

Research Hypothesis :

**How to utilize urban  
farming and reallo-  
cate agriculture  
into potential spatial  
qualities in the  
region of  
Noord Brabant?**

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## Abstract.

The urgency of coping with future events and planning contingency policies have been escorting policy makers, researchers, urban planners, and economists over the centuries. Today, due to the escalating challenges that societies are facing, there is a need for holistic approaches that could prevent future break-downs on many levels.

In addition, the butterfly effect has become visible to us clearly, the rise of global warming, economies of scale, and growth in population are effecting all dimensions of the way we live, yet the local "Fire-wall" have failed. Therefore there is a need for a holistic defensive strategies which the rise of urbanization had shaped a new structures in the world urban communities and have led economies, ecologies, environments, energy consuming, agricultural production.

The Netherlands, like many other countries will be effected by all these challenges, as a result many conferences, debates, and policies projections were part of planning contingency plans to prevent any deterioration, Future-Proof plans are being implemented shy-fully. Moreover, many studies and researches have shown the possibility of change, especially with the current technological advancements and digital platforms which could be exploited in many fields.

Being one of the leading countries in agricultural production, and the world second food exporter after the USA, The Netherlands policy makers should be aware of the future exponential demand on food and other agriculture. Since the problem lays in the scarce land resources and abrupt grow in Dutch urbanization, yet sometimes unexpectedly. On the other hand, the need to preserve ecologies and nature, and coping with future water rising levels will also create challenging assurance in the near future. Hence, alternative farming systems arises and should be focused on the cutting edge of economy and society.

This research paper will focus on utilizing urban agriculture as a medium for a spatial smooth transition in agriculture, urbanization, having in mind a minefield of limitations which impose a certain mind-set, as this paper tackles in particular the Noord-Brabant area, focusing on the Groene-Woed & Kampene regions which are surrounded by three major cities, Den Bosch, Eindhoven, and Tilburg.

## Introduction.

During the last few decades there has been clear change in the role of agriculture in The Netherlands, agriculture by itself have changed, and this changes have its impact on all levels in the Dutch communities. While this exciting story of the Dutch agriculture and its current statues bring us to point of discussion and debate due to its holistic, major, and general influence. This research starts with a historical approach of the evolution of dutch agriculture over time, it will discuss policies which influence not only on agriculture but also on the social - economical - environmental - spatial dimensions which in many local cases created social segregation's and lack of trust and hence lost of identity in the Dutch social fabric. Then this research will suggest an alternative and more dynamic models of implementations on this field such as "*Multifunctional Farming*" or and "*Urban Farming*" models as a future-proof methodologies. Therefore this paper will host Noord Brabant, as a case study of analysis on all levels in order to have a concrete evidences in applying alternative methods.

In fact, findings arises the question of how can we implement alternative agricultural models in the region? One can learn from similar implemented models in many advanced countries that faces a similar dilemma as a role model to learn from and to add to it when necessarily. Hence it is important to measure agricultural production yields and categories, measure spatial quantities & qualities (potential spaces, means of productions, etc..) and defining gaps of knowledge in this field. It is also important to define the ecological main structure in the region, be aware of current and future plans and policies, and have a glimpse on the agricultural product and categories them in order to define a proper solution for alternative or urban farming model on both production and spatial levels. These conclusions will help in formulating a proper interpretation of the current situation in order to implement a successful compact and sustainable solutions.

Afterwards, there is a need to test several means based on not umbers, figures, charts, mapping, and interpretations in order compare contingency plans with other similar local projects, in order to have concrete practical evidences of alternative farming and its impact on its surrounding.

And then this research will dig deeper on the practical implementations and how can we stimulate changes in order to have a smooth transition and find gaps to fill. Moreover, this paper will also discuss or to be more precise "forecast" the impact of the application of technologies and alternative solutions on the society, economy, build and un built environments, and also on the spatial qualities. As a result, it is also important to search more about the utilization of technologies and how to take an advantage of local expertises.

Finally, a spatial urban mapping will be my next research in defining, and analyzing potential grounding of alternative farming solution, in order to have a full understanding of this application that will be part of the Kampene and Groene-Woed region in Noord Brabant. This phase of research will be more focused on the spatial analysis and will test the application on a 3 dimensional level, in order to define areas of implementations, or to apply potential minor surgical operations for a testing and also for tackling a certain defaults such as segregated spatial qualities of the city edges in the region.

## 1. How agriculture has played role in changing the Dutch society

During the last few decades there has been a rapid change in the role of agriculture in The Netherlands. Agriculture itself has changed: mainstream agriculture is now characterized by the use of large amounts of external inputs, minimal labour efforts per hectare and high outputs (*Reinhard & Thijssen 2000; Ten Berge et al. 2000*).

These changes were effect due to economies of scale or economically profitable, hence it has become necessary for farmers to increase farm size, efficiency and external inputs, while minimizing labour use per hectare. The latter has resulted in fewer people working in the agricultural sector. Consequently, Dutch society gradually lost its connection to agricultural production. This divergence resulted in a poor image for the agricultural sector, because of environmental pollution, homogenization of the landscape, outbreaks of contagious animal diseases and reduced animal welfare. Although the general attitude towards agriculture seems to have improved slightly in recent years, there is still a long way to go in regaining this trust.

According to (*Oenema et al. 1998; Huijser et al. 2004*). New challenges lie ahead: as The Netherlands is low lying, climate change will lead to specific problems in the field of water management. There are concerns about the availability of energy, the environment, animal welfare and the vitality of the rural areas. Consumers tend to project their private views on agricultural systems (*Bos & Grin 2008*).

The connection between the agricultural sector and consumers has gradually been lost because of the limited availability of land, tensions emerge around its allocation to different functions of the rural area, e.g. agriculture, housing, recreation, nature development, infrastructure, etc. (*Frouws 1998; Goossen & Langers 2000; Renting & Van der Ploeg 2001; De Nijs et al. 2004*). As a result to the changes, both within and outside the agricultural sector, agricultural. Clearly, there is a need for agricultural production systems that meet the demands of society on the one hand, and that are profitable for farmers on the other hand.

### 1.1 Dynamics of Dutch agriculture:

The following is a short description of the historical evolution of policies which have affected dutch agriculture and hence dutch society.

#### How did policies shape the culture of agriculture in the Netherlands across modern history?

#### ***The post-World War II ( Marshall Model)***

At that time, the lack of fertilizers (factories had been converted from war production to large-scale slaughter of animals to feed the hungry population) and lack of labour (mobilization of the male population), agriculture was generally in a depressed state (*Dornbusch et al. 1993*).

From 1948 onwards, external support provided under the Marshall Plan was an important factor in this respect, mitigating the lack of production capital (machinery, buildings, livestock and land quality). The Dutch government also invested heavily in agricultural research to increase food security and prevent future food shortages for the Dutch population. Farm productivity and efficiency had to increase. Moreover, the government wanted to maintain low food prices through cost-effective agriculture and restricting salaries to stimulate industrial production and export.

Soon after WW II, agricultural production volume exceeded that of the pre-war years (*De Widt 1954*). In Dutch agriculture, land productivity growth was especially high from 1950 to the mid-1970s, while during this period the labour input in agriculture declined from almost 600,000 to less than 300,000 man-years.

#### ***1960's till 1975 (OVO model)***

Another important stimulus for the excellent production results was the Onderzoek, Voorlichting Onderwijs (OVO) model or 'triad' (research, extension and education) that, because of its success, remained the leading principle in Dutch agriculture for decades (*Van Dijk & Van Boekel 2001*). Due to the crucial role of farmers in guaranteeing food security, their position in the rural areas was unassailable in this era.

After the mid-1970s, food security was no longer perceived as a problem, while concurrently environmental organizations such as the World Wildlife Fund (established in 1961) and Greenpeace (established in 1971) brought the importance of negative environmental impacts, such as loss of biodiversity, to the attention of the general public.

#### ***1980 -2000's (Globalization & Neo-Liberalism Model)***

Nevertheless, Neo-liberalism was seen as an alternative (*Müller & Wright 1994; Roseboom & Rutten 1998*). Institutionally, neo-liberalism implies privatization, deregulation, including deregulated international trade and reduced government interference. In the period 1980–2000, the agricultural labour force continued to decrease due to ongoing mechanization and rationalization (*Bieleman 2000*). Concurrently, traditional societal patterns in rural areas changed drastically (*Frouws 1998*).

*Diagram above is a visual summery of the impact of agricultural evolution on the Dutch social qualities.*



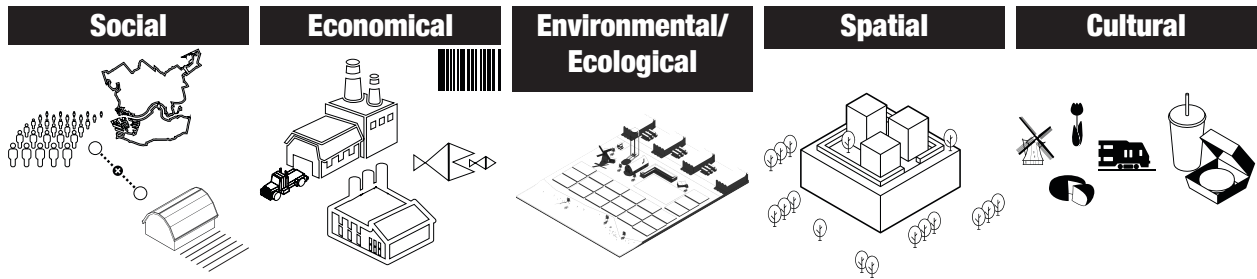


Figure 1 Illustrates the algorithm of dutch agriculture evolution vs the societal dynamic over time.

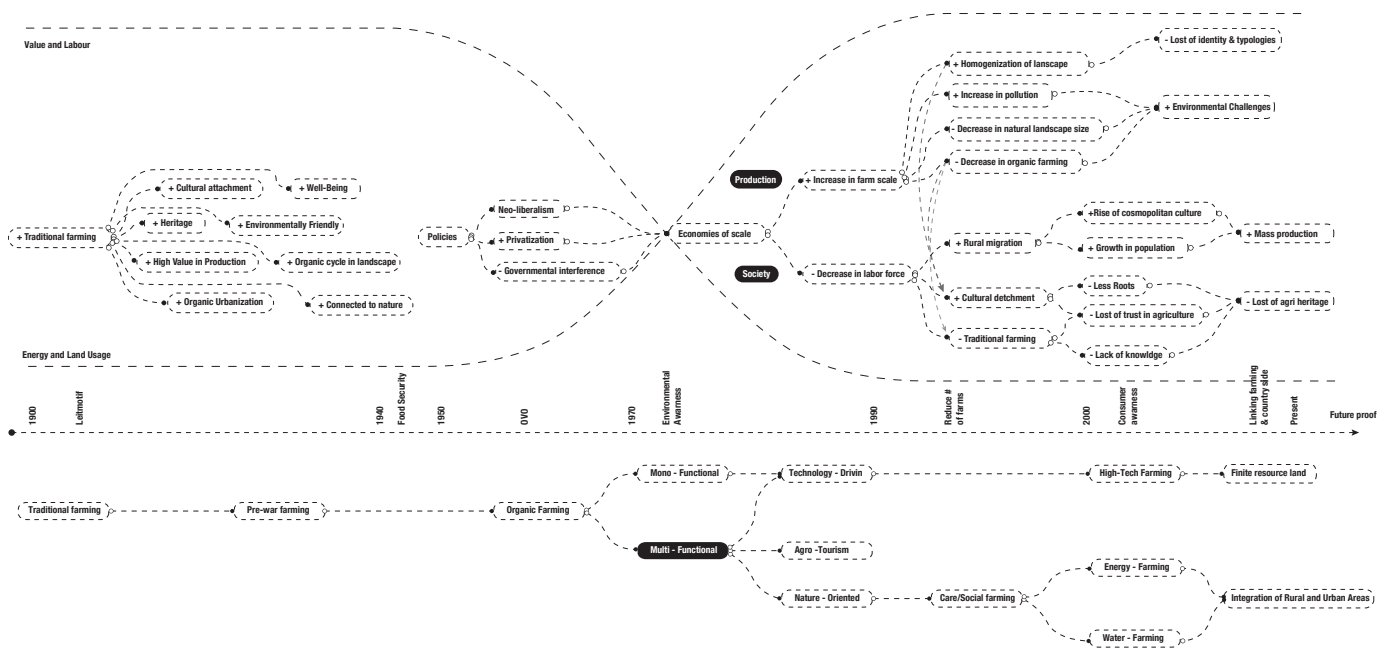


Figure 2 Illustrates the algorithm of dutch agriculture linear model vs a multidimensional application over time.

## Conclusions from chapter 1:

Traditionally, it is obvious that farmers formed the backbone of society in rural areas: they dominated municipal councils, church boards, management of cooperative banks, etc. As their numbers decreased, these traditional societal patterns changed. Due to the application of several agricultural models and economies of scale, farmer's children left the agricultural sector, searching for better employment opportunities or income and moved to economically more favorable regions. Hence this has led to a declining population in rural areas (Mak 1996). As the number of farmers declined, bonds between agriculture and society have weakened with fewer people having roots in rural areas.

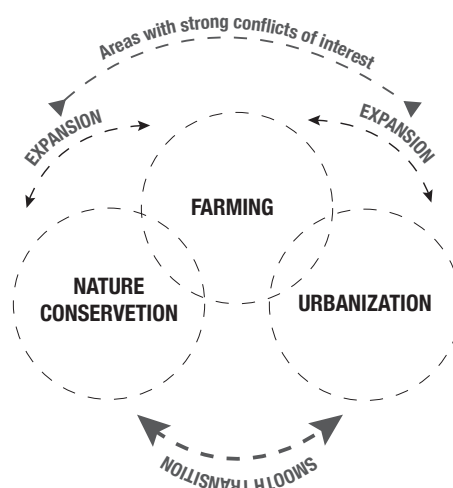
Nevertheless, there is always possibility to learn from the past and try to overcome challenges by creating alternative multi-dimensional solutions instead of linear models in order to shape and maintain an optimal outcome and sustain a high quality standard of well-being.

## 2. What are the alternative models of usages and visions which could be beneficial to the re-transitioning agriculture into the urban/social fabric?

### Areas under tension

The landscape of The Netherlands is strongly urbanized and land usage functions compete for the available space (Opdam et al. 2001). This struggle also has an enormous impact on the possibilities for farmers to continue farming. In areas with strong conflicts of interest (e.g. nature conservation v. farming, or urbanization v. farming), it will be very hard for farmers to continue their farming activities conventionally. This will be especially the case if these farmers need to expand their farm in order to reach their optimal size from the viewpoint of economies of scale.

Figure 3 illustrates the tension or conflict of the spacial interest of three main factors in land expansion.



However, alternative opportunities present themselves:

### 2.1 Multifunctional Farming (Urban Farming)

According to (B. G. MEERBURG\*, H. KOREVAAR, D. K. HAUBENHOFER, M. BLOM-ZANDSTRA AND H. VAN KEULEN) in their research on the influence of the changing role of agriculture in Dutch Society, which proposed the Multifunctional Farming as an effective solution in which provides coherent transitions of agricultural dynamic role in reforming a smooth transition between areas of conflicts on several dimensions.

### Re-linking Rural to Urban as an integration of urban farming transition

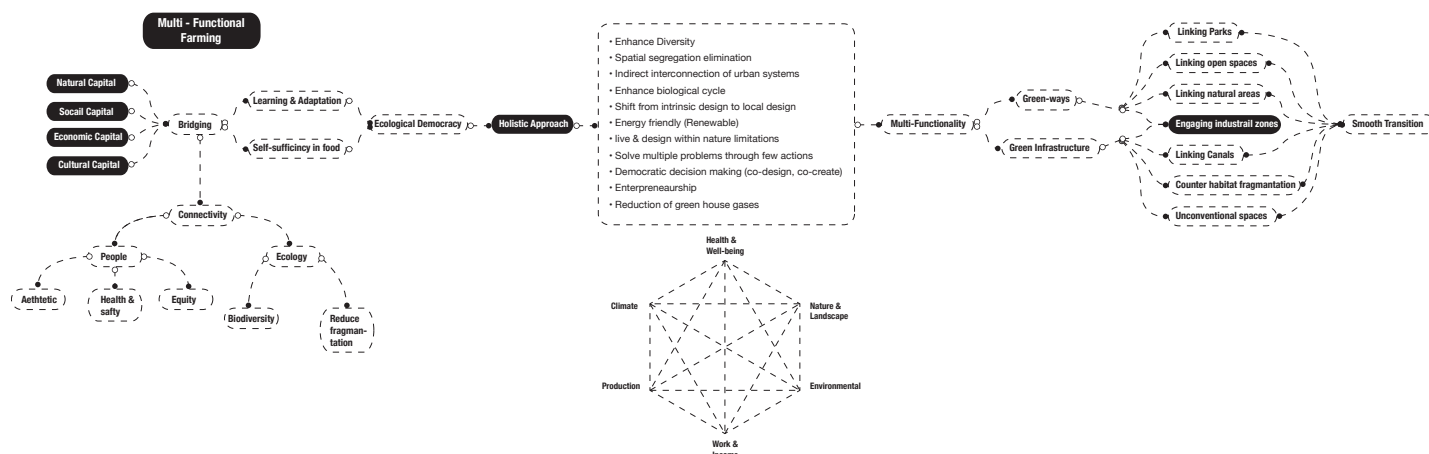
A discussion and an algorithm on possibilities in a change of the mono-functional agriculture culture vs Multi-functional agriculture.

Multifunctional farmers links farming, the rural area and its visitors through initiation of recreational activities such as (camping at the farm and Bed & Breakfast or maintenance of nature and landscape, in addition to their agricultural activities) as an example.

Others organize social care, company events, children's birthday parties or by selling farm products, etc. Part-time farming has become a possibility, as high levels of mechanization no longer require farmers to be continuously present at their farm. All these developments have led to new forms of entrepreneurship. Sometimes this entrepreneurship originates from farmers that appreciate social contact, which is difficult to find in a mere technological environment such as modern agriculture, sometimes it originates from purely economic motives (Van den Ham & Ypma 2000).

However, the rural areas and spacial expansions are not enough as the land is a finite resource, Currently, there is a debate about whether farmers should specialize or whether they should combine different functions in order to earn the highest income. While on the other hand there is an urgency of integrating farming in urban contexts.

Figure 4 illustrates the algorithm of the potential of Multi-Functional Farming in regenerating a holistic ecology as a Future Proof Model.



## Conclusions from chapter 2:

Conclusion from this chapter advice an alternative multi-dimensional solutions for a future-proof scenario for a sustainable agriculture, and a mean to prevent any future defaults that may occur. This is due many challenges that are uprising and predicted, as well as formulating contingency plans have been already upon discussion and negotiations.

The economical/social/technological forces plays huge role in such an event, yet both positively and negatively.

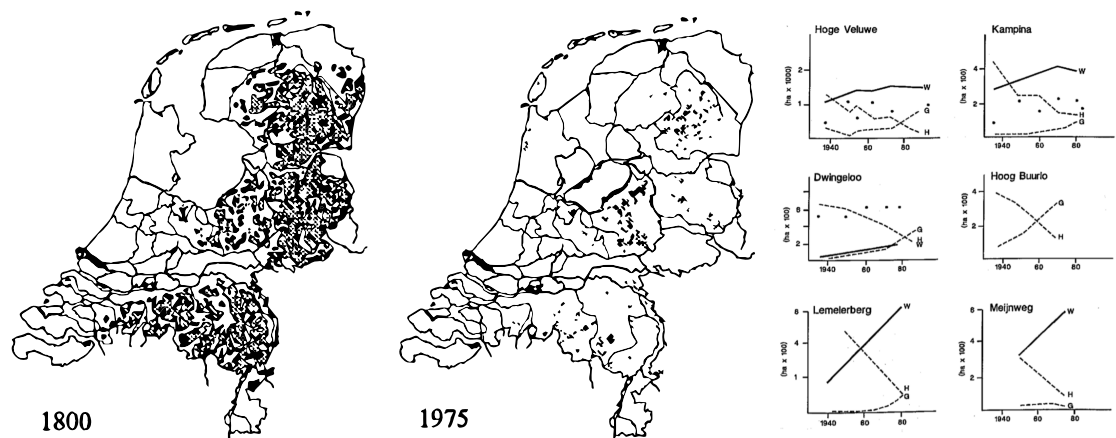
There are many solutions regarding integrating farming with its community, nevertheless farming as traditional model is optimal model but doesn't sustain a bright future due to the scarcity of land.

In a conclusion, spatial qualities should be took into a serious consideration, this fact led me to search more on areas of agriculture and to find potentials in managing the space of agriculture for optimal production, sustainable solutions, and eliminate spatial segregation.

Hence the next Chapter will research more on potentials in

- 1- Managing land resource or categorize spatial qualities
- 2- Categorize the agricultural qualities and the ability of relocation
- 3- Measuring yields and hectare areas
- 4- Finding methods and tools

*The following diagrams illustrate a dramatic changes in the natural / spatial qualities in The Netherlands.*



### 3. Noord Brabant as a Case Study of the application of Multifunctional Farming and the urgency of Urban Farming as a future- proof strategy.

Noord-Brabant is a province of the Netherlands and therefore economically, socially, culturally and in many other ways connected to the rest of the country. It is also connected to its direct neighbors Belgium and Germany, as well as the rest of Europe and ultimately the world. To perform the task we were given and assess the (possible) self-sufficiency of Noord-Brabant in 2025 we have to make a thought experiment. Imagine that suddenly the province of Noord-Brabant is a lonely island with no connection to the rest of the world in whatever way and especially not in food. This means the inhabitants of Noord-Brabant will only be able to consume what is also produced within the boundaries of the province

#### How can we implement Urban farming as a future proof model of agriculture?

Research on current agricultural facts and numbers and data.

#### 3.1 Cases and examples from abroad a lessons to learn from:

Urban Farming is on the agenda of many cities and countries. A few important examples of cities working on self-sufficiency and sustainability in urban agriculture are Toronto, London, San Francisco and Belo Horizonte.

Toronto inspired other cities to also tackle the issue of urban agriculture and its social influence. The city of London, established the Healthy and Sustainable Food for London strategy (*Reynolds 2009*). This included the creation of a food board, which supports educational measures and local markets. Another example is the region of San Francisco where urban neighborhoods were identified as "food deserts". This means that the accessibility of fast food is by far larger than that of fresh products.

Mexico is another example of a country striving for more self-sufficiency in food. "A special programme called SAM - the Sistema Alimentario Mexicano, or Mexican Food System - was launched in order to increase production of staple crops and attain national food self-sufficiency, while ensuring cheap food for the cities and poor rural population" (*Austin and Esteva 1987*).

#### 3.2 Measuring yields and areas

The definition of the degree of self-sufficiency in food (categories) as the ratio of the amount (weight) of food items produced in Noord-Brabant divided by the amount (weight) of food items consumed in Noord-

Brabant. The outcome then is a percentage of self-sufficiency for different consumption categories in food for a point in time.

Yet, This problem originates from the simple fact that there are no data available on:

#### GAPS:

- a. The provincial exports and imports, as well as the very complex structure of today's food system, which is not our case.
- b. **The limitations that will arise in the input view and the spatial view of the problem. Inputs and outputs from agricultural production and Land consumption are various and can obviously not all be considered in a project of this size. In which analysis will be focused on.\***

The Central Bureau of Statistics (CBS) has got data available on the different use of land in Noord-Brabant. Different categories of land are directly or indirectly usable for (urban) agriculture and husbandry. From the collected data the total amount of surfaces has been calculated for Noord-Brabant. These data would help in formulating a spatial analysis of the areas of possible implementation of Multi-Functional farming or and in another word urban farming in Noord-Brabant province.

##### 3.2.1 Rooftop areas - Figure 5

The amount of hectares in usable rooftop areas is calculated separately, since the CBS has no data available on this topic. The main surfaces where rooftop agriculture can potentially be applied are housing land, industrial land, retail and hospitality industry (hotels, restaurants, cafes). According to the CBS around 50 percent of housing land consists of buildings. Around 30 percent of industrial land, retail and hospitality industry consists of buildings. According to research done by the municipality of Rotterdam around 25 percent of the total rooftops is suitable for urban agriculture (*Gemeente Rotterdam Groen van Boven, 2007*). The total amount of space for usable rooftops is **6448 hectares**.

*Figure 5 shows that the large majority of land is agricultural land, forest or open nature.*

##### 3.2.2 Soil Types -Figure 6

The shift of soil type is due to the rivers the Waal and the Maas where sand contains little nutrients and is therefore not very suitable to grow crops and vegetables. In contrast to clay retains relatively much nutrients and is therefore suitable for growing crops and vegetables.

##### 3.2.3 Ecological Main Structures - Figure 7

These areas are confined as protected areas for nature preservation which enables zones to be connected. The main goal of the is to preserve nature in the interest of biodiversity. These areas are less flexible to transform to other land use, for example agriculture, since they are protected by policies and regulations.

### 3.2.4 Agricultural land and Urbanization - Figure 8

The percentage of agricultural land is between 40% and 100% for most municipalities in Noord-Brabant. Municipalities with clay soil have relatively more agricultural land than municipalities with sandy soil. Municipalities with a high percentage of agricultural land are often not urbanized.

### 3.2.5 Future plans and urbanization developments

- Figure 9

Other aspects that might influence the land use are the future plans of urbanized expansions and developments. Those areas seen in Figure 7 represent future plans in offices, businesses, retail and housing. Future developments might occur in already urbanized areas (revitalization) and therefore the amount of rural area is not decreasing significantly. There are however some future plans by which the urban development is an expansion on the rural area.

### 3.2.6 Agricultural production in Noord Brabant -

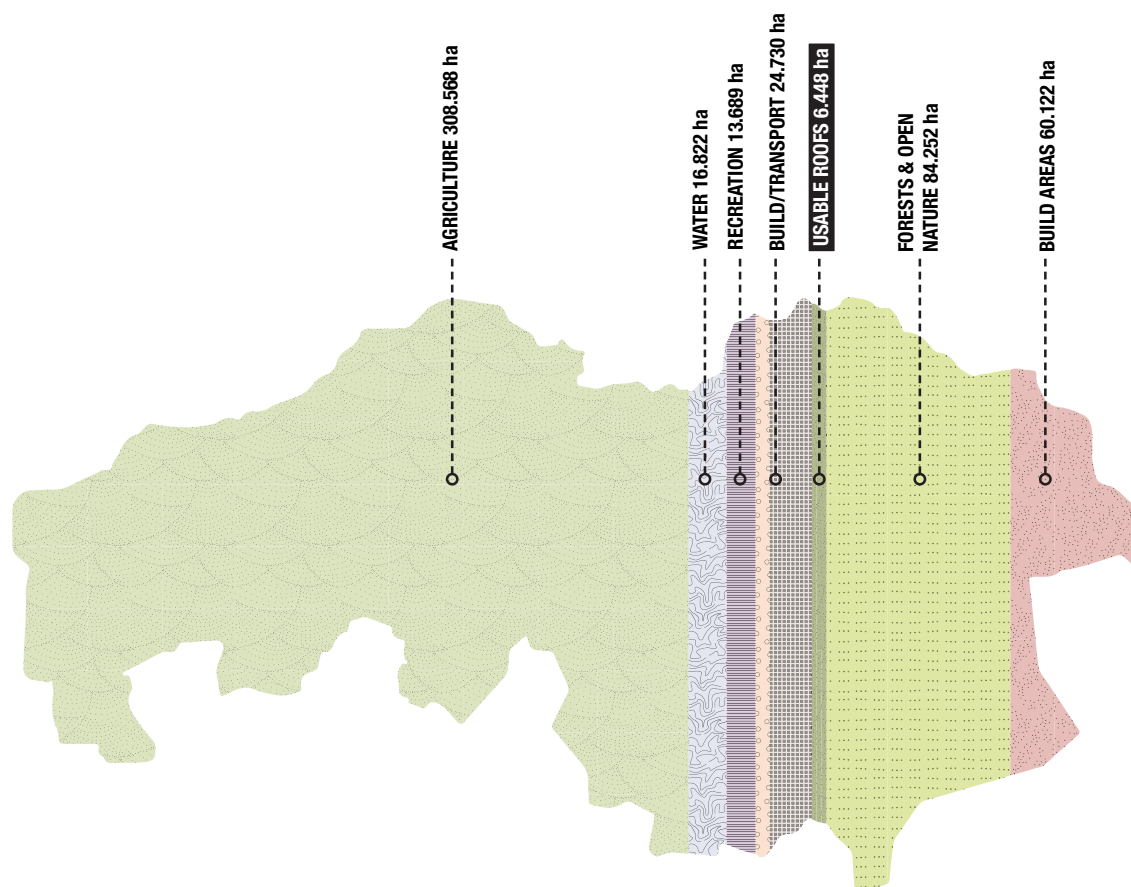
Figure 10

The main type of agriculture in the province is animal husbandry, hence most farms are connected to livestock production with total number of **4375**. While on the other hand, horticultural products are also present in both under glasshouses and open air respectively of **717 farms** and **2321 farms** and are divided to forage crops production **67778 ha** followed by **15425 ha** and **16099 ha** cereals and potato, and vegetable production of **9647 ha**.

**Total vegetable production in Noord Brabant (tons) = percentage of the national horticultural area present in Noord-Brabant x total national vegetable production (tons) / 100**

As per animal feed production, is out of subject for the current proposal.

Figure 5. The different surface areas of Noord-Brabant in hectares (ha) (CBS 2014)



*Figure 6. Types of soil in Noord-Brabant (EduGIS, 2014)*



*Figure 7. The Ecological Main Structures (EHS) of Noord-Brabant (EduGIS 2014)*

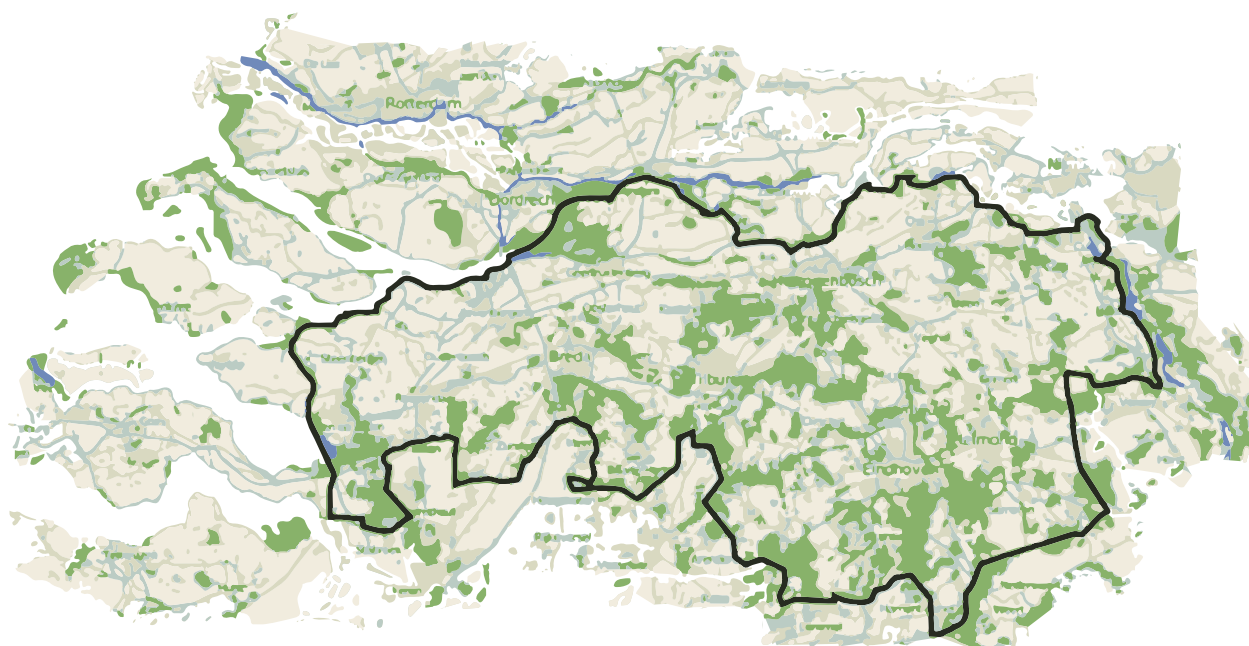




Figure 8. The Ecological Main Structures (EHS) of Noord-Brabant (EduGIS 2014)

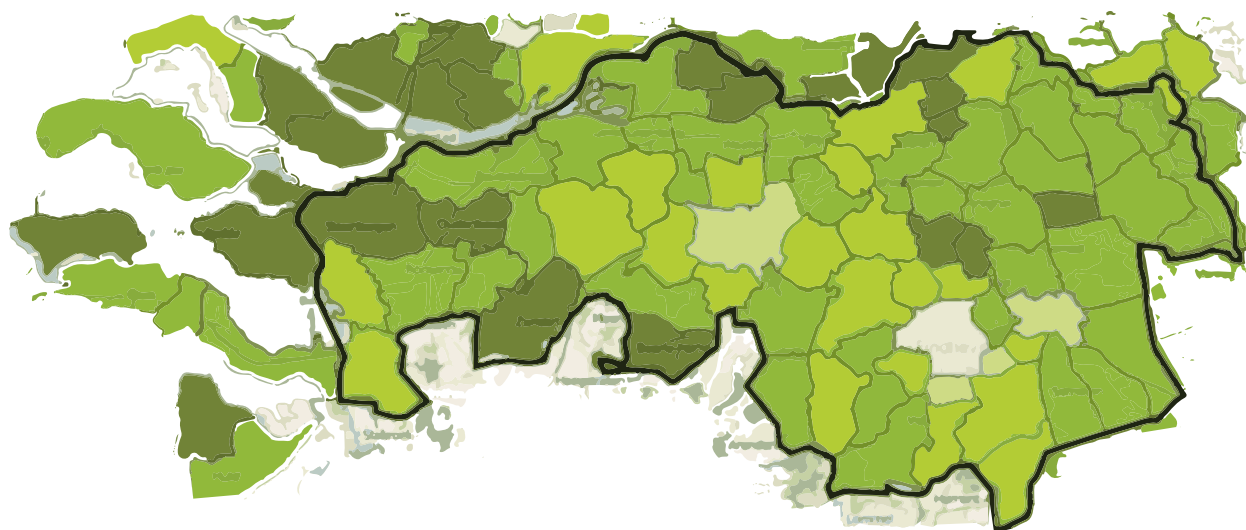


Figure 9. Future plans of urban development 2025 Noord-Brabant (EduGIS, 2014)

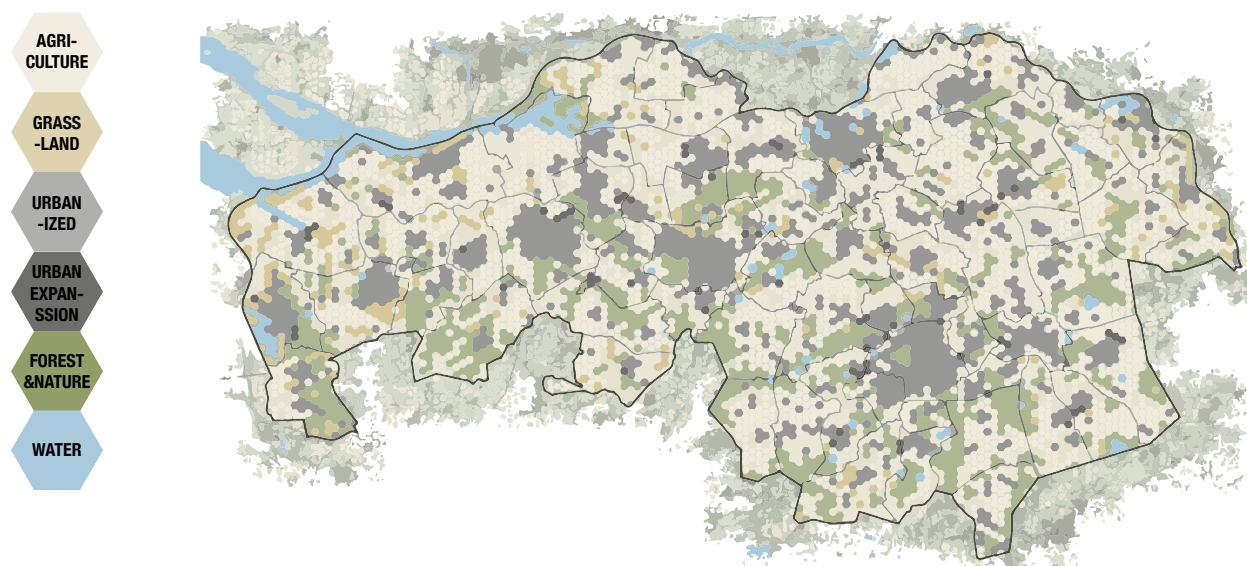
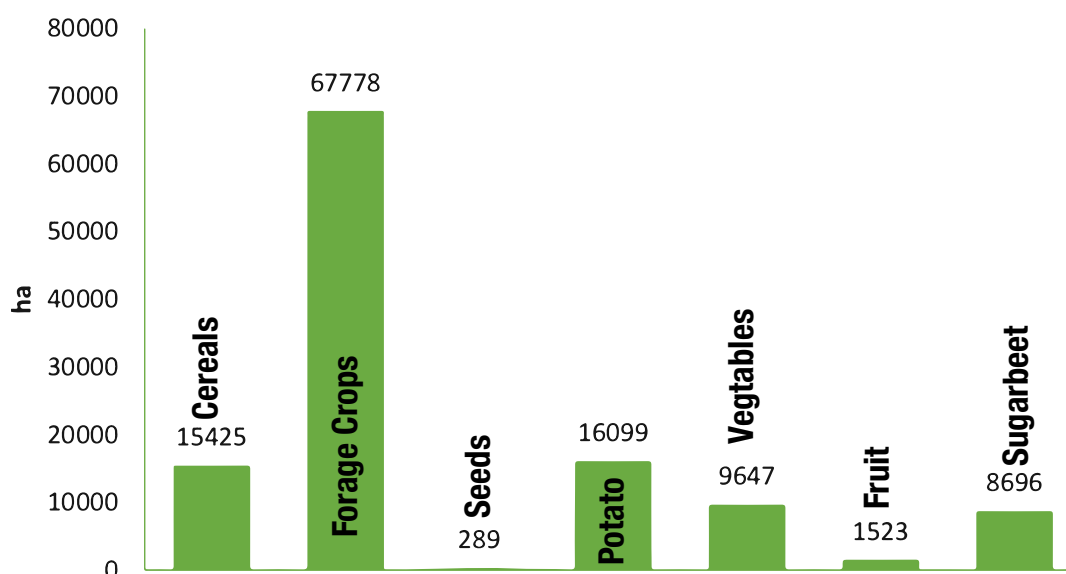


Figure 10. Area cultivated in Noord-Brabant in hectares (CBS 2013)



### 3.3 How can we introduce urban farming and land reallocation as a future-proof model of agriculture in Noord Brabant?

#### Urban Agriculture vs local markets needs vs location

The urban food production is generally underestimated. Urban agriculture contributes to the food production of many cities to minimize the food insecurity of vulnerable groups, especially in developing countries (Stevenson *et al.* 1996). There are some examples of urban agriculture for commercial aims, such as the production of hydroponics lettuce and ornamentals close to supermarkets in the city of Santo Doming or Brooklyn Grange Farm in Queens, consisting of a 4000 square meters commercial organic farm in New York City (Brooklyn Grange Rooftop Farm, 2014). However, most of the urban agriculture is carried out by privates for self-consumption. Some examples are the allotment gardens in Stockholm and in Rotterdam and urban gardens in Amsterdam (Barthel *et al.* 2010).

#### 3.3.1 What are the potential-production-methods and areas of implementations?

Different production methods are used for food production in cities. There are traditional gardens, build in unconventional spaces, such as balconies, public gardens and roofs are used next to the intensive gardening in soil. Hydroponics is gaining popularity as a solution to the problem of access to land. Organoponics is another technique, usually applied by state-owned gardens, which consists in raised container beds filled with compost and soil, where vegetable crops are cultivated very intensively. This method is useful for the areas paved with concrete or with very poor soils (Armar-Klemesu 2000).

#### 3.3.2 Lessons learned from the world (examples)

*\*referred to section 3.1*

With the increasing population and the consequent decrease of the available land, new high-density strategies have raised in cities, one of those is the roof gardening. This kind of agriculture is an extreme answer to the increasing urbanization. There are already examples of agricultural activities on roofs in many cities all around the world. There are some examples in the USA and in London, of roof gardens for commercial activities, like local markets or restaurants. Other examples are in Tokyo, where an ordinance obliges to devote 20 percent of the roof area of all the buildings to greenery. In Singapore it is also very common to practice agriculture on rooftops and inside high building, because of the density of the city. It could produce potentially 25 percent of the total vegetables consumed.

#### 3.3.3 Research on practical implementation of alternative farming and potential products

Several researches have studied the practical implementation of roof farming and inside building farming, trying to determine which crops are more suitable for different techniques and what yields can be achieved. For outdoor cultivations, such as rooftop gardens, there is of course a climate limitation, only adapted species can be grown. Moreover hydroponic techniques are preferred for logistic and economic reasons for a range of crops which includes :

- leaf crops (spinach, salad etc.),
- herbs and other crop such as Cucurbitaceae (pumpkin, squash, courgette),
- Solanaceae (tomato, eggplant, pepper etc.)
- beans.



The limitations of rooftop and indoor farms are of course in production of cereals, feeds and large-scale animals.

### 3.3.4 Research on practical implementation of alternative farming and potential products in Noord Brabant

Based on the observations made in the 'Spatial analysis of Noord-Brabant' (using data from the CBS) and after calculating the amount of area suitable for urban agriculture, land was divided into four categories:

- **rooftop area suitable for urban agriculture**
- **parks and gardens**
- **allotment gardens and Building sites.**

Assumptions were made regarding the type of urban agriculture suitable for these areas.

For rooftop areas are assumed that hydroponics are mostly being used, in parks and gardens are assumed that intensive urban agriculture is possible, whereas in allotment gardens conventional urban agriculture would be usual and building sites might

only be used for conventional urban agriculture due to their temporary status.

According to estimations, which can be understood as an 'educated guess',

**The real degree of urban agriculture in 2025 in Noord-Brabant cannot be forecasted, the urban areas would be able to grow 124659 tons of fresh products (mainly vegetables) each year.**

This is approximately one seventh of the current conventional vegetable production in the province and would actually suffice to cover the total current consumption of vegetables. Urban agriculture can therefore be seen as an important stimulus for society in different fields, and is also able to contribute to the demand of agricultural products in the province.

*(Table 10 presents a spatial chart of areas in ha which provides information on the possibility of urban agriculture in Noord Brabant.)*

Figure 11. Possibilities for urban agriculture in Noord-Brabant in 2025

	Area (ha)	Factor	Used area	Production method	Yield t/ha	Products grown (t)
<b>Rooftops</b>	6449	0.05	322	Hydroponics	190	61263
<b>Parks and gardens</b>	3880	0.2	776	Intensive urban agriculture	60	46560
<b>Allotment gardens</b>	329	1	329	Conventional urban agriculture	12	3948
<b>Building sites</b>	5370	0.2	1074	Conventional urban agriculture	12	12888
<b>Total</b>						<b>124659</b>

### 3.3.5 Stimulating urban agriculture and reallocation of land, how?

#### A- Engaging Public Sector

The most important aspect for urban agriculture is available land. Local authorities can offer their fallow lands for urban agriculture. It is important that these lands are situated in busy parts of the city, so that they attract attention from by-passing people. To attract more attention urban agriculture gardens can also be situated in green parts of the cities, like parks. Also other large land owners, like ProRail and property developers, can help urban agriculture by offering their land for one or more seasons. People should also be able to get information about urban agriculture. The Brabants Netwerk Stadslandbouw (BNS), established by the BMF, is an excellent actor for this task.

#### B- Engaging Semi-Public Sector

Urban agriculture can also be supported by a broader range of actors. Schools can for example be involved by letting their pupils work in the gardens. Also students from vocational schools can help in maintaining the gardens. Students from a college in Ede are for example helping in the maintenance of the garden from the local hospital (*Gemeente Ede 2014*).

#### C- Engaging private Sector via reallocating land to produce more goods.

Via gradual shift to other production methods or producing other goods. This will have a big impact on distressing farming land that have been used over decades and been subjected to lots of pesticides and other agricultural products which influence the soil quality and a healthy ecological cycle.

### Conclusions and lessons learned from chapter 3:

In this chapter, which focus on Noord Brabant province and the ability of integrating alternative agriculture in order to maintain smooth transitions between certain spatial qualities in the region.

It is clear that agriculture occupy a tremendous space in the province of Noord Brabant.

Yet to make it evident, similar cases and scenarios where studied briefly, and a quantitative research took place in order to back-up the conclusions of the previous chapters.

After defining gaps of knowledge, limitations, spacial qualities, agricultural concerns, learning how to calculate areas, yields of agriculture then defining potential spatial qualities and juxtaposing various conclusions and concerns via mapping of the region of Noord Brabant. We can conclude the following:

There is an urgent minor surgical operations in some areas in both agriculture and urban spaces.

It is clear that relocating certain agricultural methods such as horticultural agriculture will have huge positive impact on its surrounding.

It is obvious and clear that many similar operations had a successful influence in many other countries and cities in the world, that is because gaps are filled properly via applying alternative production methods and techniques, grounding them on several spatial qualities that are not exploited properly such as rooftops, unused common spaces.

Many agricultural products could be smoothly transformed into various urban contexts such as public sectors in The Netherlands and Noord Brabant, rail ways and public building is an example. On the other hand semi public locations also have the potential in absorbing urban agriculture such as schools, academic facilities, health facilities, high-tech industrial areas will also help in engaging the qualities of urban farming.

And then it will be easy to approach the private sector in agriculture in order to reallocate farming for a better ecological cycle and for an optimal production.

The qualities of this transitions are various and covers many dimensions, it will reverse the domino effect of global challenges, and will sustain the well being quality in the region.

We can also conclude from chapter 3 that many agricultural products have the potential to be part of the urban fabric, via implementing various cutting-edge agricultural techniques and methods. Nevertheless, these horticultural products which could be reallocated are the basic food chain, that is people will become more closer to what they eat and will have a transparent control on production.

It is also evident that urban farming will generate a new economical cycle in the region, since many entrepreneurs will start to get advantage and find gaps to fill.

Finally, chapter 3 is a proof on the advantages of urban agriculture in many levels, it defines potentials as well as limitations, and this help us to conclude a better understanding of the current situation for a scientifically convinced and proved possible solutions.

## 4. What are the impacts of urban agriculture on the 3 E's?

This area of research emphasizes the need to balance the three Es of sustainability: the environmental, economic, and equity concerns for current and future generations. This definition has guided the sustainability paradigm for several decades, but scientists and policy experts have emphasized the need for a broader, holistic, and integrated approach that addresses the connections between human wellbeing and the environment (Selman, 2006).

### 4.1 Contributions of urban agriculture to urban qualities.

According To Randolph Hester's vision for sustainable urbanism in his book *Design for Ecological Democracy* he summarizes the principles of sustainable urbanism as:

1. Increase diversity,
2. Integrate parts of urban ecosystems that have been segregated,
3. consider the many and diffused indirect interconnections of urban systems
4. follow the flows and cycles of biological processes,
5. evolve the design from the intrinsic character of the locale,
6. rely on renewable energy and resources,
7. live and design within the natural limits of the bioregion,
8. solve multiple problems with few actions
9. reveal natural processes through design
10. use democratic decision-making processes,
11. co-evolve human development, human habitation and nature to achieve human fulfillment and the restoration of ecosystems. (Hester, 2006).

Although, some cities have set measures for sustainable development based on certain indicators according to Local Agenda or national guidelines. Quality of life indicators are usually related to aspects such as "amount of public green spaces per inhabitant", "public parks" and "recreation areas" and important factors to make the city livable, pleasant and attractive for its citizens. The society needs a holistic approach to the management of the development process, embracing economic, social, cultural and ecological considerations. Landscape is a framework within which this can be done (Roe, 2007).

### 4.2 Elements involved.

Landscape and urban agriculture can be thought of as comprising the following elements: natural capital which provides irreplaceable service functions and are, effectively, life-support systems, social capital, which refers to the people living in and using the landscape, economic capital and finally the cultural capital, which is the living legacy of shared histories and human-made artifacts (Selman, 2006). This perspective also focused upon the preservation of inherent landscape qualities and values both natural resources, such as biodiversity, habitats and water, and cultural heritage in their landscape context.

Nevertheless, valuing landscape sustainability translating ecological complexity into a set of limited number of ecosystem functions that generate the goods and services valued by people.

In addition, This extension in the ecological approach is useful in bridging some gaps in landscape planning between ecology and society, but these integration with cultural and aesthetical attributes of landscape sustainability is still unsolved.

## Conclusions and lessons learned from chapter 4:

This chapter focus more on the outcomes, the potentials, and the impacts of urban agriculture or/and alternative methods of agriculture.

It is clear that agriculture is a backbone for every economy, its is an industry which shapes societies, cities, landscape, etc..

Nevertheless, urban agriculture will also have its potentials in cities, and shaping smooth transformations, and help to distress the farmlands and the landscape surrounding it.

All readings come to a point which agrees on the positive impacts of alternative agricultural methods.

I intended to back up my arguments with several references to make the utilization of urban agriculture clear and well defined and acceptable not only on the academical level but also on the practical level.

## 5. What are the potential technologies that could be utilized in achieving a smooth transition of agriculture into urban context?

According to a research paper The Future of Technology in Agriculture, there are 4 main technological advancements which could be implemented in urban agriculture, that are beneficial on many levels not only for agriculture but on a holistic level. There are for sure a lot to be added such as sensors technology, Smart materials, aquaculture, smart transpiration, etc.. but I wanted to focus on elements that could be beneficial in my research.

1. Robots offer many opportunities for the automation of the agro & food sector, including cultivation and harvesting, automation of food preparation and automation of food logistics. At present robots are used in the Netherlands for shoot production, crop protection, sorting and packaging. Experiments are already underway in plucking (tomato, cucumber, strawberry, etc.), weed control, the harvest of peppers and roses, the packaging of food and the handling of soft products.
2. Smart farming allows the customized production of specific products for specific clients.

Customized production leads to an increase in the diversity of products and production methods. Recent developments in smart farming include ever increasing data exchange between machines, management systems and service providers.

3. Renewable energy There are various reasons why the agricultural sector should play a role in the production of renewable energy. It has the required space, it produces biomass and thus plays a part in the CO<sub>2</sub> cycle. Also relevant are the eagerness of the sector in additional activities, its image and sustainability, and the EU and national agriculture policies. Reaching biomass capacity.
4. Vertical farms have been built recently in Singapore and in the state of Pennsylvania (US). Although the term vertical agriculture receives much media coverage in the Netherlands only few projects have been realized. The advantages of vertical agriculture include: no loss of harvest as a result of the weather, pests or animals, more yield per m<sup>2</sup>, production takes place near the client or market, no negative impact on biodiversity or damage to the soil, less emission of CO<sub>2</sub>, minimal use of water through recycling and considerably lower use of fossil fuels (no tractors, plowing, transport).

*(Silke De Wilde ,2018)*

## Conclusions and lessons learned from chapter 5:

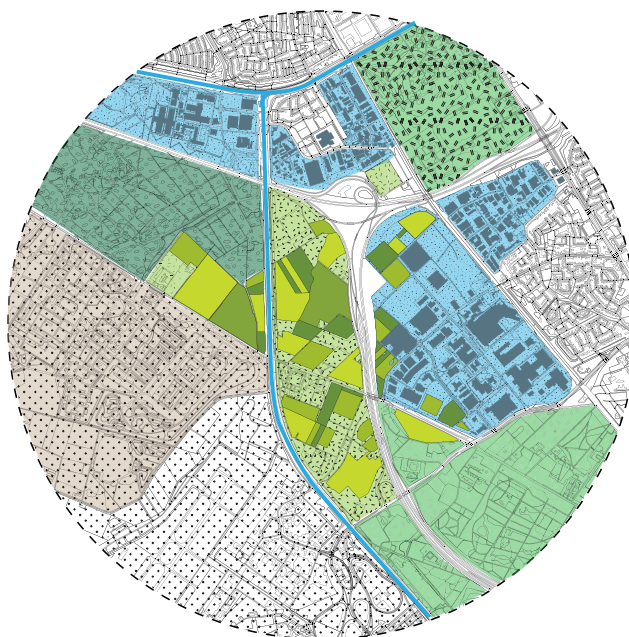
This study focuses on the potential impact of technological development on the Dutch agro&food sector in the long term. Uncertainties always leads to opportunities. Despite the focus on technological developments this futures study – by reflecting on the scenarios and by looking at developments in a context of non technological trends – offers a wide view of the future of the agro & food sector as well as the food sector in general. The discussion of technological developments is not limited to the question whether a technology will break through or not, or will play a role in the future. Thinking about the distant future allows us to go out of the box and to create room for social creativity and empathy. The technology survey, the social developments, the archetypal scenarios and the visions of the future in this study aim to boost the debate. (Silke de Wilde 109-110). It is always important to exploit potentials on several dimensions and technology is plays a huge role not only in agriculture but also it helps to generate presize answers and data that could be used in solving and predicting potential challenges.

## 6. Define area of implementing Urban agriculture in the city edges of Kampene area and Groene-Woed of Noord Brabant.

Figure 12. Shows city edges of Groene-Woed area which mapped for potential relocation and injecting urban farming



Figure 13. Shows the city edges of Eindhoven where the blue zones represents industrial zones while the green gradients are the landscape vs the conventional agricultural lands which are a potential for smooth reallocation.



## Conclusions and lessons learned from chapter 6 and General conclusion:

In general, this chapter is an annex to Design Studio project “ Smooth Transition of the landscape in the Groene-Woed, and Kampen region in Noord-Brabant.

Mapping on different areas will be subjected to many scenarios in order to achieve this smooth transition of the landscape.

I have chosen the agricultural sector as a research segment after noticing its huge impact on the area not only economically, environmentally. socially but also on its spatial influence and the huge amount of space that agriculture occupy.

This research is to back-up my proposal in order to legitimize any alternative proposals in reallocating agricultural lands in the area.

Distressing the land has a huge influence on the natural cycle of the landscape. It will let the earth to rehabilitate and to regenerate its proper natural cycle.

And since cities are already dense, yet there are spaces that could be exploited and help in the natural distress on one hand, and help to regenerate and end the segregation that is happening inside the cities on the other.

The benefits are wide and various and there is no debate on its legitimacy, yet it will be an amazing results if this could be practically implemented and tested in this area.

This research have provided me with many answers regarding my general topic, first I became familiar with the agricultural culture in Noord Brabant via studying historical events, which are related to socio/economical factors, which made policies to be tested over a century. Second, this paper have provided me with paper alternative solution of agriculture, its is not only technical alternative but also spatial, which is my concern.

The figures on the land usage, and the potential unused spaces in the region have made things more concrete ignorer to achieve this smooth transition. The tested examples in many other countries also backed up my research as an evidence on the legality of Urban Farming and its urgency in many growing cities around the world.

The rapid change in globe, and the exponential evolvment on all levels forces us architects, planers, and policy makers to think about alternative solutions, an unconventional ones. Humanity is in an ongoing trail and error, nothing is fixed or constant. Therefore, a scientific evidences backed up with data would create a wise and mature field of experimentation. Yet, we always tend to go back to our basics, but in different way each time. I personally think urban farming is nothing more than rearranging cities to be like an old authentic village where every member of such communities is an entrepreneur. Self-sufficiency is always sustainable solution, all the developed countries work hard on achieving this.

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