focus on innovation in production of food and machines acting as consultants Less exportation of food More marketing in the industry. | Yes as a coach during projects Projects | The students are capable and knowledge able | Students will always feel underprepared but they are ready | Students will always feel underprepared but they are ready | Schools need to focus on talent development less on the mass production of graduates. | Facilitation of non-competitive research through subsidization by the government. When a profitable aspect is launched the companies begin to finance it. NL must change from a production country to an expertise country. The industries image needs to change | People to deal with issues like scarcity and limitation of resources between nations. Marketers | No there needs to me more communication between the sectors | Information. People need to be better informed about the industry.

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<tr>
<td>4</td>
<td>A lot of delicate work especially in the food industry will be done by hand</td>
<td>A lot of the work is still being done by hand in the industry</td>
<td>Quality over quantity</td>
<td>Labor will be more expensive</td>
<td>Most companies will move greenhouses to other countries like Russia</td>
<td>Not yet. They host students from MBO for internships</td>
<td>Most employees start at the both of green houses in their youth and then rise in the ranks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Will like more internship students to do projects that actually help the company no just coming to gain experience.</td>
<td>They are eager to learn</td>
<td>Yes most are from the area so they know what is required in the sector</td>
<td></td>
<td></td>
<td>The image of the industry needs to change.</td>
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<td></td>
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<td></td>
<td></td>
<td>Companies need to do more for their students and workers</td>
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<td>Workers with technical expertise.</td>
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<td>Sustainable expertise</td>
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<td>Trainings for the employees</td>
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<td>5</td>
<td>Little to no waste</td>
<td>Plants will be grown without chemical because of the possible contamination of canal water</td>
<td>No but we are open to the possibility</td>
<td>Growing on water and not substrate</td>
<td>They bring new ideas</td>
<td>They have the time to apply their results</td>
<td>They need to be educated on more than just the theory and application</td>
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<td>Research and development experts</td>
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<td></td>
<td>No it is important for the student to bring this because they have a lot of new ideas.</td>
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<td>Change the image of the industry through information access</td>
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<td></td>
<td>More people</td>
<td>Expert centered.</td>
<td>Less water</td>
<td>Yes, we try to have opportunities for young people because of the lack of technical professionals at high levels.</td>
<td>More and larger cities</td>
<td>They are nice and understand that they have to work for their opportunities.</td>
<td>Higher regulations regarding to protect water and lower energy use.</td>
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<td>6</td>
<td>More free time</td>
<td>More robots in the greenhouses</td>
<td>Work is largely automated and safer</td>
<td>Dutch green houses are moving to the tropics Canada and Russia</td>
<td>Higher population</td>
<td>Only as guest speakers</td>
<td>Food production will have to be closer to cities</td>
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<tr>
<td>7</td>
<td>More free time</td>
<td>Food production will have to be closer to cities</td>
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<td>Higher population</td>
<td>Only as guest speakers</td>
<td>Food production will have to be closer to cities</td>
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<td>8</td>
<td><strong>Technological advances, sustainability,</strong> More guiding and studying of technological developments. Sustainable</td>
<td>Yes</td>
<td>Teachers at delft</td>
<td>Enthusiastic and motivated</td>
<td>Technically ready but not in practice</td>
<td>Low</td>
<td>All they require is on the job training</td>
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<td>9</td>
<td>Awareness of scarcity of fresh water resources. Less exportation as a result</td>
<td>Yes</td>
<td>Coaching during projects</td>
<td>Focused</td>
<td>Unsure, it depends on the company</td>
<td>Low</td>
<td>More experience</td>
</tr>
<tr>
<td>10</td>
<td>Mechanicalized workforce</td>
<td>The Netherlands remains a market leader.</td>
<td>No</td>
<td>Unsure</td>
<td>Unsure</td>
<td>Unsure</td>
<td>Higher level of education and collaboration</td>
</tr>
</tbody>
</table>
10. References


Breugem, S., Breugem, T., Scheffers, W., Sonneveld, E., & Voskamp, R. (n.d.). 'De Nederlandse tuinbouw in 2050' De scenario's (pp. 1-10, Rep.).


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Lindy van der Veen, (2013)


ecosystem-andrea-saveri


12. Glossary

**Crossover**: The overlap between disciplines.

**Communication**: Refers to the utilization of words, image, sounds and behavior to share a message, thoughts or ideas to others.

**Green**: Refers to study of or relating to agriculture and horticulture.

**Technique**: Refers to the study of or relating to other areas of study like engineering and Megatronics.

**Marketing**: The presentation of a product, service or idea for promotion, selling and distribution. This involves making people aware of a product service or idea and making sure the idea, product or service is accessible.

**Globalization**: Refers to the creation of an integrated global market usually marked by freedom. This freedom can refer to freedom in trade, flow of capital and ideas.

**Agricultural industry**: Refers to the study and practice of utilizing soil in the production of crops and livestock. People employed in any sphere of this are a part of the industry.

**Horticultural industry**: Refers to a branch of the agricultural industry that focuses on the science and art of growing crops. Those employed in any sphere of this are a part of the industry.

**Urbanization**: Refers to the adoption of urban characteristic. These include collaboration and combination to create larger and more central values and areas.

**The gap**: Refers to the distance in collaboration and communication between disciplines.

**Urban farming**: Refers to the practice of farming in or around a city or town. It is usually seen as a part of movement for sustainable communities.

**City Farming**: Refers to the practice of urban farming in cities. These are usually done as community run projects.

**BYOD**: Bring your own device. This refers to the policy allow students to bring their own electrical devices (tablets, Laptops) to school with them.