Creating a Resilient Food System for the AMA

FOOD ISLAND

MSC3 APRIL 2018
AR2U086 R AND D STUDIO: SPATIAL STRATEGIES FOR THE GLOBAL METROPOLIS
AR2U088 RESEARCH AND DESIGN METHODOLOGY FOR URBANISM
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...IT IS NOW THE YEAR 2040

After an enormous disaster, the world has completely vanished and only the Amsterdam Metropolitan Area (AMA) has remained. Since the event, mankind has gone insane. Fact is: there is hardly any food left. It has now become impossible to import the food that we relied on before and there is not enough production within the area to provide for our consumption needs. While some are barely staying alive, food prices are rapidly increasing and the handful of purchasing companies have full control over the accessibility to the food. While our food supply is shrinking, the amount of food waste is only increasing. The two main waste incinerators are unable to handle all of our waste, which leads to terrible and no further to mention, unhealthy environments. Due to pollution and land use cities have become uninhabitable and many animals and plant species have gone extinct. However, we are still desperately trying to extract any nutrients out of the products that are left, but it is not working and soon there won't be any food at all...

**Note: This experimental exercise is not a realistic vision, but an approach to learn from the current food system within the AMA which is highly dependent on the import and export of food. The scenario is set up in a way to highlight the unsustainable, vulnerable and reliant aspects within the food system and to showcase opportunities to improve resiliency and thus sustainability.*

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01.1 ABSTRACT

Governments and private and non-profit organisations from international to local levels have acknowledged the idea that more sustainable systems are required to reduce our ecological footprint (WWF, 2016, Jonkhoff, 2012). The food system is a very important aspect within our lives, socially as well as economically but it is also one of the most important causes of unsustainability. The Amsterdam Metropolitan Area (AMA), a key player within the global food sector, is also working to a more sustainable system with their focus on a circular economy. This research outlines the fact that in order to reach a more sustainable economy, there should also be an emphasis on resilience. In analysing the region, there were several dependencies highlighted within the food system. Within the aspects of production, retail and end of life, each are dependent on a handful of controlling and dominating stakeholders as well as unsustainable and uncircular practices. Thus, there is a heavy emphasis on the food system needing to adapt and change to growing demands and trends.

This led to our research question of, ***How can the food system become more resilient in the AMA to promote a sustainable circular economy?*** In our research, scenario planning and weather mapping were used to showcase and locate feasible opportunities for our goals and strategies within the AMA. The primary strategies to create resiliency within the food system were to decentralize, diversify and connect aspects related to various urban and agri-food trends. This project envisions a decentralized system that contains a dense network of diverse and independent stakeholders with localized sustainable projects. There is also an emphasis on creating smaller and shorter connections within the chain. This includes incorporating and empowering various smaller stakeholders and actors with positive incentives but also restricting dominating stakeholders with policies and regulations. In addition, through the creation of more transparency through integrated and multiscaled design solutions, this will increase awareness and promote healthy and sustainable practices within the system. Food island encourages a thriving circular economy that is resilient and thus more sustainable.

Key words: Circular economy, sustainability, food system, diversifying, decentralizing, connecting

01.2 MOTIVATION & RELEVANCE

Figure 1 *Word cloud related to the important aspects of the food system*

Aim of the research

This research project is part of the TU Delft Urbanism Msc3, Research and Design course, which focuses on regional strategies for the Amsterdam Metropolitan Area (AMA) and the circular economy as a theoretical background. This research will aim to develop a strategic regional framework that contributes to the social, economic and environmental development regarding the food system within the AMA. This framework is comprised of a combination of spatial guidelines and non-spatial policies that show and implement the interrelations between design, planning and politics. A set of established planning instruments (ie. scenario planning) will be utilized to take into account and integrate different stakeholders and objectives. *Food Island* addresses multiple scales from the neighbourhood community centre to its' global influence. The main objectives of the strategic framework is to account for the development of a circular economy while integrating resilience so that sustainability is better ensured. Besides proving a set of knowledgeable tools based on facts, this research aims to be critical towards our current society and future developments.

Why Food?

Food is heritage, food is environment, food is history, food is identity, food is communication, food is sharing, food is health, food is personal, food is growing, food is fuel, food is prosperity and food is changing.

We cannot survive without food. As a result, the food system is deeply rooted in societal and economical relationships within the global network which will be further elaborated on in the following paragraphs.

Figure 2 *This landscape is brought to you by farmer and horticulturalist (Raap, 2015)*

Food and Nature

When looking from a broader perspective of what defines countries, the landscape is one of the main prominent features. From British drystone walls to the Dutch scene of meadows, ditches and windmills. Although it might seem cliché, these examples clearly show that landscape and agriculture work hand in hand in shaping our stereotypes and our perception on nature. Farming and local production has been part of our historic landscape for centuries, which emphasizes that the idea of this close connection is not new. According to Raap, from the EU reflection group and Cultural heritage (2017), it therefore seems logical to consider a mutual understanding of and cooperation between landscape, heritage and agriculture.

The landscape, whose character is the result of the interaction between natural and/or human factors; is also supporting animal species, biodiversity and water quality (Raap, 2015). For example, in the case of grassland-bird management, culture and nature complement one another. Peat meadows have always harboured many grassland species and the birds thrive in herbaceous grassland. As a result to preserve biodiversity, forms of management postpone or stagger mowing (Raap, 2015). Another example that exemplifies improving biodiversity and water quality are Dutch ditches which include nature-friendly banks. However, the above examples are the result of traditional, low intensity farming and according to Raap (2017) and amongst others, (WWF, 2016) there are imminent dangers coming from farmers who are transforming their fields to the demands of economically viable production. Food production has become one of the most important contributors to the loss of biodiversity and land degradation (WWF, 2016). For example, unsustainable agriculture and overfishing are causing degradation of natural habitats and is also a driving force behind exceeding the planetarium boundaries for nitrogen and phosphate . These negative impacts are also a prominent cause behind climate change, biosphere integrity loss, land system change and overuse of fresh water (WWF, 2016). Despite the immense consequences for the environment, the expectation is that current food production will only continue to increase to keep up with the growing population, prosperity and consumption of animal protein (WWF, 2016). Urban and industrial expansion have also begin inching into conservation and historic areas that are beloved and cherished.

Figure 3 Ketelhuis, university cantine BK, TUDelft

Food and Culture

The concept of culture is broader than race or ethnicity. Culture shapes how people view the world, their attitudes about health and their food preferences. Cultural cuisines are the reflection of geography, climate and history of the location where the culture is developed (Massachussetts, 2006). Within each culture and region, people may prefer certain foods, preparation methods and food combinations for meals and snacks. We grow up eating the food of our culture and food plays a significant role in our social lives. We associate the food of our childhood with warm feelings and good memories and it ties us to our families and communities. From African American 'soul food' to large Mediterranean family diners. But food is also a way of communication and sharing food with friends and is inherently linked to integration and connection (Massachussetts, 2006).

With that said, multiculturality is growing and diets are changing. The Dutch political culture advocates for socio-cultural integration and immigration from both western and non-western inhabitants which has grown enormously within the past few decades (Delsen, 2012). Especially within the Randstad region as it an international mix of inhabitants. The internet and social media are also playing a big role in the constant change of consumption patterns. Everybody wants to eat and try-out whatever is new, exciting and unknown, from black Japanese hamburger buns to cupcakes and macarons in all colours and flavours. However, the region simply cannot produce all the different types of foods that we **want**, partially because there isn't enough physical land to produce on, but moreover because certain crops can't grow within certain geographical climates. As a result, we are importing a large amount of raw and processed food. Importing and exporting goods comes with tremendous negative effects. Transportation has a large environmental impact due to greenhouse gas emissions and global warming. In addition, transportation of food requires an abundance of (plastic) packaging along the way. This is generally not recycled or re-used and negatively affects the environment. In addition, local producers are unable to compete with the low prices of unfair labour abroad. *So do we really want to send those pigs all the way to Spain just so that we can eat Iberico ham?*

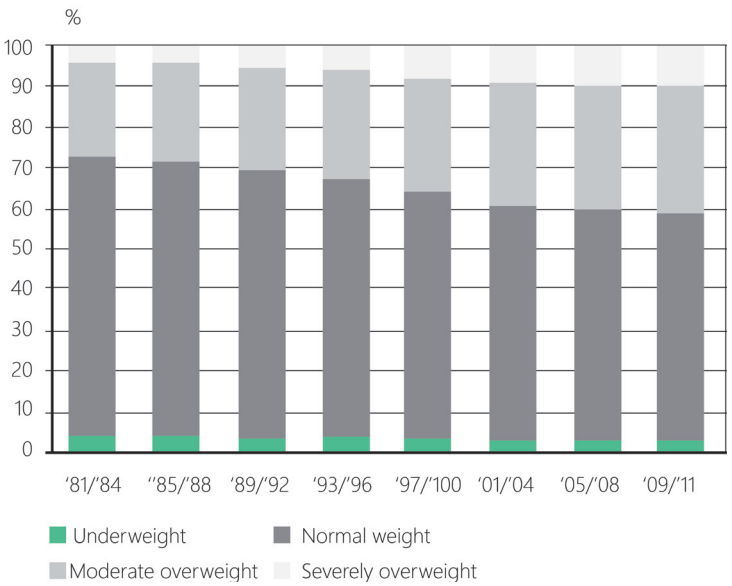


Figure 5 Poor dietary patterns have contributed to the fact that almost half of the Dutch population are overweight and obesity in the Netherlands (CBS, 2011)

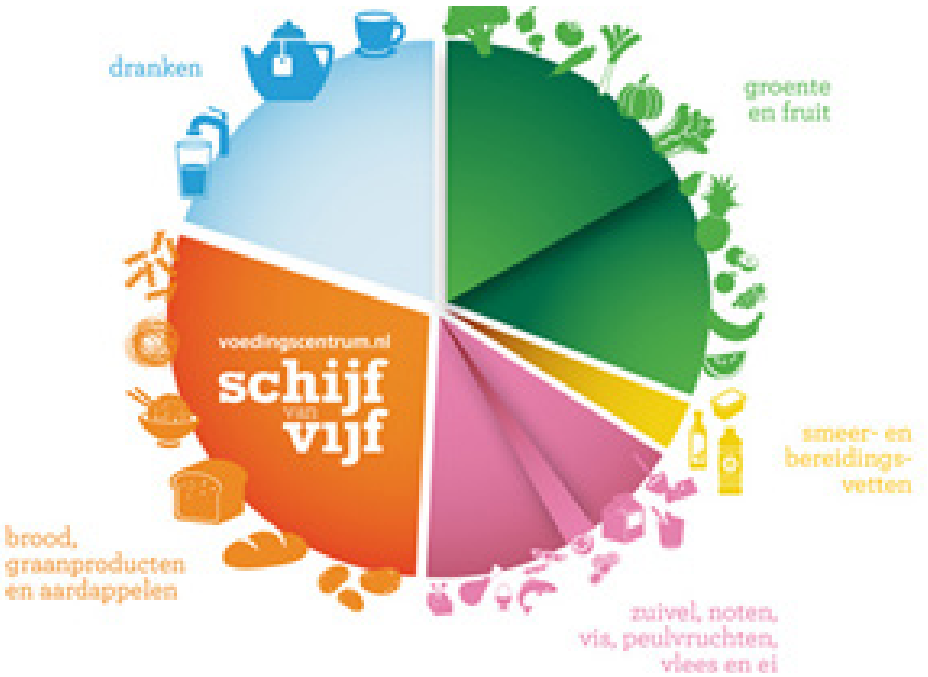


Figure 4 Governmental dietarian education, Schijf van vijf, Voedingscentrum (2015)

Food and Health

When looking from a broader perspective of Food, it is essential to digest nutrients that provide energy for activity, growth and all functions of the body. Food can be seen as fuel for our daily life activities and a certain diet can make or break your rhythm and mood. For this reason, healthy diets have been promoted throughout history and are still promoted by various sources of advertisement. Within the Netherlands the government even subsidises independent information about healthy, safe and sustainable food, through the medium of the Voedingscentrum (see figure). Healthy food is also about food safety and food quality and these rules have been established on an European level and are tracked and monitored by governmental institutions. The Dutch food and consumer product safety authority (NVWA) is monitoring food safety within all parts of the food system. The authority closely monitors all stages of food processing to retail for hygienic practices and to find any traces of contamination.

As a whole, different systems have been set up on a national and international scale to regulate and ascertain that we, as a society, can benefit from healthy and safe foods. However, providing information through different types of mediums has its negative effects. All these sources can differ and conflict with each other, which influences our opinion on what is regarded as healthy food. This results into numerous diet fads, such as the 'mayo diet' or the 'five bite diet'. Not only do these different sources change our diet and outlook on food, but according to Offer et. al (2010) most (negative) dietarian changes in regards to our health and well-being have come from our welfare regime. Our welfare state comes along with multiple types of what the Dutch like to call 'welfare diseases', such as some types of cancer, diabetes and heart and vascular diseases. The causes of these diseases are largely related to excessive use of alcohol, smoking, unhealthy habits and bad diets. We all want our food fast, easy assessable and if not pre-made, then pre-cut into pieces and slices that lengthen the already linear food chain.

Stark statistics reflecting our dietary patterns have resulted in a growing trend of obesity (see figure) and heart and vascular diseases. Additionally, according to Van der Bier (2012), increased affluence has also played a large part in the significant change of diet in recent decades. People are in the position to buy more and better quality of food. At the same time, the supply of food has increased substantially as a result of increased agricultural production and developments in the food industry. However, due to the demand of wanting more and better food has led to food modification. Organisms of crops are being changed to make them more efficient, chickens are fed to their limits to have them slaughter ready within 30 days after birth and fruits are drenched in chemicals to keep them fresh for oversees shipping. *How healthy can this really be for us?*

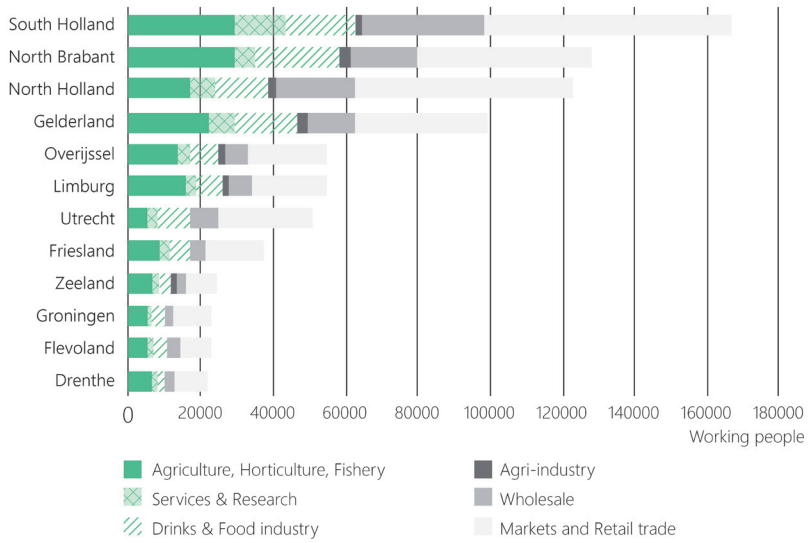


Figure 6 People working in agribusiness per province, Netherlands (OESO, 2015)

Figure 7 First floating farm in Rotterdam © Architecture firm Goldsmith

Food and Technology

About three-quarters of the Dutch agricultural production is meant for export (CBS: Berg, 2016). The Dutch food sector is the second largest agri-export country of the world (WRR, 2014). This varies from Dutch cheese being exported to Germany to baby milk powder exported to China, which has increased fifty fold over the last ten years (CBS: Berg, 2016). Only the US has a higher agricultural export then the Netherlands. In addition, about 65% of the Dutch goods trade surplus is due to trade in agribusiness and related goods (CBS: Berg, 2016). About 1 out of 10 Dutch people are working in agribusiness and according to research, the importance of agriculture and food production of the Dutch economy will only increase in the coming 15 years (Ecorys, 2014).

This highly profitable economic realm is to a great extent the result of the Dutch efficient and hands-on, technological and innovative character within agribusiness. It is therefore not a surprise that the Netherlands is internationally renowned for their innovations on production and processing. About 50% of business within agriculture are actively working to innovate (OESO, 2015). These technological developments and trends drive the economy of which some more common known examples are: having the first floating farm in Rotterdam and 3D printed food. However, the fact that we want everything to work bigger, better and faster in order to keep the economy thriving, comes with unsustainable side effects. We are intensively using the land in order to keep up with export demands, which decreases biodiversity, and creates greenhouse gas emissions. The energy required to supply all these innovative technologies and processing of food is largely unsustainable and puts pressure on the environment. More-over, this highly technology driven export regime is changing the way the food industry is working. Industrial agriculture needs significant upfront investment, which usually requires farmers to up scale production (WWF, 2016). Furthermore, technological innovations have generally favoured large-scale producers due to their capital- and resource-intensive nature. This makes it increasingly difficult for farmers to change course, once these investments and structural shifts have been made. As example, when farmers invest in expensive equipment, like machinery for monoculture crop production, it is difficult for them to switch to a different system of production until the equipment is paid off. The use of alternatives may not yield enough short-term benefits to be considered viable (WWF, 2016). These mostly unsustainable technological quick fixes and deregulation are then essentially decreasing the variety and self-sufficiency of food production within areas and centralizes the system which makes it vulnerable. *So how good does innovation still sound?*

Figure 8 Greenhouse and urban farming, photo by Cristian

So think again, why food?

Food is overfishing, food is intensification, food is never enough, food is polluting, food is expanding, food is welfare diseases, food is fad diets, food is resource depleting, food is modified, food is polluting, Food needs to change.

The development of preceding negative and unfavourable practices have been closely researched and documented over the last few decades. Governments, private and non-profit organisations have now acknowledged the idea that more sustainable systems are required for us to reduce our ecological footprint. Analysis suggest as well that humans have already pushed four of these planetary boundary systems beyond the limit of a safe operating space (WWF, 2016). However, in recent years, there has been a shift from just documenting consequences of our economy to a more practical prevention and recovering type of research and thinking. This ranges from international agreements such as the 17 sustainable development goals to local regulations such as the monitor for a sustainable Netherlands (CBS, 2017). Amsterdam Metropolitan Area (AMA), in specific, is actively working towards a more circular system within their economy in order to combat non-sustainable practices (Jonkhoff, 2012). But we think, amongst others (Derissen, 2009; The Stockholm Resilience Centre & CSIRO, 2009; Walker, 2006; Wilkinson, 2011), that in order to reach a more sustainable economy, this should be in relationship with and connected to resilience. In fact, some argue that resilience has already replaced sustainability as the main concept in the urban discourse, with research on 'resilient cities', 'resilient planning' and 'resilient design'. AMA has not yet adapted resilience within their strategies for the region, whereas; we believe that more resilient systems are a great opportunity for a more sustainable environment.

There are of course multiple aspects within our economies that can be regarded as unsustainable and in desperate need for change. However, we see the food system as one of the largest systems that has an enormous impact on the environment and our lives. It is important to showcase opportunities that can possibly change within multiple aspects of the chain and our lives. For that reason, we chose to further investigate the food system within our project with sustainability, the circular economy and resiliency in the back of our minds.

PROCESSING

DISTRIBUTION & STORAGE

RETAIL

CONSUMPTION

END OF LIFE

01.3 FOOD SYSTEM ANALYSIS

- Production
- Processing
- Distribution and Storage
- Retail
- Consumption
- End of Life

01.3.1 PRODUCTION

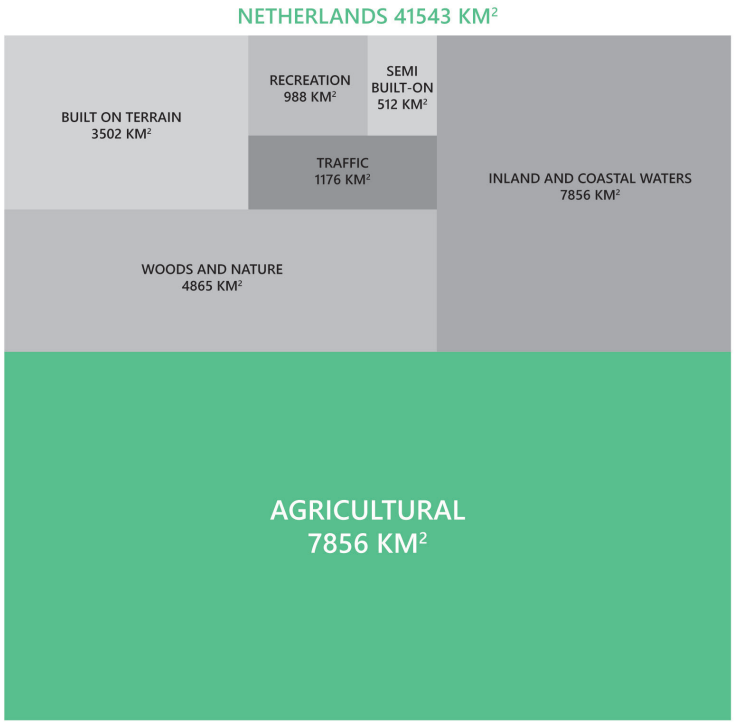


Figure 9 Surface area of te Netherlands by landuse (CBS, 2010)

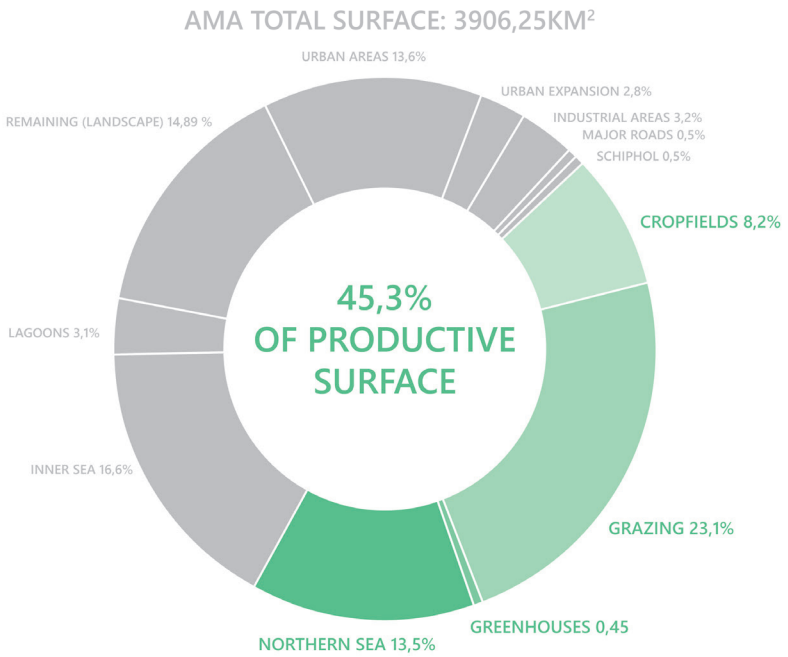


Figure 10 Land use in the AMA (GIS, 2017)

Dutch food production

Food occupies a prominent and visible place in Dutch society. It is a basic need, it is an important factor in public health, and it makes a significant contribution to the economy (De Vries et. al, 2015). Agriculture in the Netherlands is very prominent in the appearance of the Dutch landscape. Even though farm acreage has decreased to some extents in recent years, still 55% of the Netherlands' surface area is used for agricultural purposes, see figure above. Of all cultivated land, 53% is pasture, 29 percent is arable land, 13 percent is used for green fodder and 5 percent for horticulture.

Frontrunner and large agricultural enterprises

Through the means of scaling up production, specialisation, mechanisation and the industralisation of primary production process, Dutch agriculture has undergone far-reaching intensification. They are a frontrunner when it comes to the rationalisation and modernisation of agriculture and food production. The transformation of agriculture with the use of fertilizers and pesticides on a large scale ha sled to significant roductivity increases. The volume of production per hectare has increased approximately fivefold since the early 1980's (Van Bruchem & Silvis, 2008). Likewise has the production per worker and per animal increased.

In addition to this, agricultural enterprices, have become larger. The average numbers of hectares per farm rose, weareas the number of farms has significantly decreased. This is enormous increasement is also the case with the average number of animals per farm. The number of animals are much higher within a number of industrial farms (De Vries et. al, 2015)

Secondly, Dutch farms have started to specialize. Instead of varied produce, they have began to focus on one or two products. This also means that we highly depend on these specialist dairy, pig and chicken farms and the production stage becomes more and more of a centralized system.

Figure 13 Greenhouse Production

Figure 11 Poultry Farm

Figure 12 Apple Orchard

Figure 14 Potato Cropfield

PRODUCTION	STAKEHOLDERS (WHO?)	INTERESTS/OBJECTIVES (WHAT?)	INFLUENCE (HOW MUCH?)
PRIVATE	• Farmers	Profit, provide healthy and qualitive food. They can also be sustainably oriented	■■■■
	• Industrial farmers	Profit within competitive sector, efficient and good quality of food	■■■■
	• Farmers Association	Ensure and coordinate competitiveness and entrepreneurship between businesses	■■■■
	• Schiphol Airport	Profit, centralized logistics (connection of flows)	■■■■
	• Food Technology Industry	Profit & growth of (also sustainable) innovation within production (i.e. producing on air, water etc.)	■■■■
	• NS & other food transportation companies	Transport goods	■■■■
	• Digital retail companies & new technology companies	On-line exchange between farmers; Help farmers implement new technologies	■■■■
PUBLIC	• Ministry of Infrastructure and Water Management	Invest or plan for local habors/waterways/roads etc.	■■■■
	• Port of Amsterdam	Centralized logistics (connection of flows)	■■■■
	• Municipalities	Security and accessibility to food	■■■■
	• Universities and institutions	Create awareness on food (industries)	■■■■
	• Ministry of Economic Affairs and Climate Policy	Regulating imports/exports, financially healthy and prosperous Netherlands within the global sector	■■■■
	• Ministry of agriculture, nature and food quality	Support sustainable agriculture, restore and maintain natural areas	■■■■
	• Planning authorities	Plan for new area for agriculture	■■■■
CIVIL SOCIETY	• Citizens	Get involved in urban farming and other forms of production; Raise their awareness of sustainable food system	■■■■
	• NGOs	Advocate and monitor different aspects associated with production (i.e. supporting innovation, sustainable environment, safety and transparency)	■■■■
	• Environmentalists & animal activists	Care about nature conservation (i.e. biodiversity, land degredation etc.) and a clean, healthy environment; Care for health and well-being of animals	■■■■
	• Neighbourhood community	Raise awareness	■■■■

*Influence within this aspect of the food system

Can I still have my spinach in February?

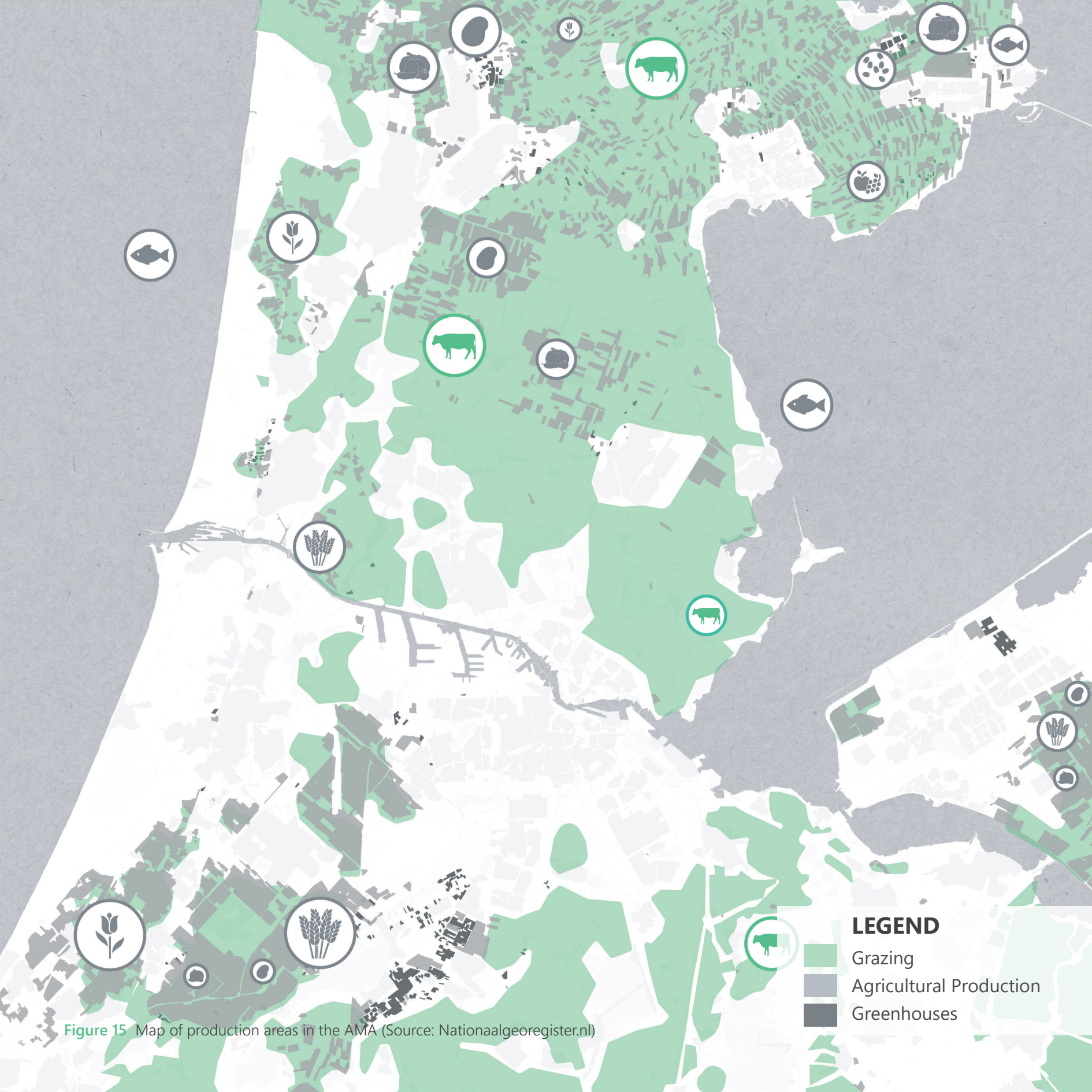


Figure 15 Map of production areas in the AMA (Source: Nationaalgeoregister.nl)

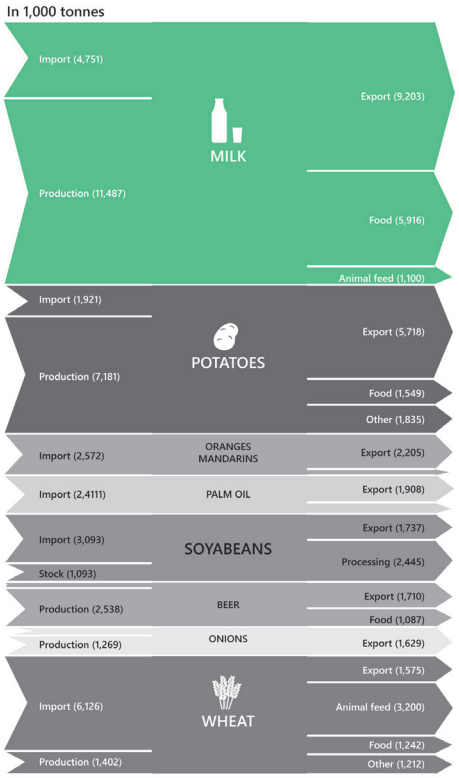


Figure 16 Trade products (FAO, 2015)

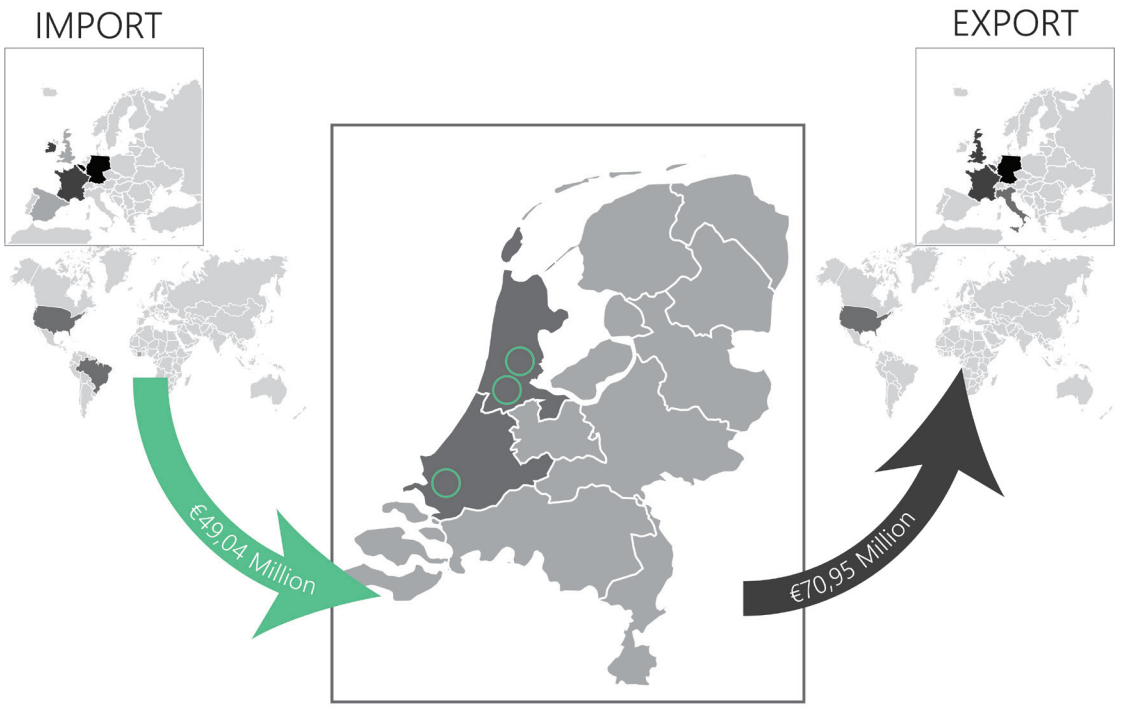


Figure 17 Import and export countries (Worldbank, 2017)

Trade

Trade has become increasingly important to the Netherlands.The volume of food is considerable on both the export and the import side. The Netherlands is one of the worlds biggest exporters of agricultural and horticultural products (CBS, 2016). Around 80 percent of the Dutch export goes to other countries in Europe, mainly Germany (Worldbank, 2016). Imports also comes from most countries in Europe, with the exeption of fruit.

The Netherlands produces, imports, processes, trades and exports raw materials and (intermediate) food products. Part of its import and production is of course intended for humand consumption, part is used for animal feed and an important part is (re-)exported. Some of the export products, such as milk is mainly produced domestically, while for other products, such as oranges and mandarins, the Netherlands is mainly a transit country.
Within the AMA, Schiphol airport and the Port of Amsterdam are the main locations distributing food over water and by air.

Figure 18 Schiphol Airport, export of people and products

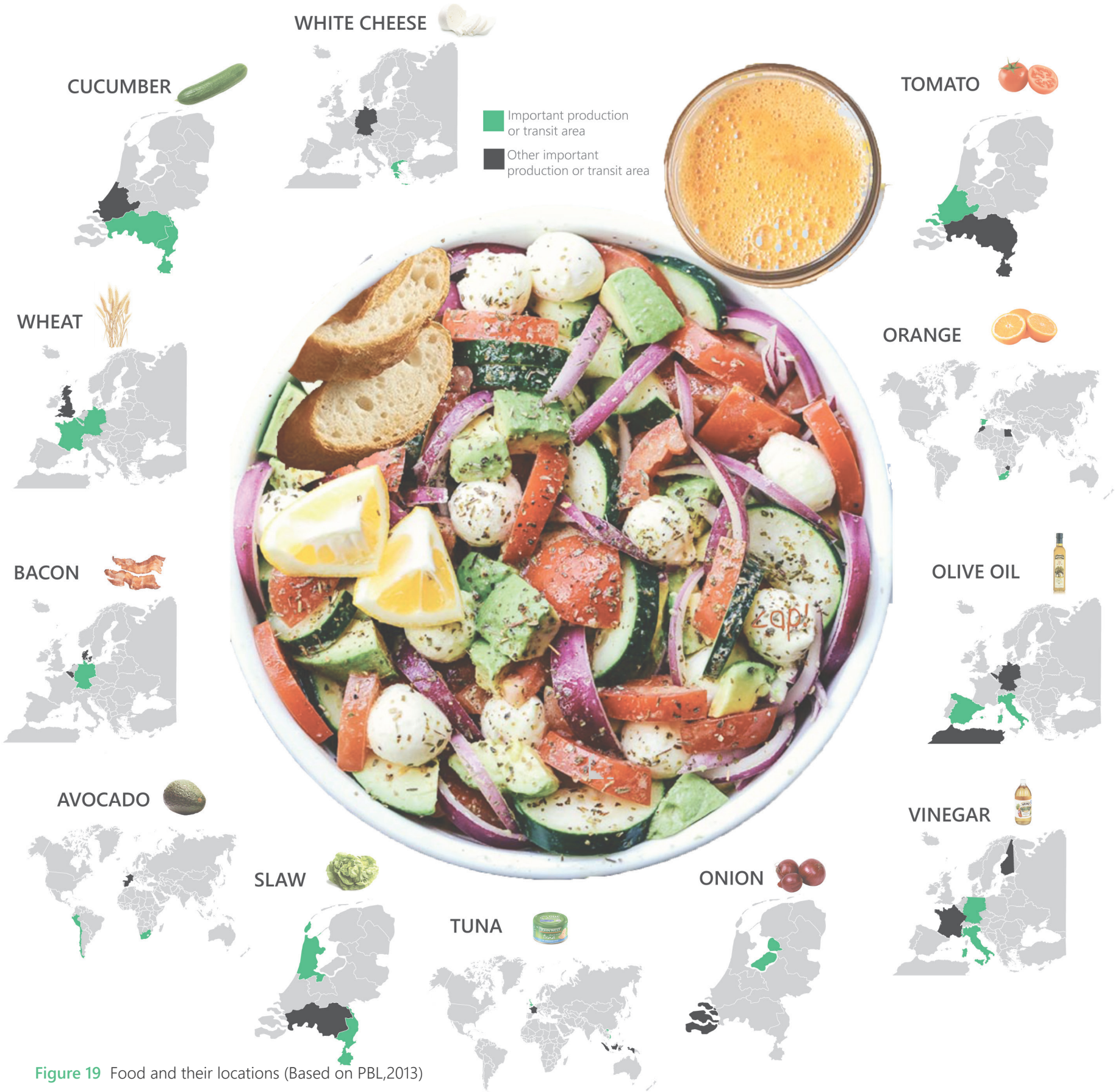


Figure 19 Food and their locations (Based on PBL,2013)

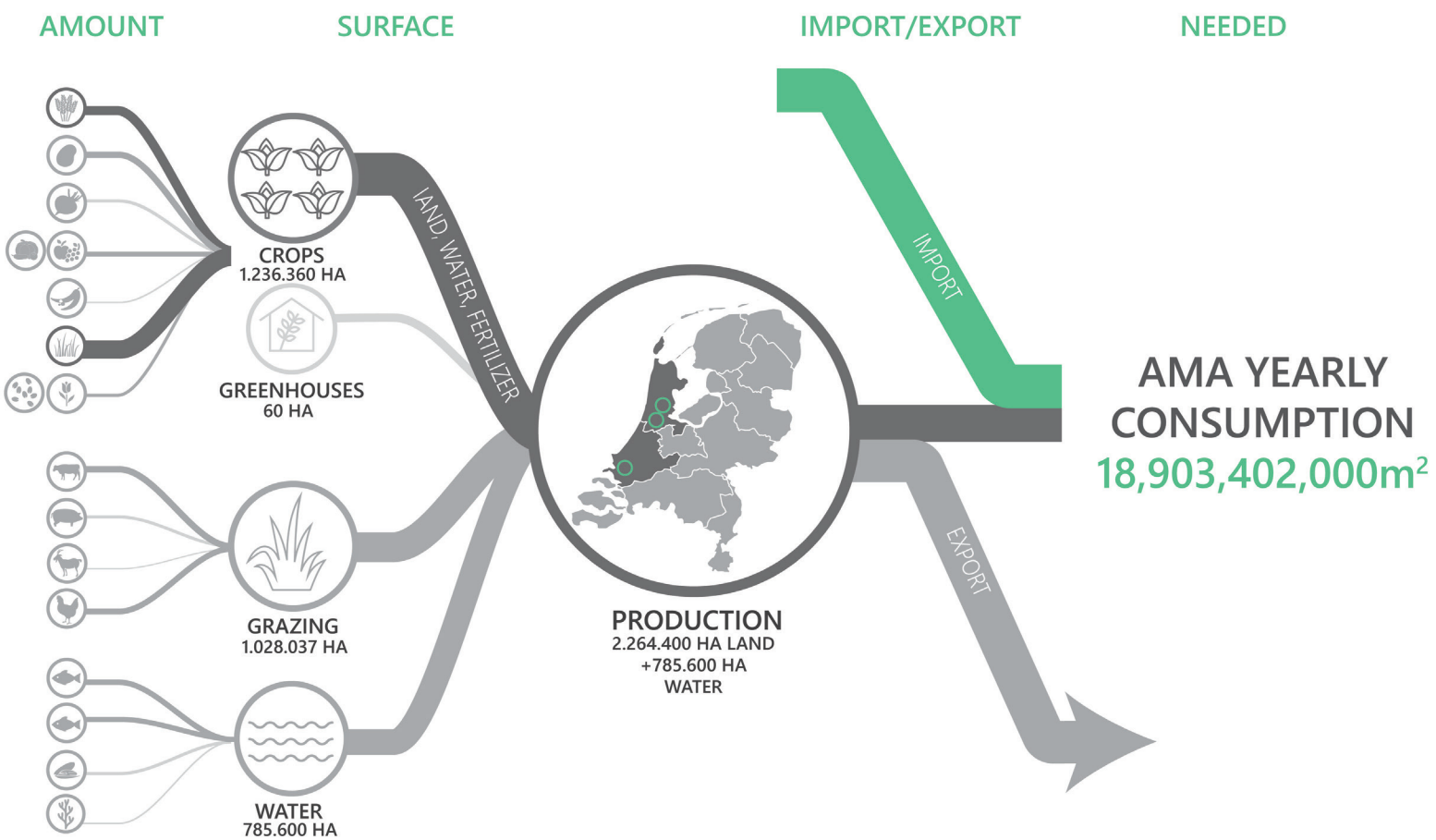


Figure 20 Production flows within the AMA

Source: Eurostat: Agricultural census in the Netherlands, 2017

SUMMARY OF ISSUES:

Centralized: Depend on 2 points of trade for the whole region

Lack of Diversity: AMA heavily relies on importing food for our dietary wants. There is also a lack of diversity in local food production.

Disconnected: AMA is disconnected from local food production and consumption

Critical Issues within the System.

After analyzing the production phase and as the map on the highlights, the AMA heavily relies on two major locations for the import and export of food. The region produces a lot of food, yet the majority of it is being exported elsewhere, see also diagram above. There is a lack of connection between local production and consumption. In addition, the food that is produced locally, is lacks variety, because of the change to more specialized and centralized farmers

Figure 21 Main ports for distribution (Source: Agrarisch Areaal Nederland, Nationaal Georegister, 2017)

03.1.2 PROCESSING

Figure 22 Factory production/processing line

Complex chains

Food chains come in all shapes and sizes. The chain of fresh horticultural products are organised differently from chains of processed products and products with a longer shelf life (De Vries et. al, 2015). In example, the way that the cocoa chain is organised differs from the way the veal chain is organised. The cocoa chain consists of many seperate links and is imported from different locations, but the Dutch veal chain -from animal feed to processed consumer goods-, on the other hand is for a large part controlled by one company, but needs to be cut, processed and dealt with through a diversity of businesses.

This also means that a diversity of economic relationships exists between businesses in a chain. From spotmarkets to long-term contracts and consecutive links within a single parented company. The number of suppliers a business deals with can vary considerably. The geographical scale on which businesses operate also differs considerably: in addition to businesses that operate locally or nationally, there are businesses that are active in many countries and in international markets. Moreover, the geographical scale of the chain as a whole can vary widely. They can cross national borders or connect activities on different continents.

In other words, most food is not produced in a single cain but in a complex network of chains. For this reason, overview is almost impossible to attain.

Quality standards have lead to wastage

High appearance standards from supermarkets and consumers for products lead to food waste. Some produce is rejected by supermarkets due to rigorous quality standards concerning weight, size, shape and appearance of crops (FAO, 2011). Therefore, large portions of crops never leave the farm. The same process occurs during the entire part of the processing phase. This ranges from oddly cut vegetables to mispackaged biscuits. With the food processing chain continuously elongating, this inevitably means more and more waste along the chain.

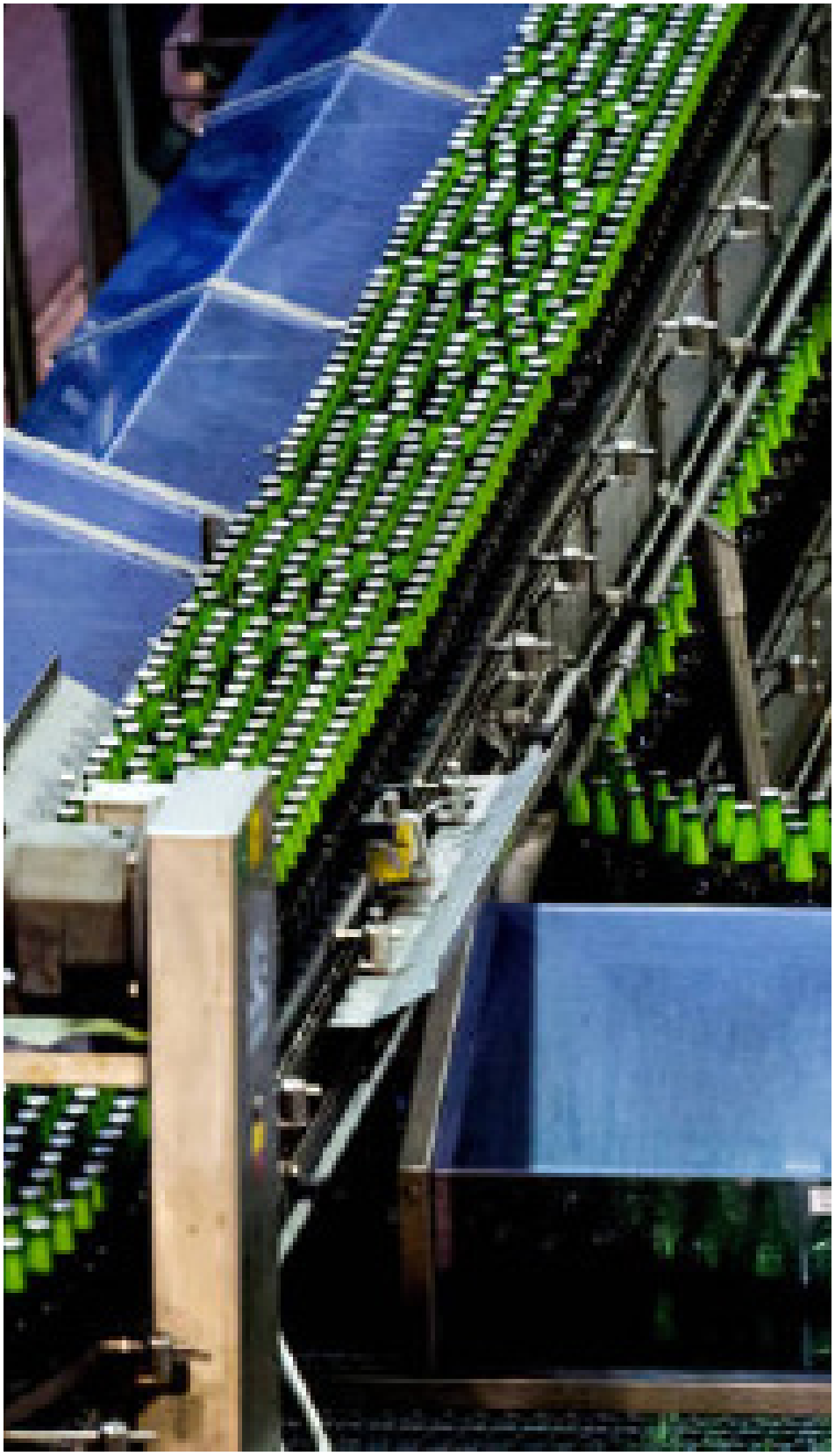


Figure 25 Beer packaging facility and sortment

Figure 23 Vegetable selection process

Figure 24 Vegetable selection and sanitation process

Figure 26 Milk factory

PROCESSING	STAKEHOLDERS (WHO?)	INTERESTS/OBJECTIVES (WHAT?)	INFLUENCE* (HOW MUCH?)
PRIVATE	• Processing factory (slaughterhouse, dairy industry, vegetables etc.)	Profit through efficient processing, good quality of products	■■■□
	• Packaging facilities/manufacturer	Profit through processing within an efficient system	■■■■
	• Energy supplier	Profit through a coordinated centralized energy system	■■■□
	• Labor/workers association	Protect the rights of the people that are part of the union	■■□□
	• Independent food inspection businesses	Ensure healthy and clean food	■■■□
	• Food Technology Industry (also educational institutes)	Profit by innovation of processing businesses (i.e. new machinery)	■■■□
PUBLIC	• Regional and municipal governance	Ensure safe and healthy products,	■■■□
	• Ministry of agriculture, nature and food quality	Ensure good prospects, safe and healthy products	■■□□
	• Netherlands Food and Consumer Product Safety Authority (NVWA)+ European Food Safety Authority (EFSA)	Ensure safe and healthy products	■■□□
	• Ministry of Social Affairs and Employment	Foster a socially and economically vigorous position of the Netherlands, with work and income security for everyone.	■■□□
	• Ministry of Infrastructure and Water Management	Ensure access and mobilty to and from processing industries	■□□□
CIVIL SOCIETY	• Adjacent neighbourhoods and households	Minimal disturbance and or nuisance from processing industry, clean, healthy environment	■■□□
	• NGO's	Advocate and monitor different aspects regarding processing (i.e. supporting innovation, sustainable environment, safety and transparency)	■■□□
	• Animal activists	Care for health and well-being of animals	■□□□
	• Environmentalists (ecologists)	Care about nature conservation (i.e. biodiversity, land degredation etc.) and a clean, healthy environment	■□□□

*Influence within this aspect of the food system

But who will cut my vegetables?

Stakeholders & issues

It is almost impossible to examine and elaborate on all the stakeholders within the processing phase. As explained before, each food group has its own route from production to consumer, which means you could hypothetically make a specific stakeholder diagram for all products that are consumed within the region. The chart above shows a couple of 'outside' actors that are most likely to be during the processing phase.

The soy chain

If we focus on one of the most complex chains, soy, as seen on the right, we can draw the complicated route that this important ingredient goes through before reaching the end consumer in a variety of products. Not many consumers are aware of the fact that about 150 grams of soy, which is most likely imported from South America, are used to produce one kilogramme of Dutch cheese.

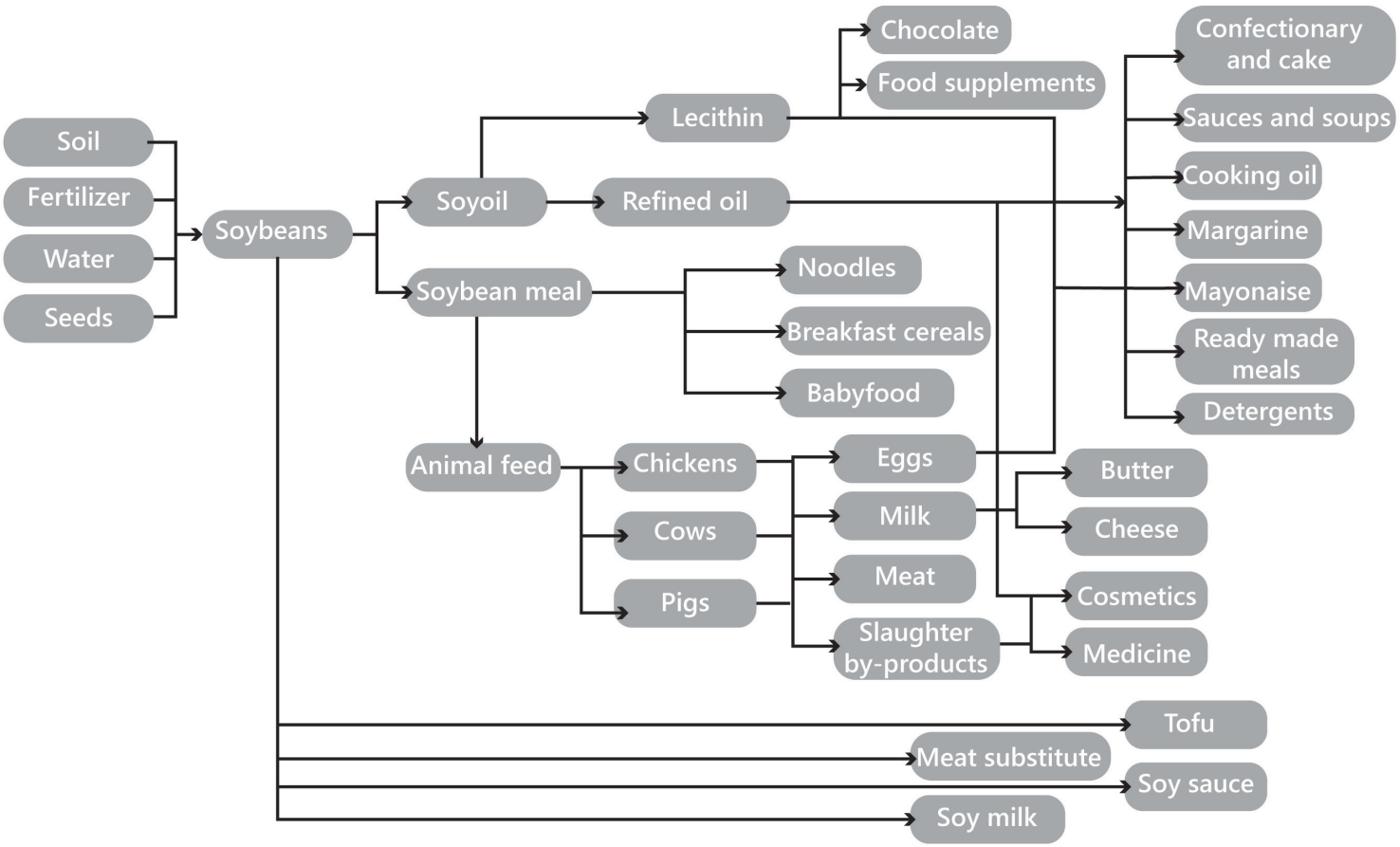


Figure 27 Schematic overview of soy chain (Based on De Vries et. al, 2015)

Figure 28 Soypod

Figure 29 Soybean meal

Figure 30 Typical Dutch cheese

03.1.3 DISTRIBUTION & STORAGE

DISTRIBUTION AND STORAGE	STAKEHOLDERS (WHO?)	INTERESTS/OBJECTIVES (WHAT?)	INFLUENCE (HOW MUCH?)
PRIVATE	• Dutch distribution centres	Profit by storing food for distribution to retail	■■■■
	• Schiphol	Profit by ensuring locations for distribution and storage centres	■■■■
	• Storage industries	Profit by storaging food	■■■■
	• Energy suppliers	Profit through providing energy to storage centres (i.e. cooling, heating goods)	■■■■
PUBLIC	• Port of Amsterdam	Ensure place for distribution and storage centres	■■■■
	• Education (universities and schools)	Create awareness on food (industries)	■■■■
	• Ministry of infrastructure and waternet	Ensure access and mobilty to and from processing industries	■■■■
	• Ministry of Economic Affairs and Climate Policy	Strong international competitive position and protect sustainability	■■■■
	• Ministry of agriculture, nature and food quality + NVWA+ EFSA	Ensure food safety	■■■■
CIVIL SOCIETY	• Adjacent (not many) households	Minimalise disturbance	■■■■
	• NGO's	Advocate and monitor different aspects regarding Distribution and storage (i.e. supporting transportation, sustainable development, safety and transparency)	■■■■

*Influence within this aspect of the food system

Will my vanilla swirl icecream still be frozen?

From farm to fork

The popular saying 'from farm to fork' is somewhat misleading as it suggests that one or only a few straight lines connect the raw material to the end product. If we follow the food materials, however, a different picture emerges. The materials zigzag between different businesses and countries before it ends up on to our plate (De Vries et. al, 2015). A simple pizza has as many as twenty different ingredients. A coated cocktail nut has over thirty, which reaches the end product along different paths.

This process of storing, cooling and then distributing the food happens within the distribution and storage phase within the food system. Cooling and storing facilities are usually located on large industrial areas, near larger distribution mainports. Within the AMA this is mainly around Schiphol area and on the Port of Amsterdam. The location of distribution centres vary per supermarket brand. They 'collect' their products within one large distribution factory , see also images on the right, before they ship it of to their stores across the country.

Just as within the processing phase, distribution and storage occurs on multiple locations and within varied businesses. Distribution and storage however, is largely controlled by a few stakeholders who dominate the retail sector, which will be further explained in the next chapter.

Figure 31 Dairy storage

Figure 32 Inside supermarket distribution centres

Figure 33 Distribution centre Albert Heijn (Ahold, 2015)

01.3.4 RETAIL

Figure 34 Carrefour Market, special care taken into the fresh departments, especially the fruit and vegetable section for "premium" shopping

Purchasing Food in the Retail Sector

In the analysis, the retail sector is taking into consideration all the locations where the Dutch purchase food. This accounts for supermarkets, wholesalers, local farmer markets, specialty stores (cheese, bread, meat and etc.)

Can I still have stroopwaffles?

The Dutch Retail Market- Supermarket Dominance

In the Dutch Food Retail Market, approximately 80 percent of the retail outlets are full service and have floor spaces ranging between 500 and 1,500 square meters (Vermijs, 2017). To understand the full convenience and scale of supermarkets, on an average, Dutch consumers live 900 metres away from their nearest large supermarkets (Statistics Netherlands, 2017). Retail stores are also constructed in central and residential areas of cities for ease of access. The remaining 20 percent of retail includes mainly convenience stores (in or within vicinity of office buildings, city center, motorways and train/metro stations), wholesalers and superstores located in shopping malls and industrial parks that are only accessible by car (Pinkaers, 2016). Increasingly, Dutch consumers are purchasing more and more of their food from supermarkets, "77 cents of every euro they spend on groceries ends up in a supermarket till" (Statistics Netherlands, 2016)

A significant change in the food sector is the 'supermarket revolution'. As defined by The Netherlands Scientific Council for Government Policy (2016), what used to be the producer driven chain, where producers would hold the power to decide which products would be produced and purchasing cost, has now shifted to a buyer-driven chain, where now "major supermarkets have a large influence on food production" (De Vries, 2016, p. 29). This has led to a key vulnerability within the food system where now a small group of purchasing managers of supermarkets an enormous large power over the Dutch food chain (PBL, 2016). With supermarkets having a dominant position within the sale of foodstuffs, profit has increased

Figure 35 Albert Heijn - Major supermarket and one of the main purchasing companies over the distribution of food

Figure 36 In contrast, Albert Cuyp Market is a local market found in Amsterdam

over the years at the expense of specialist stores (CBS, 2017). "For example, the turnover of supermarkets in 2017 increased by almost 21 percent (6.0 percent more volume) compared to 2008 , while specialty stores lost over 11 percent in sales and almost 25 percent in volume during this period"(CBS, 2017).

Other issues identified in the Dutch retail sector involve the top two retailers (Albert Hejin and Jumbo) having control over 50 percent of the market (Pinkaers, 2016). Following behind are the German discount markets, Aldi and Lidl, having 17.3 percent in shares. Lastly, independent food retail stores are gradually decreasing in the market share. Notable in the retail food flow analysis, the transportation of food goes through a lengthy process from production to consumers, which results in higher costs of food and waste produced along the chain.

However, there is a growing trend that consumers are looking for sustainable or organic products, ready-to-eat meals and buying for convenience. Not only are supermarkets are prevalent in physical stores but they are also gaining momentum in on-line retail.

Figure 37 Market share of food groups over the years (PBL, 2017)

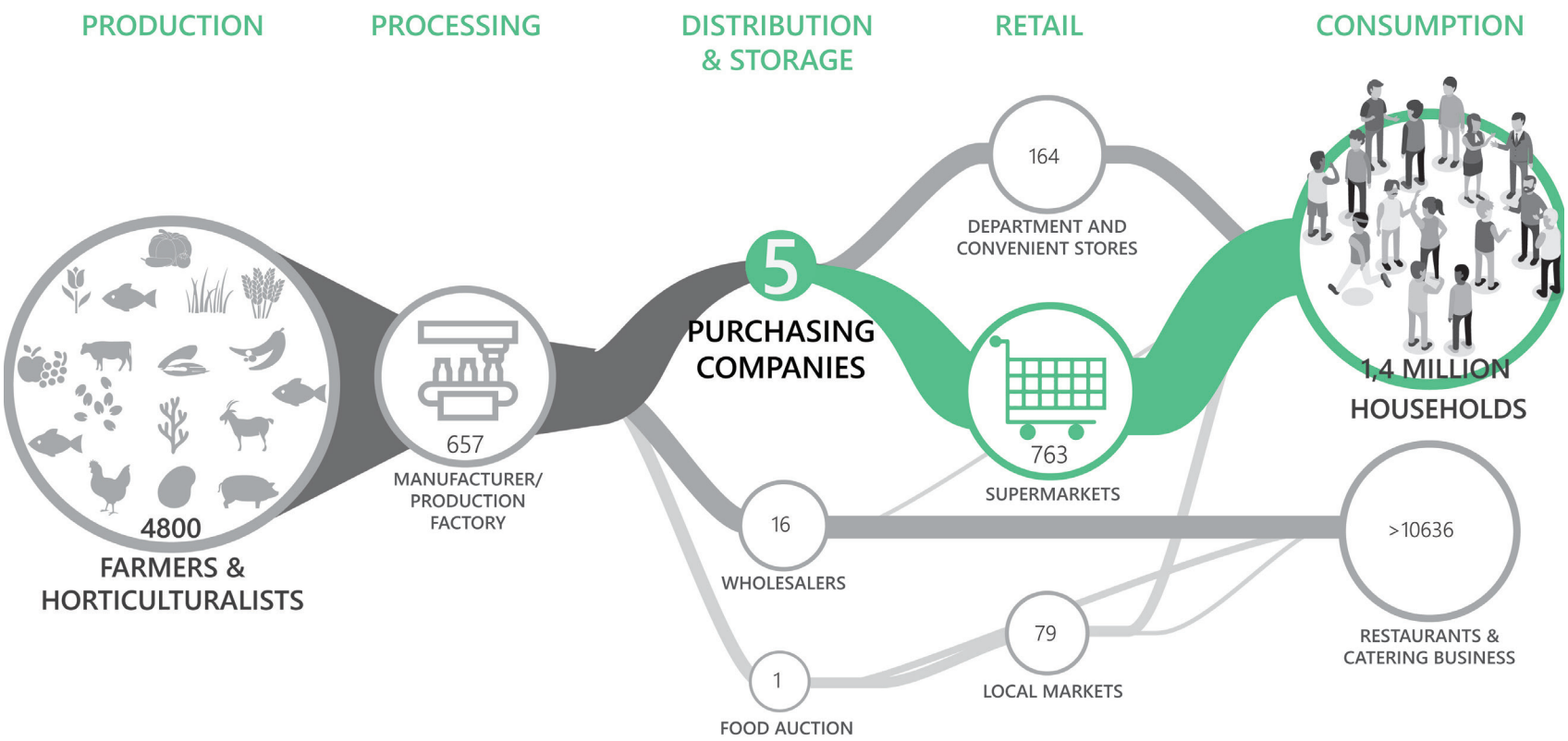


Figure 38 Retail food flow diagram in the AMA (Source: The Dutch Food Retail Market, USDA, 2016; Openstreetmap, 2018)

SUMMARY OF ISSUES:

Centralized: A small group of stakeholders (purchasing companies) have power over the distribution of food.

Lack of Diversity: Purchasing options are limited and restricted. Consumers prefer supermarkets over other sources.

Disconnected: No direct connection from production to consumers.

Critical Issues within the System.

As per the retail flow diagram in Figure 8, the highlighted path shows the dominant figures currently seen in the food industry. A pinch point can be seen where only 5 purchasing companies manage the prices of food within the AMA. Supermarkets have also begun to take a large market share in the economy at 80% as more and more consumers are shopping for convenience.

Figure 39 Map of the large distribution centers in the AMA (Source: The Dutch Food Retail Market, USDA, 2016; Openstreetmap, 2018

RETAIL	STAKEHOLDERS (WHO?)	INTERESTS/OBJECTIVES (WHAT?)	INFLUENCE (HOW MUCH?)
PRIVATE	• Farmers market association	Good food and life quality	■■■□
	• Farmers	Profit through qualitative, efficient and competitive retail	■■■■
	• Purchasing companies (Ahold, Jumbo, Lidl etc.)	Profit through centralized logistics	■■■■
	• Restaurant and catering business	Profit with minimum loss of resources and attractive innovation. Safe goods to sell	■■■□
	• Farmers' associtations	Protect the rights of the people that are part of the union	■■■■
	• Food delivery services	Profit, more goods = more business	■■□□
	• Digital retail (online shopping companies)	Profit by having more goods to advocate, geared towards consumers, with efficient retail as goal	■■□□
	• Advertising companies	Profit through directed advertising	■□□□
	• NS	Existing train stations can be used for future trade of food	■■■□
	• Other food transportation companies	New ways for small retailers to get access to local food	■□□□
PUBLIC	• Municipalities	Ensure accessibility to retail, Protect financially stable community	■■□□
	• Governmental advertising	Raise awareness throughout society	■■■□
	• Netherlands Food and Consumer Product Safety Authority (NVWA)+ European Food Safety Authority (EFSA)	Ensure safe and healthy products	■■□□
	• Ministry of Social Affairs and Employment	Foster a socially and economically vigorous position of the Netherlands, with work and income security for everyone.	■□□□
	• Ministry of Economic Affairs and Climate Policy	Tax provisions etc.	■□□□
	• Ministry of Infrastructure and Water Management	Invest or plan for local habors/waterways/roads etc.	■■□□
CIVIL SOCIETY	• Citizens	Healthy food, food quality	■■□□
	• Neighbourhood community	Raise awareness, healthy food provided for everybody	■■□□
	• NGOs	Advocate and monitor different aspects associated with retail (i.e. supporting innovation, sustainable environment, safety and transparency)	■□□□

*Influence within this aspect of the food system

Figure 40 TimeOut Market, a famous market in Lisbon, Portugal

Figure 43 Outdoor market in Maastricht, Netherlands

Figure 42 Produce in Albert Hejin

Figure 41 Produce in Albert Hejin

01.3.5 CONSUMPTION

Where do we consume our food?

The Dutch consume 80% of their food at home. Influential factors for a healthy diet among children and adolescents are based on the readily available food at home and accessibility.

What if I don't like the taste of milk straight from a cow?

The Unsustainable Dutch Diet

The current Dutch diet is not sustainable and this largely impacts the environment through a variety of ways such as: the general population wastes a large amount of food, we consume a high proportion of animal products and consume more energy (kcal) than is recommended (RIVM Report, 2017). The environmental footprint of the average diet is 1.6 global hectares (RIVM Report, 2017) which is twice the area available on the planet available per person. As mentioned in the Amsterdam Circular Economy (2017) report, an average meal travels roughly 30,000km before it arrives on our plates and the energy cost for an imported strawberry is 24 times higher than a locally grown one bought in the right season.

In recent decades, there has been a significant shift in the Dutch diet including the growing consumption of animal products and processed food (after the Second World War). Processed food and the decline in time taken to prepare food has also been supported by the availability of ready-to-eat meals. There has also been a declining consumption of vegetables and as a result, the current diet contributes to rising levels of obesity, overweight populations and diet-related diseases. Based on statistics, in the Netherlands, 1.4 million people are obese and 6 million adults are overweight (Food For Thought, 2012).

To put into context, Dutch consumers eat on average 1 kilo of solid foods and drink 2 liters of beverage daily. From the 1950s to 1990s, meat consumption has grown. Other notable food groups is the high consumption of alcholoic and non-alcholic beverages, dairy products and

Figure 44 A greenhouse restaurant

Figure 45 Markthal, Rotterdam

fats. Our eating habits strongly determine how much we produce and that is directly linked to sustainability factors such as land, water use, depletion of resources and greenhouse gas emissions. The dependency of importing food is especially higher within the AMA as mentioned in the previous section. Even though much of the produce such as meat and are produced in the Netherlands, the AMA relies a lot on nearby regions for its food. In addition, there is a higher dependency on other types of foods like fish, fruit and wheat from other countries (RIVM Report, 2017)

How did this Happen?

Over the past couple of decades, food consumption has changed and has been primarily influenced by an increase in prosperity, increased food supply and globalisation (RIVM Report, 2017). Exotic foods have also been introduced to the market and household spending on food has gradually declined. Other trends intrinsically linked is due to agricultural and technical innovations. Easily, the greatest impact to greenhouse gas emissions is meat which is seen to contribute to 60% of greenhouse gas emissions (RIVM Report, 2017).

Current Measures for Sustainable Eating

The Nutrition Centre has developed several tools to enable sustainable healthy eating and choices such as the Food Footprint, animal welfare tables and food certifications. However, it is not typical in the Netherlands to have mandatory education on nutrition guidelines. It is also important to note that most children in the Netherlands do not fulfill the guidelines for healthy nutrition as provided by the Dutch Health Council (Battjes-Fries, 2016). However, there has been a shift and movement towards food education in primary schools and one of those is Smaaklessen (Taste Lessons). This program is a practice-driven school-based nutrition program to promote healthy nutrition and food quality. The main focus is to increase children's interest in food and to promote a healthy and conscious eating behaviour. At the moment there are currently 4000 primary schools in the Netherlands that have adopted the Taste Lessons program. On a larger scale, Wageningen University is also working together with scientists, primary school teachers and students to develop educational material. Other environmental benefits could be achieved by wasting less food, eating less meat, purchasing sources of plant-based protein and only eating what we need.

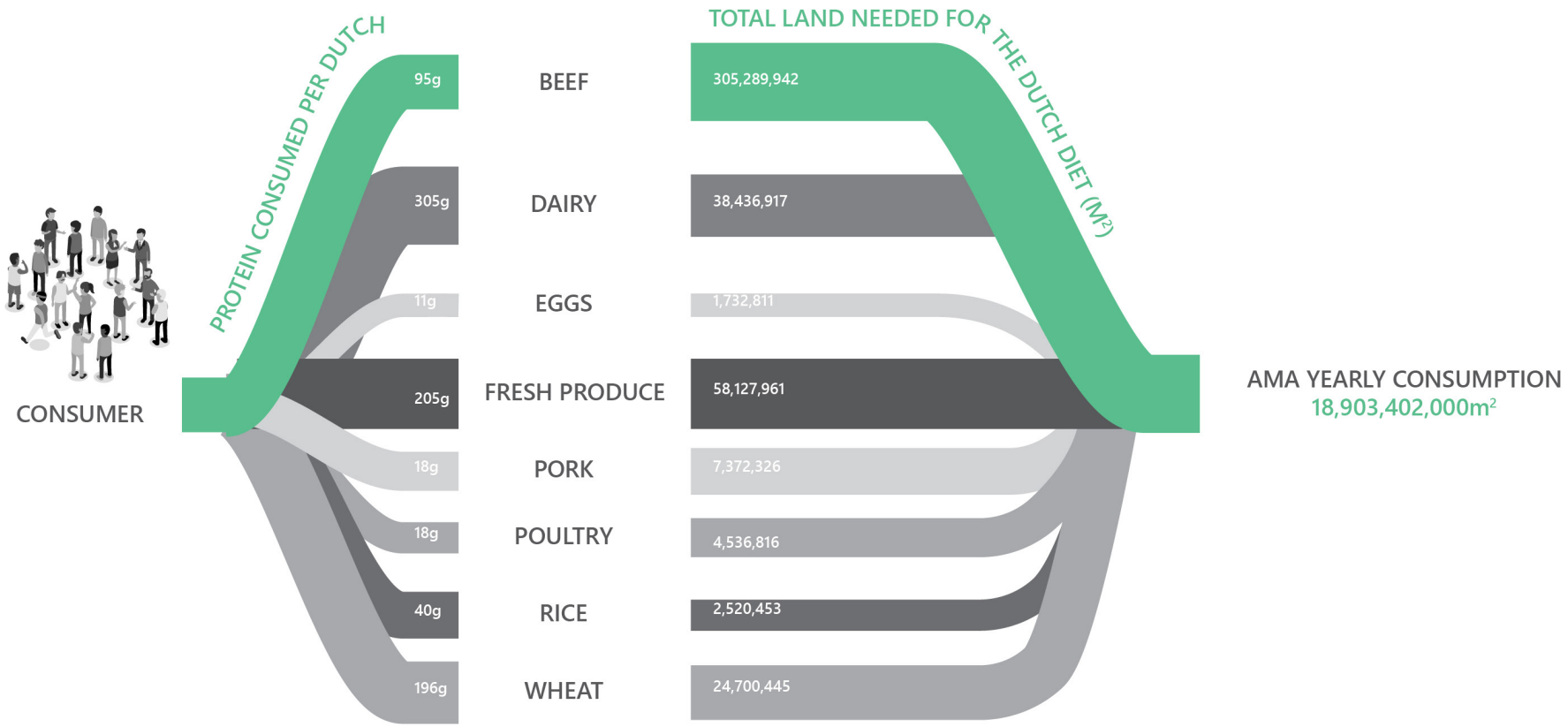


Figure 46 Food Flows showing Dutch Consumption patterns over the course of a year

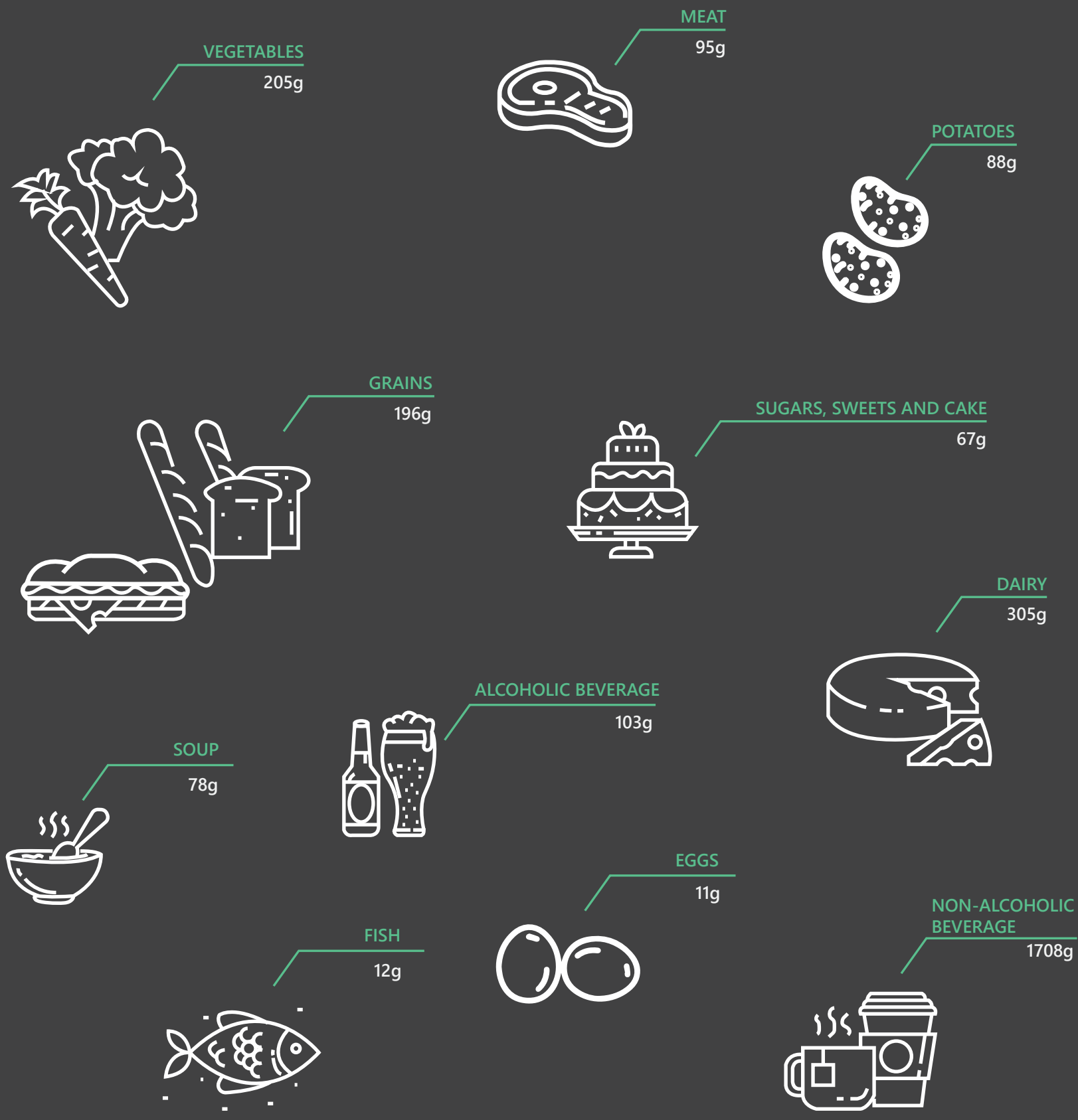


Figure 47 Average Dutch Diet (PBL, 2017)

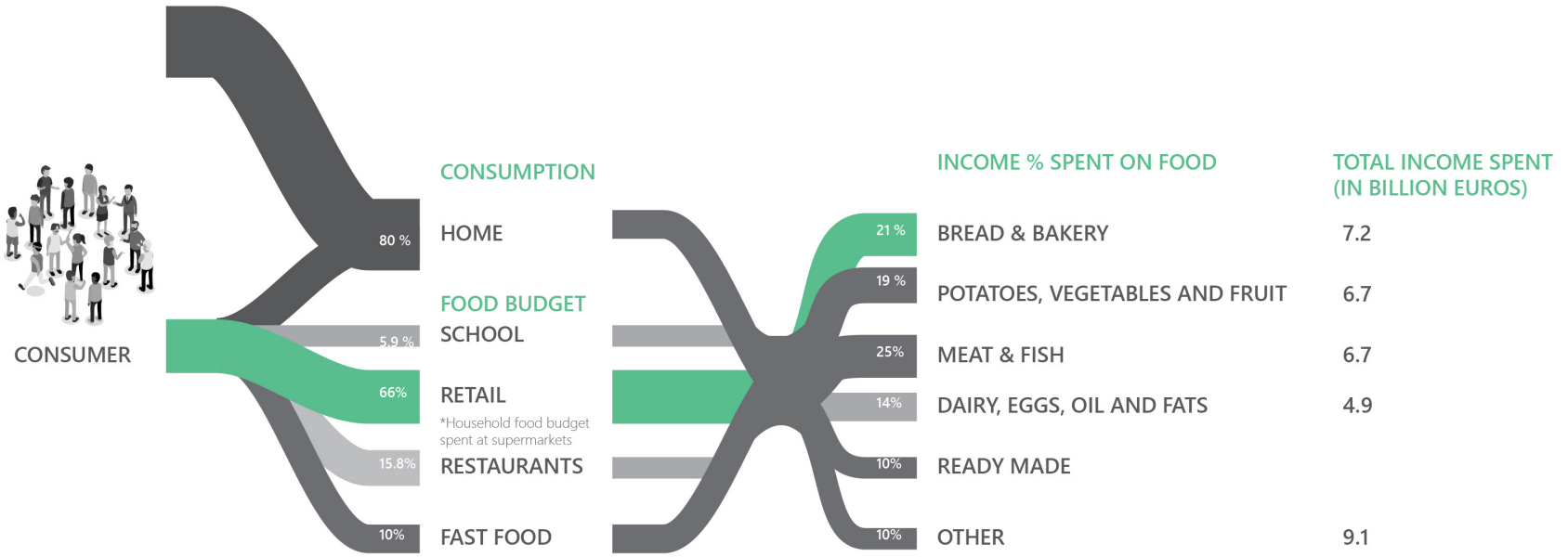


Figure 48 Food Flows showing Dutch Consumption patterns over the course of a year

PRODUCT GROUP	MEN	WOMEN
Red Meat	31%	29%
Milk/dairy products	12%	13%
Drinks (non-alcholic)	7%	14%
Drinks (alcoholic)	6%	1%
Cheese	6%	7%
White meat	5%	7%

Figure 49 Table showing products to the total greenhouse gas emissions of the Dutch diet, in terms of percentage (PBL, 2017)

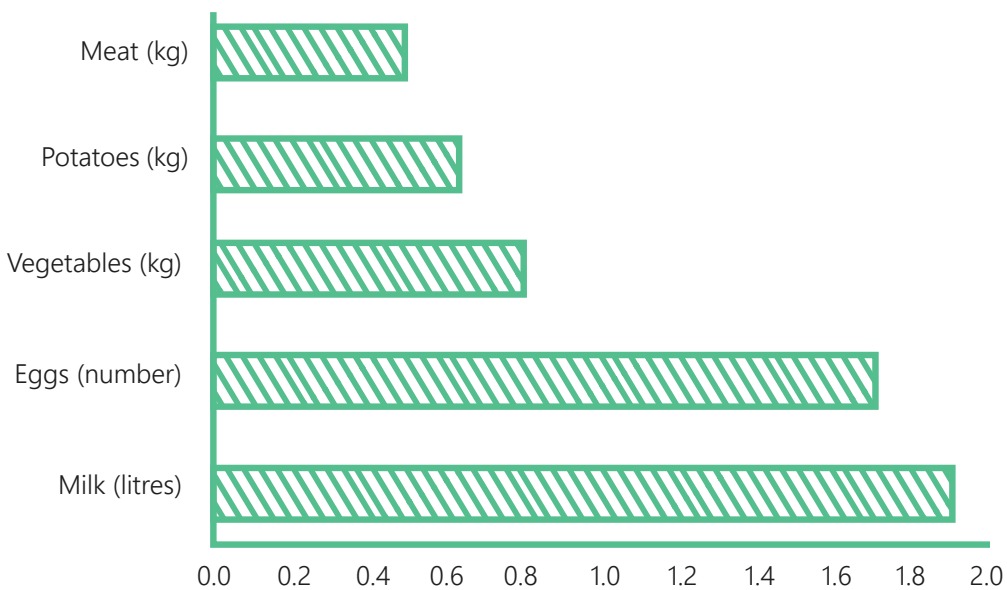


Figure 50 Agricultural production per person per day (PBL, 2017)

CONSUMPTION	STAKEHOLDERS (WHO?)	INTERESTS/OBJECTIVES (WHAT?)	INFLUENCE (HOW MUCH?)
PRIVATE	• Hospitals	Ensure and protect the health of people	■□□□
	• Restaurant and catering businesses	Provide safe food	■■■□
	• Grocery stores/supermarkets	Provide safe food	■■■■
	• Health insurance companies	Profit from the health of people	■■□□
	• Advertising companies	Influence diets and consumer patterns	■■□□
PUBLIC	• Voedingscentrum (government)	Raise awareness on diets	■□□□
	• Ministry of agriculture, food quality and nature	Ensuring accessibility to food and drinks, healthy, clean and sustainable	■■□□
	• Municipalities within the AMA	Providing food, protecting and ensuring accessibility	■■■□
	• Netherlands Food and Consumer Product Safety Authority (NVWA)+ European Food Safety Authority (EFSA)	Ensure safe and healthy products	■■□□
	• Schools and universities	Provide safe foods	■■■□
	• Foodbanks	Nourish People, build nutrition, build solutions	■□□□
CIVIL SOCIETY	• Society (people)	Consume safe products	■■■■
	• NGO's	Advocate and monitor different aspects associated with consumption (i.e. transparant, healthy, accessible food)	■■□□

*Influence within this aspect of the food system

Visualizing Consumption

The diagrams on the left are to illustrate the average consumption patterns of the Dutch population. As shown in figure 46, most of our consumption occurs within our homes. The food budget is therefore also mostly spent within the retail industry. Most incomes are spent on bread, vegetables and meat. The growing trend on ready made meals have already shifted income spending on easily accessible meals.

To put into perspective, dairy products and eggs are significant to the Dutch Diet as they are the leading numbers in agricultural production per person. As we saw within the production chapter, milk is also the most exported product of the Netherlands.

Stakeholders

We mainly spend our money within the retail industry. These large stakeholders have therefore also large influence within consumption. In addition, society chooses what they want to eat and where they want to spend their money on, but they are also largely influenced by advertising and marketing strategies. The food industry is largely an interaction between consumer and retail businesses. Evidently, the production industry has very little influence.

01.3.6 END OF LIFE

Figure 51 Plate of unfinished food

The End of Life of Food

The end of life is not only accounting for food waste produced by consumers but also in all aspects of the food chain where there are food losses. End of life is intrinsically tied to all aspects of the food system. If any aspect of the food chain was to change, this would severely change environmental, ecological and spatial dynamics of the AMA.

Definition of Food Waste

"'Food waste' refers to food appropriate for human consumption being discarded, whether or not after it has been kept beyond its expiry date or left to spoil (FAO, 2013). In addition to avoidable food losses, there are unavoidable food losses in the food chain and in households. These include, for example, peels, stalks, cheese rinds, eggshells, coffee grounds, tea bags and meat and fish remains (bones)" (Netherlands Nutrition Centre, 2016).

Consequences of Food Waste

Wasting food has enormous ecological, economic and social consequences. Large quantities of food are lost along the whole food chain from harvesting, storage, transportation to our households (Ministry of Economic Affairs, 2014). Not only is the process heavily taxing on the environment and wastes valuable resources like water, soil and energy; it is also a waste of money. It is important to note that food waste contributes to a larger energy loss occurring earlier in the food chain. The embodied energy taken to process, transport and prepare food is already 85 to 90 percent of energy used in the production chain prior to the purchasing of the food. Currently, the Ministry of Economic Affairs and Ministry of Infrastructure and Environment have goals to research the full impacts of waste on a consumer level. In addition, the government is working on a comprehensive food policy concentrated on public health, environmental sustainability and resilience. Since 2009 and the implementation of food waste policies, reduction of food waste still not changed and te target goal of reducing waste by 20% has not been met.

How much food is actually wasted and where does it go?

An enormous quantity of perfectly unspoilt food never gets consumed and gets thrown away in households. In the Netherland, 38% of total food waste is caused by consumers, who are the largest wasters (Netherlands Nutrition Centre, 2016). On average, each person wastes 47 kilograms per year which is approximately € 350 per household and € 155 per person (DamnFoodWaste, 2017). Based on dietary trends, the top 5 most wasted goods are dairy, bread, vegetables, fruits, sauce and fats. To put this into perspective, the AMA wastes around 109, 651, 000 kg of food in a year just from households. However, when taking account of

Figure 52 Aerial photograph of AEB

Figure 53 Aerial photograph of HVC

the whole system, consumers waste 83 to 151 kg per capita.

In the Dutch agriculture sector, large streams of mineral waste do not end up with the consumers or return to agriculture ie. slaughterhouse waste. Minerals in the food processing industry also end up in sewage sludge, incinerated or is returned back to agricultural soils through composting. The food processing industry is another contributor to food waste (21.3%) and eventually is used as animal feed (Wageningen UR food & biobased research, 2013).

Taking Amsterdam as a case study, food waste is hardly ever collected separately and 70% of the waste is processed and incinerated by the Waste end Energy Company (Afval Energie Bedrijf, AEB). The remainder of the waste ends up in sewers which is later treated at the sewage treatment plant (RioolWaterZuiveringsInstallatie, or RWZI). An even smaller fraction ends up composted (Gemeente Amsterdam, 2013). In the AMA, the lowest concentration of organic waste separation takes place in Amsterdam at 19% and the highest in Ouder Amstel at 67%.

Looking out for the future

We must begin to think how to prevent and repurpose food waste. Strategies needs to redesign the food system for sustainability with multiple criteria involving social, environmental and economic reorientation in the food supply and consumption patterns. Small measures have been taken place to combat food waste such as public private partnerships with the Dutch nutrition centre. Example projects include DamnFoodWaste (2017), an online and offline campaign against food waste. The event organized "megalunches" in Amsterdam, Rotterdam, and Groningen ad raised awareness to over 6 million people in the media.

However, there is currently no national or regional plan in specifically addressing food waste but there is a policy document Sustainable Food – Towards sustainable production and consumption of Food, 2008 is included in a policy document. It is also important to note that the ministry states that food waste reduction is cannot be achieved without adding value to the waste streams or else it would just lead to further increase in waste.

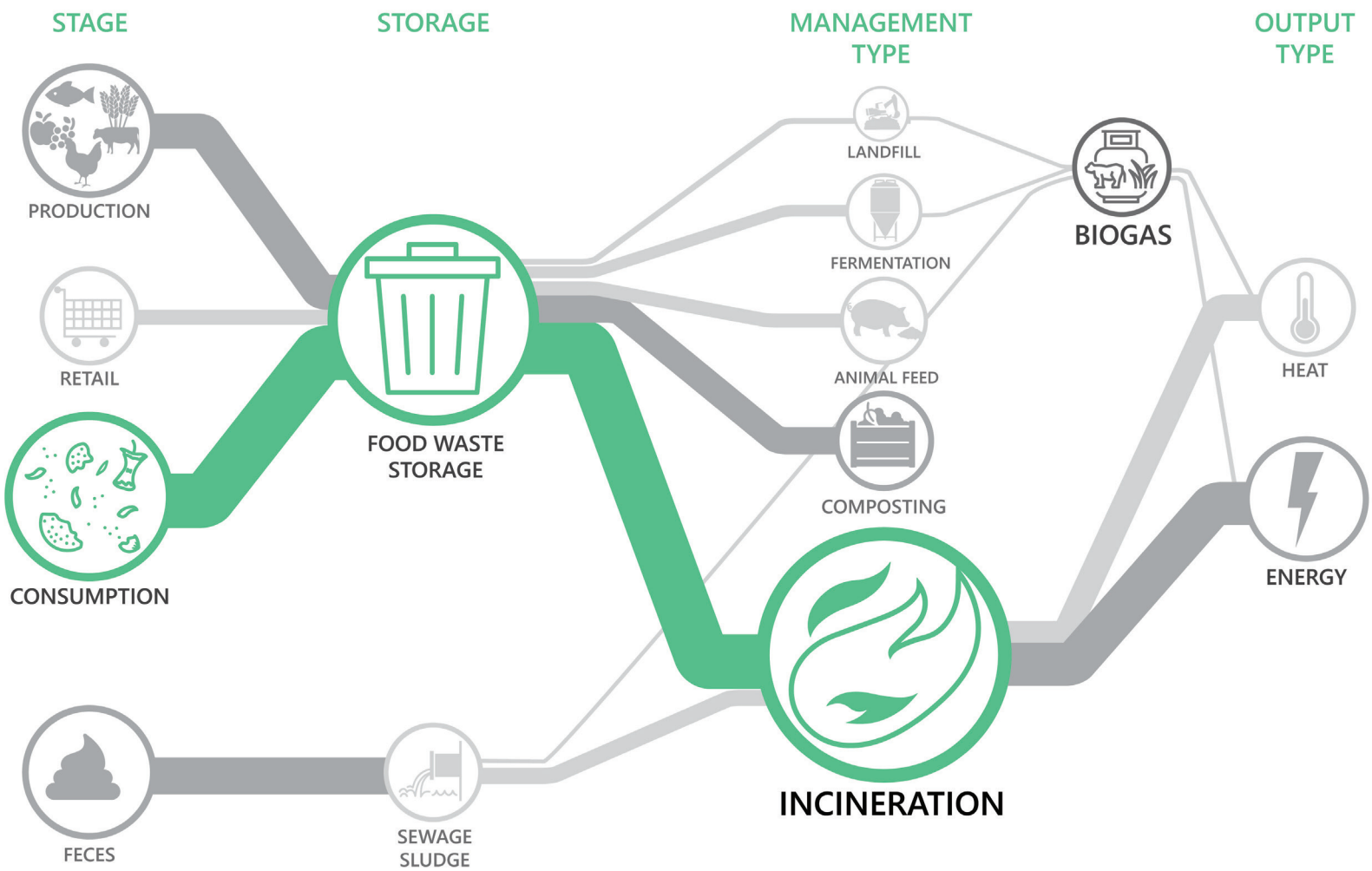


Figure 54 End of Life flow diagram

SUMMARY OF ISSUES:

Centralized: Depend on 2 Waste management facilities for the whole region.

Lack of Diversity: Food waste often ends up being incinerated.

Disconnected: Limited connections to sustainable alternatives to deal with food waste.

As per the end of life flow diagram in Figure 11, the first column outlines the stages of the food system that produces food loss and food waste. The highlighted path indicates the fact that consumers are the highest food waste producers and that majority of the waste ends up being incinerated.

On the map to the right (Figure 12), municipalities in the AMA heavily rely on 2 specific waste management facilities, HVC and AEB.

Figure 55 Waste management facilities locations (Source: i.a. Klimaatmonitor, Rijkswaterstaat, 2016)

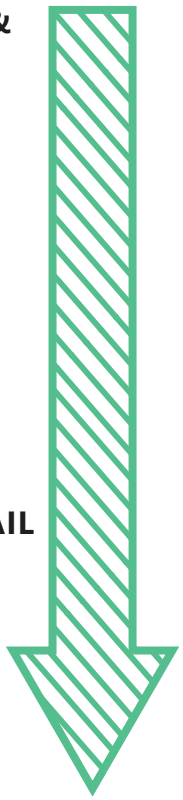
CAUSE

Due to rapid urbanisation and growth, preferred dietary patterns have emerged which have resulted in an increased pressure on the global supply system. Major challenges faced include ecological sustainability, public heath risks and long term sustainability of the Food system.

**Statistics based from European Environment Agency (2016) https://www.eea.europa.eu/media/infographics/wasting-food-1/view*

HUMAN ACTIVITY

SOURCES OF FOOD WASTE



MANUFACTURING & CULTIVATION	**39%**	Energy Use, Synthetic fertilizers, animal manure, industrial CO2, Water Use, Food Loss (ie. crops sorted out not meeting quality standards)
PROCESSING		Energy Use, Packaging materials, Food Losses (ie. edible food eaten by pests, degraded by fungus and disease)
DISTRIBUTION & STORAGE		Energy Use, & Food Losses (ie. edible produce sorted due to quality, expired, damaged)
WHOLESALE & RETAIL	**19%**	Energy Use, & Food Losses (ie. expired before purchase, spilled or damaged)
CONSUMER	**42%**	Energy Use, Food Preparation & Food Losses (ie. purchased/cooked but not eaten)

EFFECTS

BIODIVERSITY IMPACTS

Biodiversity loss in the Netherlands is largely due to agriculture and urbanisation. Population Density and intensive land use also put pressure on biodiversity.

ECOLOGICAL EFFECTS

Depletion and increased demand of land, water, and fossil fuels. Livestock farms contribute to ammonia emissions, the leaching of nitrates and phosphates into the ground water and surface water, and dehydration of grounds (PBL, 2017)

SOCIETY & ECONOMY

The Dutch population have increasingly consumed more processed products, creating unhealthy dietary patterns and risk of being overweight, obese or adopt health related issues. In addition, each household loses € 350 to food waste.

END OF LIFE	STAKEHOLDERS (WHO?)	INTERESTS/OBJECTIVES (WHAT?)	INFLUENCE (HOW MUCH?)
PRIVATE	• Waste incineration factory (AEB, HVC)	Maximal benefits from waste, maximal energy production	■■■■
	• Other sustainable waste management facilities (i.e. biogass industry)	Maximal sustainable benefits from waste through	■■■■
	• other waste management facilities(i.e. waste-construction treatment companies)	Maximal benefits/profit from waste	■■■■
	• Food related industries that produce food waste (i.e. production, processing, supermarkets, Greenport etc.)	Profit from waste, minimal loss of resources	■■■■
	• Food related technology industries	Profit by innovation of waste management businesses	■■■■
	• Farmers	Food waste can turn into composting and be reused in agriculture land	■■■■
	• NS & other food transportation companies	The existing and potential train station of transportation facilities can be used to take the food waste of urban area back to agriculture area as fertilizer	■■■■
PUBLIC	• Waternet (sewage)	Ensure coordinated logistics of waste	■■■■
	• Waste management facility (governmental owned AEB etc.)	Ensure financial stability, maximal sustainable benefits from waste	■■■■
	• Regional (administrations) municipalities (i.e. AMA, North-Holland)	Avoid accumulation and ensure accessibility to waste management facilities. Protect financial stability	■■■■
	• (Municipal) waste collection services	Ensure clean and sanitairy cities	■■■■
	• Ministry of Infrastructure and Water Management	Invest or plan for local habors/waterways/roads etc.	■■■■
	• Universities and institutions	Develop new methods of sustainable use of food waste	■■■■
	• Planning authorities	Plan for waste management facilities	■■■■
CIVIL SOCIETY	• Environmentalists	Responsible waste management, clean and healthy environment	■■■■
	• Neighbourhood communities	Ensure and advocate waste management services and ensure minimal disturbance	■■■■
	• NGOs	Advocate and monitor different aspects associated with waste management (i.e. supporting innovation, sustainable environment, safety and transparency)	■■■■
	• Citizens	Minimal disturbance and or nuisance from waste management industry, clean, healthy environment	■■■■

*Influence within this aspect of the food system

01.3.7 SUMMARY

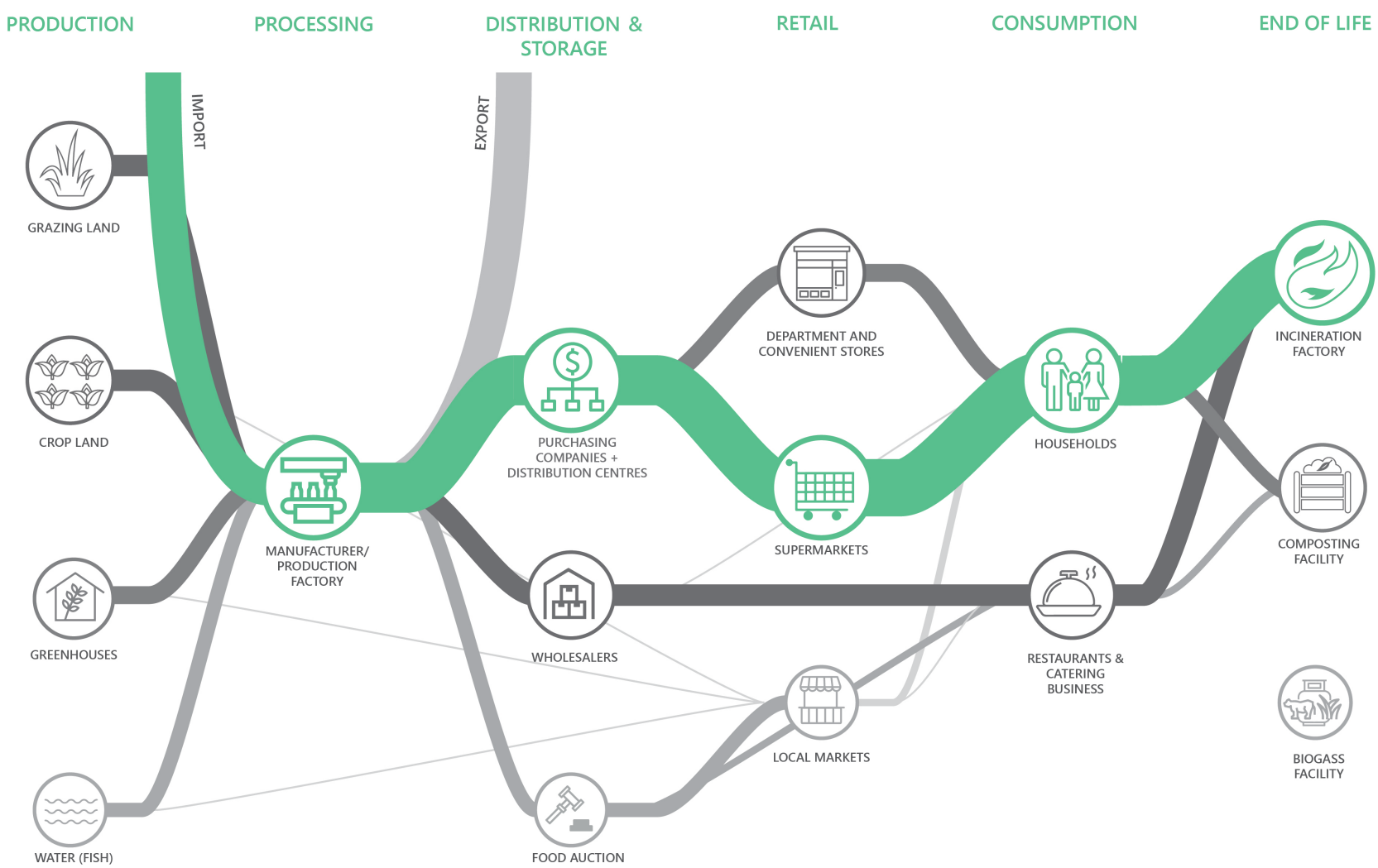
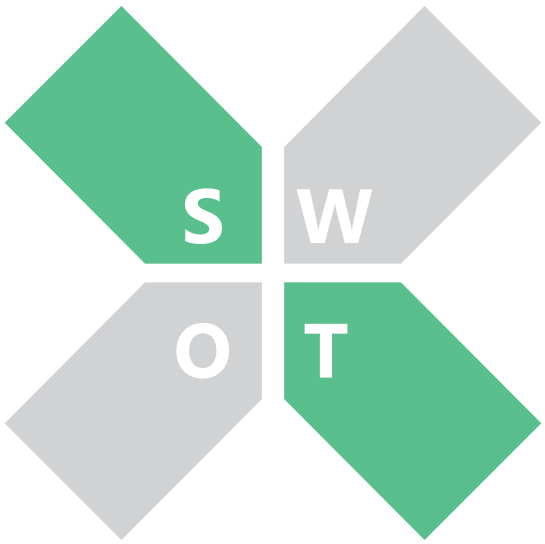


Figure 56 Summary of complete food system flow

01.3.8 SWOT ANALYSIS

- Heart of the Economic Centre
- Key concentration of start-ups, innovation & technology hubs
- Strong network and connectivity to other regions
- Efficient agricultural technologies and production
- Major distribution facilities such as Schipol Airport & ports (key player in exporting goods
- Innovative water technologies and management
- Strong nature/ecological preservation laws and policies

- Intensive land use policies
- Illegal manure trade
- Restricted agricultural land
- 30% of food is wasted
- Use of non-renewable energy
- Centralised waste collection systems
- High food consumption
- Policy: Nutrients from wastewater cannot be used in fertilizer
- Trends in health - overweight, cardiovascular diseases



- Receptiveness of society (environmental awareness)
- Taking food waste and transforming it into a renewable energy ie. biogas
- Urban farming ex. aquaponics
- Online shopping
- 5.5 billion euros for food waste management
- Health awareness - organic interest
- Recycling awareness
- Underutilized/abandoned greenhouses
- Waste landscapes

- Climate change - increase in water levels, salinization, pollution & temperature increase
- Decrease of biodiversity
- Depletion and dependency on non-renewable resources
- National regulations not allowing for experimentation with new circular processes with food wasted
- Import/Export (trade) dependent
- Brexit
- Growing overweight population

A SWOT analysis was conducted for the AMA. Each category encompasses different aspects of the social, political and economic spectrum. Key aspects will be further elaborated in the opportunities analysis and trends in the next section.

01.4 PROBLEM STATEMENT

The Netherlands is a competitive participant within the global food sector. It is the world's second largest exporter of agri-food products, a leader in innovative food technology and is renowned for its' highly productive agricultural sector. The Dutch agri-food sector covers about 65% of country's land surface and accounts for an important share of the Netherlands' GDP and about ten percent of overall employment (Vries, 2015). Evidently, the Amsterdam Metropolitan Area (AMA) is also a key player within this sector. It encompasses Schiphol Airport, the fourth largest European airport and the Amsterdam harbour, the largest seaport in Europe. The AMA also has a high concentration of knowledge institutes, businesses and flourishing agricultural lands. However, the intensive production in the agro-food sector has caused significant degradation to the land and is also the main contributor in the depletion of non-renewable resources (The Stockholm Resilience Centre & CSIRO, 2009).

Statistically, food production claims approximately 37% of the earth's land surface (Vries, 2015). In addition, the industry causes major ecological impacts due to the amount of food waste produced and incinerated, emissions from the transportation of imported and exported goods and water pollution from agricultural production (Jonkhoff, 2012). There is a growing awareness that the global food system faces difficult challenges. One of the most significant global phenomenons that nations are facing is climate change. The severity of the impacts and consequences will differ from region to region and from country to country (Vries, 2015). In order to combat climate change, sustainable goals have been set up by private, public and non-profit organizations to strategize international, regional and local scaled projects.

At the same time, the AMA also wants to transition into a circular economy to become more sustainable (Jonkhoff, 2012). In recent years, the region has been implementing initiatives to improve the use of resources and reduce the ecological footprint of agricultural activities. Several practices being implemented by the region include: reducing water consumption to irrigate crops and transforming organic waste into energy. However, in order to be more sustainable, the food system not only needs to become more efficient with resources (circular economy) but also adaptable towards future change (resilience). A resilient food system has the ability to survive, adapt and flourish despite shocks and stresses that it may be exposed to. It is important to note that the current food system in the Amsterdam Metropolitan Area cannot be regarded as resilient based on a multitude of aspects.

In addition to the unsustainable practices as mentioned above, power relations within the food supply system have changed. In the past, agricultural organisations, national government and knowledge institutes jointly determined Dutch agricultural policy. Presently, non-agricultural players (seed and feed companies, the food processing industry, traders and supermarkets), consumers, NGOs and international organisations also play an important role (Vries, 2015). The current Dutch food industry and retail sector are controlled and dominated by a small handful of purchasing companies. This can be seen as a pressing issue due to the fact that these companies manage imported and produced local food which is then sold to the generation population at set prices. Second, the retail market is saturated with supermarkets which also limits the range and variety of retail. Direct connections between local producers and consumers is also rarely seen in the industry. At the same time, a similar situation is occurring with the treatment of food waste. Within the region, there is a set of homogeneous options to deal with waste, a centralized system of waste management facilities and a limited set of connections from waste to production. To elaborate, the organic waste which is produced by different actors throughout the food chain is usually mixed with other types of waste and is then incinerated by either of the two major industries in the region. Due to the lack of separation of waste during the end of life cycle, other sustainable waste management solutions are lacking at the local and regional scale.

The vulnerabilities and dependencies highlighted within the food chain (from production to disposal) can have large negative spatial implications. If one of these centralized systems were to collapse or is unable to perform, the entire system is in danger of collapsing. Thus, our proposal is to improve the resiliency of the food system in order to strive towards a more sustainable circular economy.

Research Question

How can the food system become more resilient in the AMA to promote a sustainable circular economy?

Sub- Research Questions

How is the current food system structured and who are the key stakeholders?

What are current major trends and concepts within society influence or impact the food system?

Which aspects within the food system are most vulnerable and/or unsustainable?

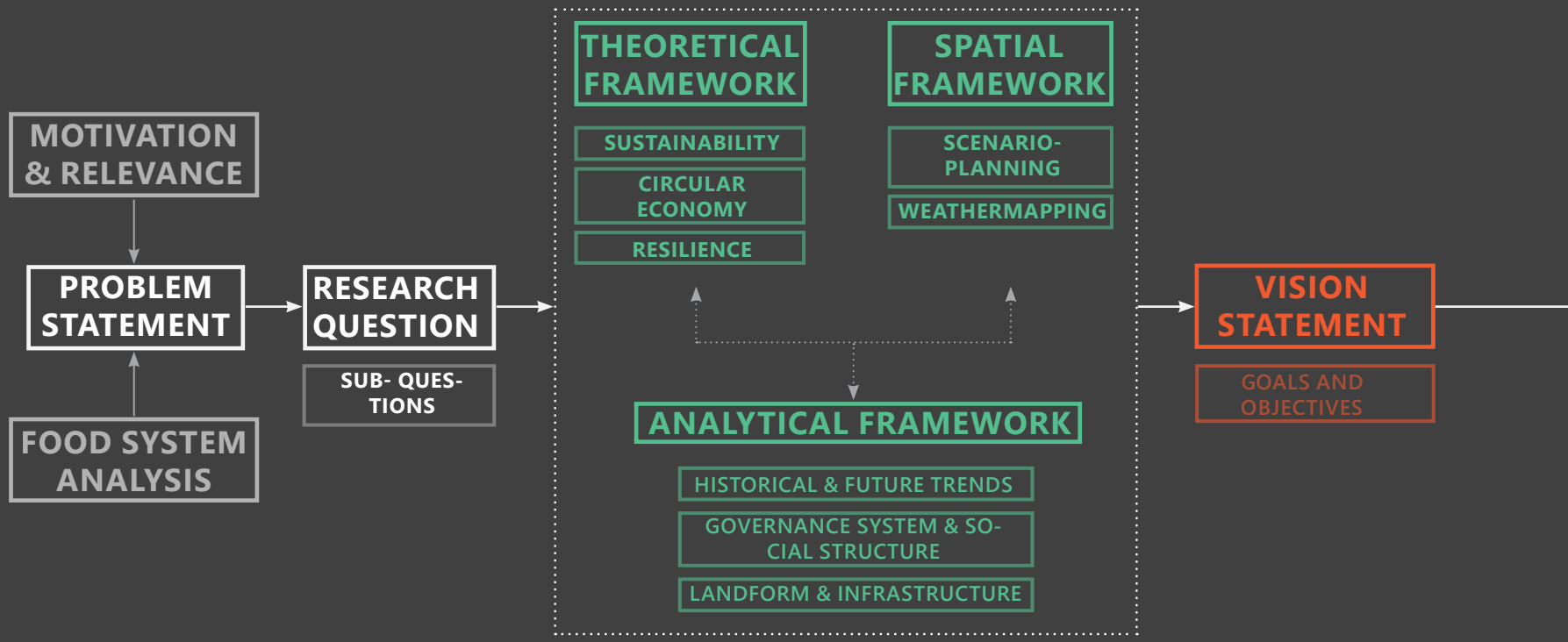
In what way can the resilience of the food system be improved and who needs to be addressed?

Which spatial implementations and non-spatial policies and strategies are necessary for improvement?

Photo by Cristian

02.0 CHAPTER

02.1 METHODOLOGY



Food Island's Research Question:

How can the food system become more resilient in the AMA to promote a sustainable circular economy?'

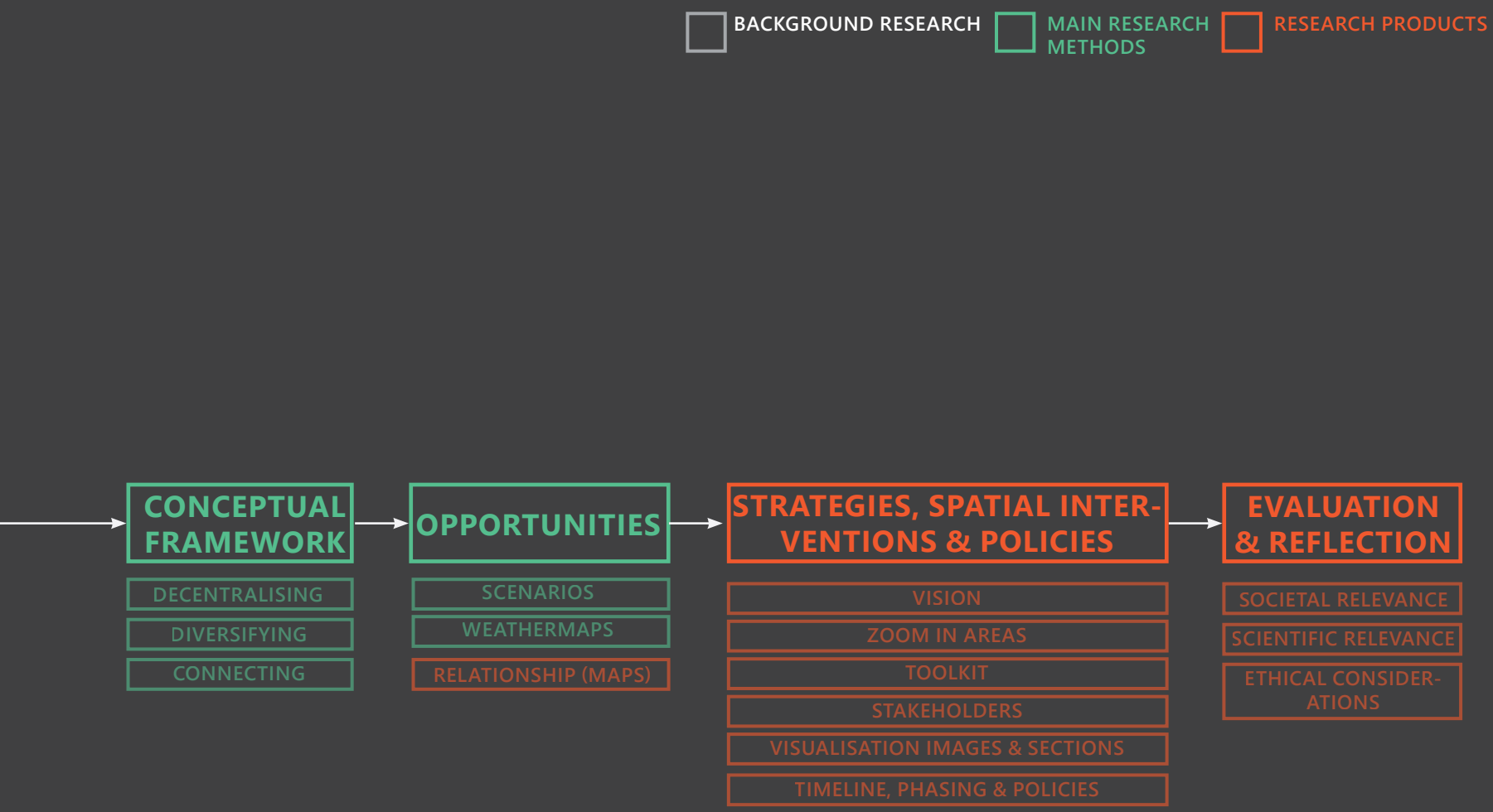
In order to conduct further research, a methodology was established to include three broad frameworks: the theoretical, analytical and empirical framework. These frameworks work in parallel in the development of the project to translate a proposed spatial and strategic vision for the AMA. In addition, the frameworks are meant to help structure and guide the report and results. Thus, the methodology is crucial to offer comprehension of the overall scope of the project while addressing key research questions under a set of criteria.

Theoretical framework

The theoretical framework forms the rationale for directing and conducting the research. This section elaborates and identifies the theories and ideas involved with our research question and their relevance within the project. The three main theories classified are: sustainability, resilience and the circular economy.

Spatial framework

The spatial framework will elaborate on the methods and approaches that will be conducted within our project. It forms the basis of evaluating the spatial analysis within our vision. The key planning and research tool utilized in our project is scenario-planning. Key aspects within this chapter will highlight the practical usages of scenario planning as an analytical and experimental tool. There will be a further explanation of the chosen scenarios, the importance of scenario planning and how this will develop Food Island's vision.



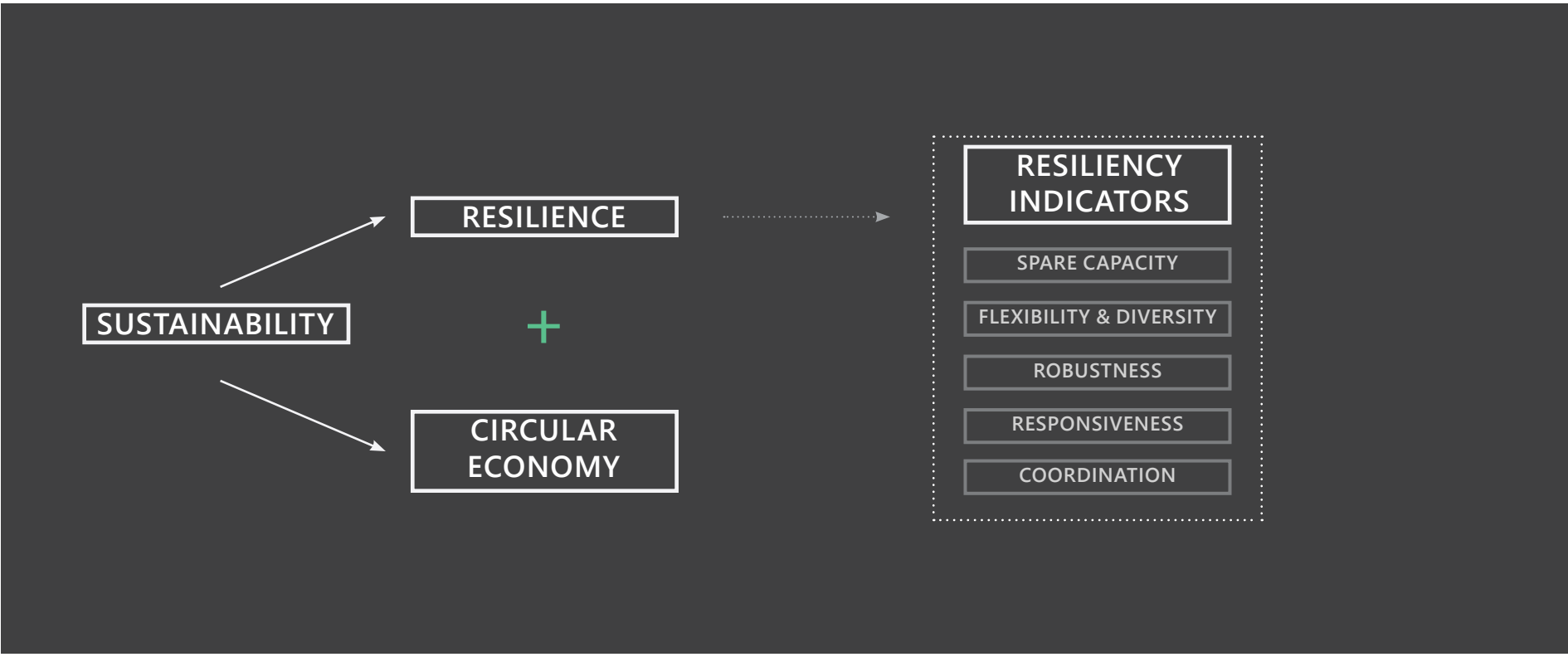
Analytical framework

The analytical framework can be seen as the qualitative research in order to answer the theoretical research question. This section will also be broken down into three portions: historical and future trends, governance and social structures and land form and infrastructure. It is there to clarify implicit assumptions and to provide a starting point for the project. Vital spatial elements and (societal) settings will be pointed out within the AMA.

Vision

The combination of the theoretical, spatial and analytical frameworks will lead to a vision statement with comprehensive goals and objectives. The rationale of the three major concepts (decentralizing, diversifying and connecting) will be explained within the conceptual framework. The conceptual framework is based on the theoretical framework and is connected to the goals and objectives. Combining the goals and objectives with the major concepts will be incorporated into the scenario-planning tool. The final vision will entail the best outcomes of our scenarios. It encompasses both strategic and spatial implementations within the AMA, which will then be described in detail within the chapters of strategies and policies and spatial interventions. In the final stage of the project, an evaluation, reflection, ethical considerations and societal and societal relevance will be explained.

02.2 THEORETICAL FRAMEWORK



BUILDING A SUSTAINABLE & RESILIENT FOOD SYSTEM IN A CIRCULAR ECONOMY: Composing The Theoretical Framework

This section of the report will include a literature review to structure the theories, ideas and perspectives utilized in ***Food Islands'*** strategic plan and design. The aim of the framework is to support and add scientific justification to the body of research conducted in this report with reference to relevant scholarly literature.

The theoretical framework will outline the necessary theories which are the, "conceptual basis for understanding, analyzing and designing ways to investigate relationships within social systems" (University of Southern California, 2018) in the Amsterdam Metropolitan Area (AMA). In addition, the theories outlined will be further developed and challenged in order to build upon the existing body of knowledge and assumptions related to the region.

In order to develop a comprehensive understanding of our project, the literature review will be separated into three categories to explore how these relate to the food system in the AMA. The following are the main models investigated as part of the main research question and problem statement:

- Creating a Sustainable AMA
- Our Position in Building Food For a Circular Economy
- Anchoring Resilience in the Region

Creating a Sustainable Food System in the AMA

A significant portion of the AMA region's prosperity and growth is directly related to the dependency of non-renewable resources to foster the agro-food industry. Consuming large amounts of energy is contributed by the production of goods to the end of life. The AMA is strategically located and a large portion of global imports and exports go through the Port of Amsterdam and Schiphol Airport. However, the AMA is disproportionately focused on the City of Amsterdam for the reliance of economic generation, employment and global attention. In order to plan for the region, there needs to be a broader focus that requires efficient and planning of the whole region and not just for a single city. The long term sustainability of

the whole region requires an analysis of land use, protection of farmland, knowledge of city expansion and population growth, infrastructure and material flows. Key to Food Island's spatial strategies is the integration of efficient and diverse infrastructure for the sustainable growth of a region while considering environmental, social and economic issues.

Sustainable development strives to improve the livability of an area which fosters social amenities, health and well-being of the individual and community. Sustainability theories and science seek to address major challenges within societies and is often referred to "meeting the needs of the present without compromising the ability of future generations to meet their own needs." (Redman, 2014, p .3) In addition, the goal of sustainability should strive to reduce the use of natural resources and production of waste while simultaneously improving its livability. The concept of sustainability is vital to be integrated into regional planning in order to plan for the capacity of local, regional and global systems (Pandis Iverot et. al, 2011). The rigorous nature of sustainable development needs to be incorporated in the food system for the AMA to systematically perceive future options, assign value to indicators and create strategies in order to achieve goals (Redman, 2014).

Food for the Circular Economy

In order to grasp an understanding of food within the circular economy, several academic references and pioneers within the field will be highlighted. Initially, the concept of a circular economy is associated with Pearce and Turner (1990) where they investigate "the influence of natural resources on economic systems and the impacts of linear and open ended perspectives" (Petrlic, 2016, p.253). Contrast to a linear economy where products are made, used and then disposed of, a circular economy tries to prolong the use of the product as long as possible including the extraction of maximum value at a products end of life to then regenerate products.

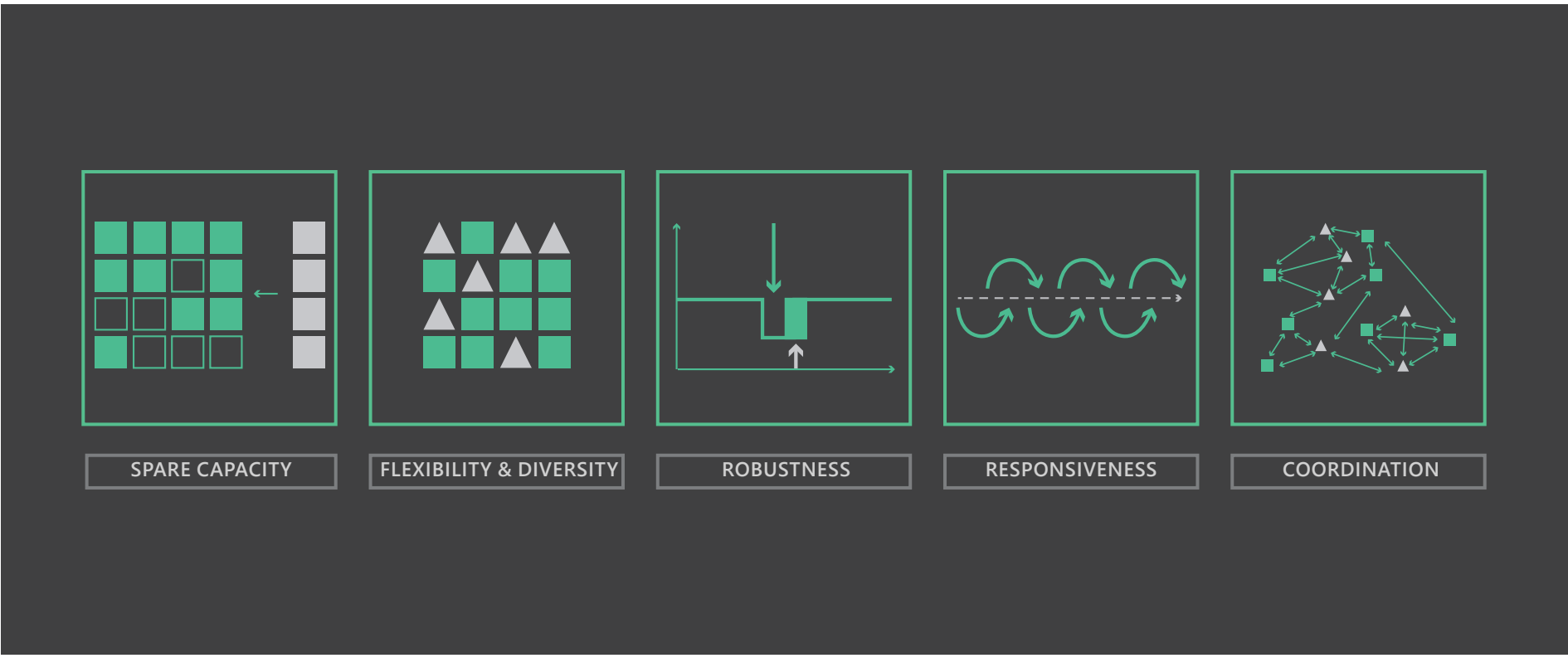
The perspective critically views how the industrial system can be restorative as well as regenerative by intention and design. Circular Economy (CE) is driven by four main principles as outlined by Petrlic (2016) "waste is equal to food; meaning that restorative loops is the central idea, (ii) building resilience through diversity, (iii) creating energy from renewable resources and (iv) thinking in systems" (p. 254). These are important principles that need to be key in creating objectives and goals for the region of AMA. CE is a strategy that accounts for activities that supports and rebuilds the ecosystem while supporting human health and society. In addition, another pioneer in the Field, Walter Stahel (Petrlic, 2016), puts forth the notion of the product-life factor where a product's life can be extended by reusing, repairing, reconditioning and recycling. Linked to the notion of sustainability, the idea refers to prolonging a product's life and their components with the preservation of natural resources and reduction of waste.

Circular Economy is a practice that constantly reflects on the interdependencies of produced goods and services and their impacts to the environment. The practice, "has also recognized the economic potential of resource efficiency, reuse of materials and recycling" (Homrich et. al, 2017, p. 526). By using this method, many companies worldwide have integrated policies to reuse, re-manufacture or recycle material during the whole duration of a products life which has many economic advantages. Incorporating this model has also positive effects for the general economy of regions, society and nature with the creation of local jobs, security of resource supply and minimization of resources needed. Several key examples to be noted is that private households could realize savings concerning mobility, use of energy and food with the realization of a circular economy. By closing loops and reducing consumption of energy, many regions can establish a self-sufficient system while reducing dependencies. The performance of industries and regions must be readjusted and critically analyzed in order to promote new policies and technologies to develop a more circular food system.

Creating Resilient Infrastructure

Resiliency is must be accounted for when reinforcing sustainability within a circular economy. Due to rapid population growth, large scale environmental impacts and a globalized economy, the AMA needs to be prepared to factors that give rise to changing trends, geographic hazards and uncertainties of the future (Siemens, 2017). There is a large stress factor with the resource footprint in a globalized economy where societies have become dependent on resources including minerals, fuels, food and manufactured goods (Siemens, 2017). Sudden shocks could include small-scale disruptions such as structural failures or even regulatory policy changes that can trigger a ripple effect in systems that can cause a crisis. Resilience is defined as the "capacity to survive, adapt, and flourish in the face of turbulent change" (Siemens, 2017, p. 9). There is an implication that the system would be able to overcome changes that are not predictable or any unforeseen threats. There is a major strength in taking resilience into design thinking and practice where it adapts an adaptive capacity and robustness in the system (Redman, 2014). In addition, resiliency builds on social and natural capital and integrates adaptability and flexibility into the system to deal with the unknown future.

Regardless of size or location, "resilient cities share core capabilities such as constant learning,



rebounding rapidly from shocks, limiting the effects of failure, adapting flexibly to change, and maintaining spare capacity." (Siemens, 2017, p. 198). The concept is key to protecting critical infrastructure systems from external and internal stresses. The AMA's economic and social development is heavily dependent on an increasingly complex set of systems that is designed to promote the production and distribution of essential goods and services (Willingham, 2008). Many flows within the system such as food, water supply, transportation and energy are critical infrastructure that also contain a set of vulnerabilities. In order to adequately address infrastructural and non-spatial interdependencies, resilience metrics will need to be applies to the region (Willingham, 2008).

Rationale and Relevance of Resilience

Pertaining to our vision, *Food Island*, there is a major emphasis of creating a resilient infrastructure system due to the lack of foresight of the AMA region being dependent on the Circular Economy model. Resilient infrastructure systems will heavily impact the way infrastructure is planned, designed, managed and maintained (100resilientcities, 2018). In many cases, integration of advanced technology within the realm of regional plans can help facilitate the development of systems with a greater ability to withstand and respond to sudden impacts. A comprehensive approach such as resiliency can help facilitate more attention in risk management, recovery capacity and recovery rate. (de Bruijin et. al, 2017). Also, utilizing the theory identifies risks within systems and puts forth the motion of engaging with stakeholders to take action for the future.

The process of creating resiliency is to unite communities, projects and priorities to focus on critical new solutions so that cities can collectively act upon their resilience challenges. As per the 100resilientcities (2018), resilience strategies are more than a milestone as they are seen as a road map and a call to take action. The notion of creating resilient infrastructure prepares cities to effectively manage and mitigate major hazards. On a smaller system design, agricultural systems can "integrate biodiversity as a link between stress and resilience because a diversity of organisms is required for ecosystems to function and provide services (Lin, 2011, p.183). It is evident that there are many benefits in applying this model such as increasing environmental performance with energy efficiency, safety and security and etc. In the case of the AMA and the existing food system, it is critical to adapt resilience principles due to the interdependencies within the system.

Using Resilient Theory

It is essential to embed resilience thinking into the design, planning and budgeting into the cities within the AMA. Key design interventions will investigate methods to accomplish goals of creating a thriving region where all of the components of a neighbourhood are working together to reduce risk and enhance development potential. As per resilience strategies there will be a focus on decentralizing, diversifying and connecting systems which will be further elaborated in the conceptual framework.

Resilience Indicators

There are 5 main resiliency indicators that will be utilized in the development of creating a resilient food system for the AMA.

Spare Capacity

This is often referred to purposely creating more spare capacity or quantity within systems so they can accommodate for disruptions, extreme pressures or surges in demand (City Resiliency Index, 2016). Examples of this include more distributed infrastructure networks and resources. This is also referred to as having redundancies in the system where they should be intentional and cost effective. Institutions and society should be able to find different paths to achieve their goals or meet their needs when the system is under stress.

Flexibility & Diversity

Flexibility as outlined by the City Resiliency Index (2016) implies that systems can change, adapt and evolve in changing conditions. Usually, decentralized and modular approaches to infrastructure or management is favoured. Flexibility can also be achieved by investing in new knowledge and technologies. Diversity works well within a flexible system as it introduces multiple ways to achieve a goal. For example, if a system was to rely on apples as the main source of food and a bug infestation were to happen, the system is vulnerable to collapsing. However, if there were a variety of fruit planted in the region, it would be better equipped with an unforeseen risk.

Robustness

Robust systems defined by the City Resiliency Index (2016) states that these are "well-conceived, constructed and managed physical assets, so they can withstand the impacts of hazard events without significant damage or lost of function". This is an important indicator to embed in design as it anticipates potential failures in the system. There is an emphasis on reducing dependency in the system and to ensure potential failure is predictable and safe.

Responsiveness

The responsiveness of the system looks into the learning capacity and adaptability of the system. These are constantly reviewing and reflecting on the every changing trends in the world. Mechanisms are put in place to continuously evolve and be modified rather than creating permanent systems. There is a constant exchange of information, knowledge and experience between businesses, consumers and the government. This indicator has a strong emphasis that people and institutions can examine and systematically learn from past experiences to inform future decision-making.

Coordination

There is an important emphasis in creating a flow and exchange of information between city systems in order to function collectively and respond rapidly through shorter feedback loops (City Resiliency Index, 2016). Consultations and engagement with communities are included in addressing future shocks or stresses that may occur in a sector. By coordinating inclusiveness and integration within communities, there is a shared ownership in building resilience across different scales of operation.

Case Studies of Applicable Examples

Using 100resilientcities as a benchmark, many cities around the world have integrated resilience thinking into plans and policies as well as design review of capital projects. Several cities that are placing resilience planning into action include New Orleans, U.S.A., Melbourne, Australia and Rotterdam, Netherlands (100resilientcities, 2018). Each of these cities have made significant effort in embedding resilient thinking into the design, budgeting, design and planning of the city as well as building coalitions with regional governments and educating and empowering key sectors in the field. These are key lessons to be learned as they have been successful in advancing the understanding of resilience principles at the local, regional and provincial level.

Compare and Contrast of Theories

To summarize, resilience and sustainability are not mutually exclusive but should be seen as partnered concepts in shaping future planning and daily management of cities (Toolkit for Resilient Cities, 2014). Sustainability represents the end goal in forward-thinking regions and pursuing, "to secure a good quality of life for all people, today and in the future, through strong and prosperous communities, a vibrant and resource efficient economy, and stewardship of both local and global environmental assets" (Toolkit for Resilient Cities, 2014, p. 13). A key strength in sustainability is that it "systematically examines future options and rigorously integrates normative values and anticipatory thinking into a scientific framework" (Redman, 2014, p. 3). In contrast, resilience works within the context of long-term sustainability while learning and preparing for a spectrum of risks that may occur between people, the economy and the environment. However, at times both approaches may conflict. For example, sustainability may encourage a more condensed and efficient set of operations in the interest of resource conservation but resilience promotes redundancy in city infrastructure to provide back-ups during a crisis (Toolkit for Resilient Cities, 2014). Conflicts such as this may result in short-term efficiency gains but may not necessarily work for long term sustainability. Therefore, in order to plan for the AMA, it is important to incorporate sustainability and resilience indicators which are reflected upon within the evaluation chapter.

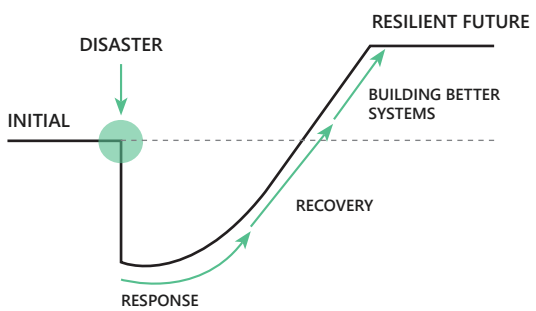
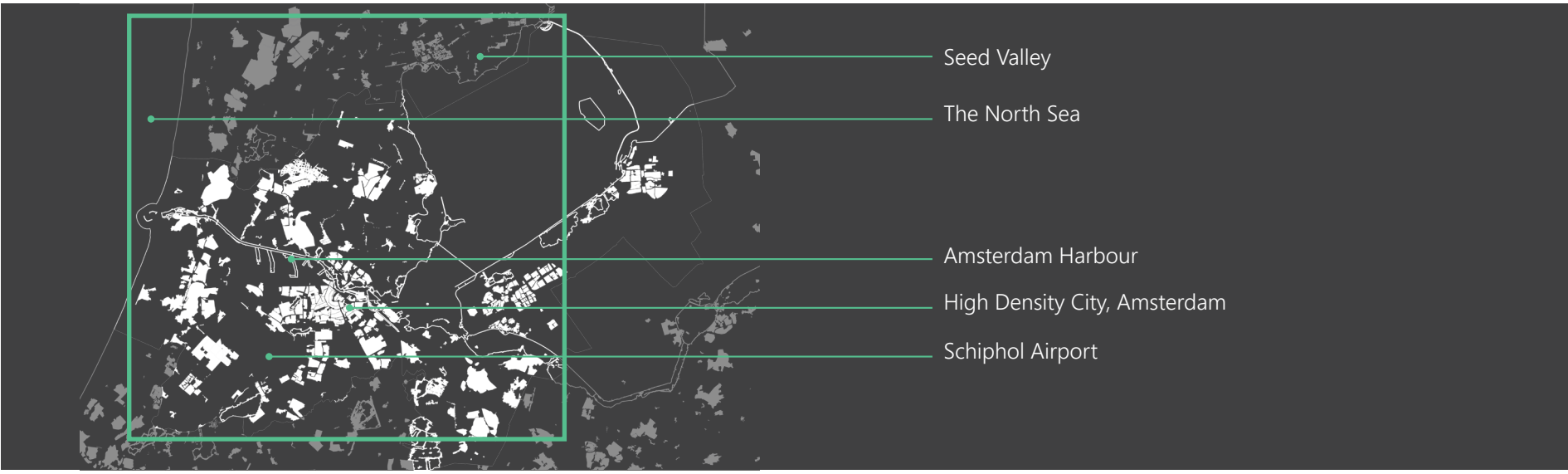


Figure 57 The process of resilience building. In this framework, the aim is to reduce risk within the system and creating a faster response time and more resilience (Lallemant, 2013).

02.3 SPATIAL FRAMEWORK



Spatial Framework

The spatial framework chapter will be outlining the practical usages of scenario planning as an analytical and experimental tool. Scenario planning offers a framework for long-range planning processes which includes: creating a vision for the future, goal setting, strategy development and implementation. The planning tool closely aligns with Food Island's theoretical framework in envisioning a resilient and sustainable future. Based on the concept of resilience, it is the ability to react to future change and bounce back to a stable state. Cutting the AMA off from the rest of the world was a means to see how the system would react as well as emphasize vulnerabilities within the food system. The chosen scenarios within our research will inform our design strategies and interventions and will have a set of guidelines and principles. In addition, it can offer comparisons of the future outlook of 2040 based on trends.

Why are we using scenario planning and how does this help us?

In essence, the scenario tool will be critical in questioning centralizations, lack of diversity and connections in the AMA relative to the food system. The scenarios will provide different perspectives in the year 2040 as well as strategic thinking of the future that includes foresight into which stakeholders are involved and the policies that would need to be implemented to achieve the vision. The scenario tool is used to test, measure and value the impacts of our interventions in the region in order to create a sustainable, resilient and circular AMA. This includes quantifying opportunity areas such as land surface required for food production, water bodies, number of facilities required and optimal transportation distances to distribute resources. Each scenario will be used to see the effectiveness of each strategy ie. New land uses, facilities and connections.

There is a great importance of selecting scenario planning to test the performance of the food system under certain conditions. It is used as a means to measure the outputs of the interventions proposed. In applying a qualitative scenario storyline, multiple quantified simulations will be generated based on a specific set of rules. As stated by Brown (2014) scenarios do not provide predictions, but they identify possible future conditions and can assist in making 'future proof' policies and plans by identifying strategic or emerging issues. The main goal of approaching the vision through scenario planning is to facilitate learning and to pose a critical perspective of the food system in the AMA. It is a constant learning process that requires refinement and a series of design criteria.

The Experimental (square) AMA

In order to define *Food Island's* boundaries for conducting the scenarios, a set of criteria were set such as:

- Important physical elements and land use regarding the food system.
- A diverse mix of existing elements within and around the AMA. To further elaborate:

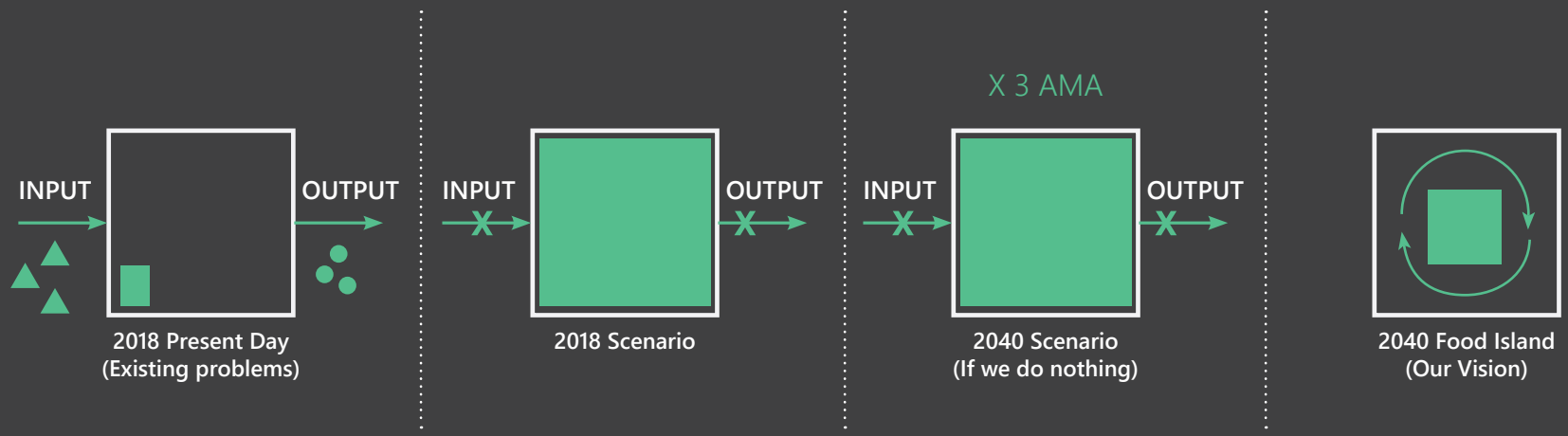


Figure 58 Diagram of the scenarios within the food system

- The production areas in North Holland is considered to be a highly productive region with strategic and dynamic relations with governments. There is also a strong investment in entrepreneurship and knowledge with the agro-food sector.
- Main import and export facilities – Schiphol Airport and Amsterdam Harbour
- Important Water bodies ie. The North Sea
- Areas that included large economic growth and infrastructure ie. the southern section of the square belong to Randstad includes Amsterdam and Almere
- Sample of different population trends and dynamics. In the existing defined AMA boundary, the region only showcases one type of population growth
- *Bonus: squares look nice (you've got to admit)

Weather mapping

To showcase opportunities within the area, weather mapping can be utilized to show high and low potentials to implement strategies. Similarly to observing a regular weather map and precipitation that may occur in an area, the weather map in this case, showcases high potentials for project opportunities.

Putting "Food Island" into Context and Comparison to Future Trends

To put the storyline of *Food Island* in context, there are several ongoing trends that are often showing a similar extremity and not-so-far-off reality of literally countries cutting relations and building walls. In contrast, cities and regions around the world are investing technologies, policies and strategies in order to become more self-sufficient. In the case of Food Island, it forces the situation on an extreme scale.

On a global scale, nations like China is aiming to be more self-sufficient but for the United States, the perception is that they are literally making themselves into an island with threats to cut off trade and tax-cuts. Having a strain in trading relations can easily put nations closer or at a distance. Other hindering policies that could severely impact the Netherlands is Brexit which influences imports, the economy and education. Each example offers an analogy of the "island", whether the public has chosen to isolate itself or the governing state.

To compare, the Rotterdam and the Hague Metropolitan Region (MRDH) is proposing a resilient food network and the authority has set an agenda for a Regional Food Strategy (Spoelman & Nefs, 2015). The AMA needs to reflect on emerging trends and techniques that will largely impact the Dutch Food System. If a nearby region is competitive to the AMA which also has large stakes in the economy and spatial configurations, it is vital to discuss the future of the food industry in the AMA. The AMA must be prepared to adjust to new country dynamics while maintaining policies and strategies that look towards being ecologically sustainable, resilient and circular.

02.4 ANALYTICAL FRAMEWORK

The analytical framework clarifies implicit assumptions and provides a starting point for the project. Some of the vital spatial and societal setting will be pointed out within this chapter.

Historical and Future Trends

Food has always been a trending topic, not only globally but within the Netherlands. Over the years, there has been an extreme interest from the public in urban farming as well as a changing food culture in the Netherlands that is closely tied to global trends. It is a pressing and urgent issue to adapt and change the current food system as many conflicting problems are arising such as climate change, land degradation and scarcity of water. A significant question posed is how can we adapt our regional food system to deal with these challenges? Municipalities in Rotterdam and the Hague (Spoelman & Nefs, 2015) have already begun to invest in looking at food strategies due to the concern they have with the realm of food sustainability. Food plays an important role in our health and municipalities have begun to stimulate urban farming and educational program to not only increase awareness amongst the public but improve the quality of life in cities. Many research and studies within the Dutch culture have been conducted over the years by Wageningen University and other institutions to showcase several main trends such as: a growing interest in locally produced food, multifunctionality in agriculture and growing efficiency in food production (Spoelman & Nefs, 2015, p. 9).

Growth and Growing Interest in Locally Produced Food

Consumers in larger urban cities such as Amsterdam, Rotterdam and The Hague are showing a growing interest in locally produced food (Spoelman & Nefs, 2015, p. 9). Case studies such as Fenix Food Factory in Rotterdam sell locally produced food. Researchers believe that the trend will continue to growing because of food production transparency and also with the public's awareness of climate change. Investing in locally produced food will reduce the amount of kilometers needed to transport food and will also make cities and regions less dependent on other countries.

Multi-functional Farming

The implementation of multifunctional farming has been a huge bonus to local farmers and it is estimated that locally produced food products, education and other rural services in the Netherlands amounts to 232 million euros in 2007 (Spoelman & Nefs, 2015). There is an enormous growth potential between 1.5 and 4.5 billion euros. Multifunctional farms can include recreation, nature and education that can also assist in generating income for urban farmers by providing a more attractive environments. For example, Fenix Food Factory in Rotterdam allows consumers to buy fresh, locally produced foods and also consume them.

Efficiency in the Production of Food

The Netherlands have increasingly become more efficient in the production with food due to the large investments into agro-food research and technology. As such, the nation has become a global leader in developing new techniques and over the years many of these will be implemented in technology-based and intensive agricultural areas, which has already been seen in the MRDH region (Spoelman & Nefs, 2015). Several food production developments that will have large impacts in the future include: vertical and aqua agriculture, sensor technology, and weather modification technologies.

Governance System & Societal Structure

Food plays a large role within the Dutch governance because of its economic value (Vries, 2015). Within different scales of the governance, from the European Union to different local municipalities, there is more or less a common strive for food security, innovation and sustainability within the food sector. These reoccurring themes are visible within future objectives and policies as well as economic expenditures.

The hierarchic structure of the governance within the AMA is as followed: European Union (EU), Dutch government, the provinces and local municipalities of the region. All of these governing bodies make decisions which have implications on the food system. While the European is more of a regulating body, the municipality Amsterdam has an executive role. Within the European Union, the Common Agriculture Policy (CAP) ensures a good working conditions for farmers, while setting requirements for animal health and welfare, environmental protection and food safety' (European Commission, 2016). To reach this goal, the EU spends around €65 billion per year. The focus within the Netherlands is economical, they strive towards innovation and a more sustainable usage of resources to decrease the dependency on subsidies (RVO, 2018). This agenda is managed by the Ministry of Agriculture, Nature and Food quality, which is one of the twelve ministries in the Dutch government. The goals mentioned above, are managed through multiple subsidies, with a total budget of around €2,5 billion.

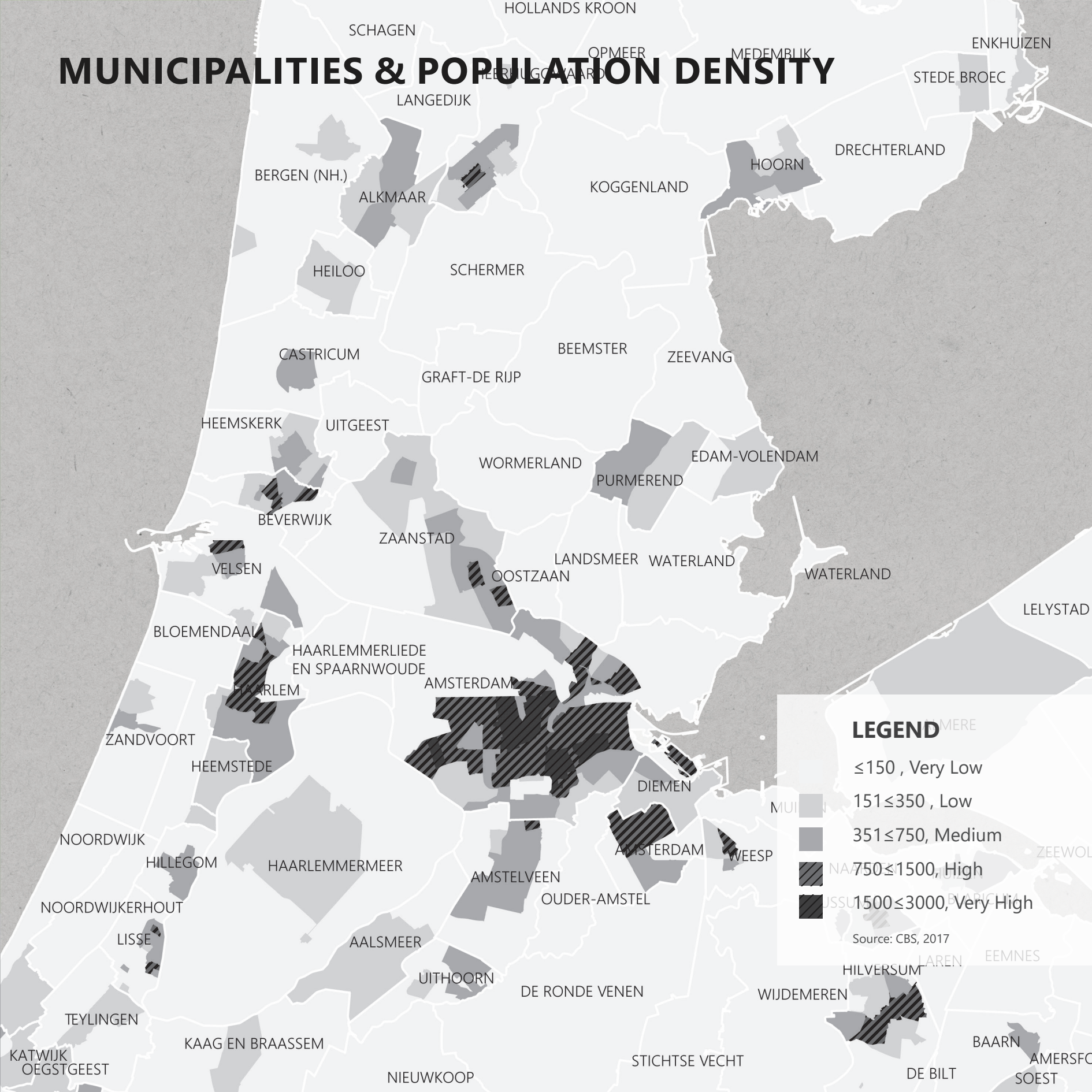
The provinces are directly managed by the national government and therefore share the same goals, yet specified towards the area. Within the AMA there are four provinces: Noord-Holland, Zuid-Holland, Flevoland and Utrecht. The largest part of the AMA area is covered by the province of Noord-Holland. The province of Noord-Holland has the goal to invest in innovation, knowledge and cooperation, which is similar to the national government. The province arranged five different important economical areas that this goal focuses on: Greenport Noord-Holland, Greenport Noord-Holland Noord, Seed Valley, Metropoolregio Amsterdam Agri & Food and the fishing sector. The province board ensures municipalities share and follow these goals, even though municipalities might have different focus points, specific for their location. The municipality of Amsterdam, in example, focuses on urban farming, while the municipality of Waterland on the other hand focuses on the preservation of nature during their intensely cultivating of the landscape. Within the AMA square, there are a total of 62 different municipalities with each their own focus point, see also map on the right.

Land form and Infrastructure

While in history land within the Netherlands grew, literally, agricultural land is currently declining. Urban areas and natural areas are increasing in size (CBS, 2016). Especially the recent increase of natural area is interesting, since it has been declining for the past decades. Within the Netherlands it had to provide space for agriculture as well as urban expansions. The continuous battle on land use was always (easily) won by the food sector, since it provides a higher economical profit. However, the food sector has become more and more efficient with the usage of land and over the years, there is a decline in agricultural land use and therefore an increase in other types of land use such as natural space (PBL, 2018). This trend is particularly evident in the north and south of the Netherlands in provinces such as Drenthe, Groningen and Friesland and Zeeland and Brabant. This is because land value within these areas is low, due to the decrease of population (CBS, 2016). Other areas, especially within AMA, there is an increase of population and land values are high. Natural, but also agricultural land are losing the fight against urbanisation. According to CBS, this trend is only expected to increase within the next twenty years (2016)

Figure 59 Top to bottom: 1850, 1925, 1990, 2005. Source: topotijdreis.nl

MUNICIPALITIES & POPULATION DENSITY



03.0 CHAPTER

03.1 VISION STATEMENT

In 2040, the Amsterdam Metropolitan Area (AMA) will have a resilient food system that has the ability to survive, adapt and flourish against future shocks and stresses. The Netherlands will maintain their prominent position in the field of food and the AMA will continue to assist in leading the world in innovative and sustainable food production. Important contributions include improving food security and conserving the vitality of ecosystems. Presently, the AMA is comprised of 32 municipalities and two provinces (North-Holland and Flevoland) and over 14% of the Dutch population is living within this area (CBS, 2017). It is important to consider the changing demands of the growing Dutch population and consumption trends. There will be significant impacts on sustainable agricultural production, processing of food, distribution of goods and food waste management within the system. Existing and new developments will need to integrate and take into consideration the interests of various stakeholders such as: NGOs, policy makers, municipalities and businesses in the food and agricultural sector. The future of the AMA will encompass core values of the circular economy, reduce vulnerabilities amongst the food system and create a more livable environment.

Integrated research, theories and regulations

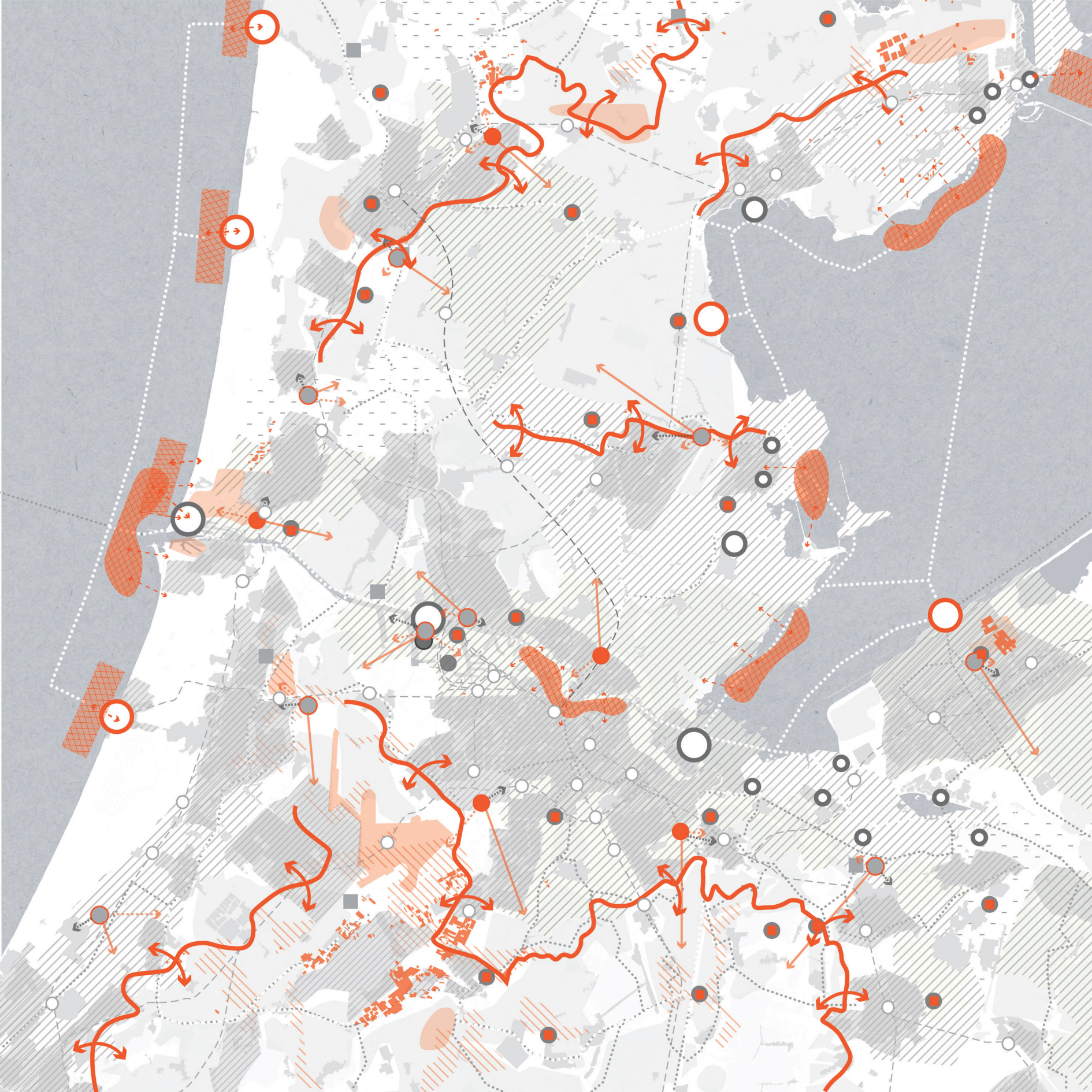
Presently, the world leaders have set up 17 global goals to build a more sustainable world in 2030 (UNDP, 2016). In addition, the Ministry of Economic Affairs, Agriculture and Innovation in the Netherlands have defined certain climate-resilient strategies to be build upon (2016). The goals will also be guided by the vision and agenda of a circular economy within the AMA (Jonkhoff, 2012). Utilizing scenarios will provide an opportunity to learn and integrate economic and spatial decisions to improve the resiliency of the food system in the AMA.

Decentralized, diversified and connected system

The decentralized system will contain a dense network of diverse and independent stakeholders. The food chain will be reduced to localized and smaller systems, which will make the network accessible and affordable. Self-sufficient cycles along with participation from the public, will increase awareness of food system and promote healthy consumption patterns. In addition, creating more transparency within the food system will enforce major corporate stakeholders to be socially and environmentally responsible. Essentially, main stakeholders within the food industry such as agriculture production businesses, purchasing companies and processing factories will be heavily involved with governments, knowledge institutes and innovation businesses. Transparency within the food system includes open policies and databases which will allow for the transmission of knowledge to the general public.

Conclusion

The region will be encouraged to continue thriving as a competitive entity within the global agri-food sector. There will be an emphasis within the AMA to have a dense, diverse and self-sufficient network with incremental improvements at the individual, community and regional scale. Different actors within the food system will be regarded. In addition, new technologies, innovations and spatial strategies will ensure long term solutions in response to urban issues related to food and agriculture. Food Island will integrate sustainable principles from production to end of life and will not only account for a healthy and durable circular economy but also a resilient food system.



03.1.1 GOALS & OBJECTIVES

PROBLEMS

Centralized:
Depend on 2 points of trade for the whole region

Lack of Diversity:
AMA heavily relies on importing food for our dietary wants. There is also a lack of diversity in local food production.

Disconnected:
AMA is disconnected from local food production and consumption.

Centralized:
A small group of stakeholders (purchasing companies) have power over the distribution of food.

Lack of Diversity:
Purchasing options are limited and restricted. Consumers prefer supermarkets over other sources.

Disconnected:
No direct connection from production to consumers.

PRODUCTION

PROCESSING

DISTRIBUTION & STORAGE

RETAIL

STRATEGIES

Decentralize:
Creating and improving the networks of food production and transportation

Diversify:
Strategically placing innovative & sustainable new forms of food production

Connect:
Enhancing the relationship between agricultural areas in the whole region

Decentralize:
Increasing exposure and facilitating growth of small scale retail to increase their competitiveness

Diversify:
Supporting existing small scale retail (with low market share) and creating opportunities for the development of multiple forms of retail

Connect:
Providing a direct relationship between urban & production areas

Centralized:
Depend on 2 Waste management facilities for the whole region.

Lack of Diversity:
Purchasing options are Food waste often ends up being incinerated.

Disconnected:
Limited connections to sustainable alternatives to deal with food waste.

GOALS

1 Our goal is to create more resiliency and awareness within the food system
2 We want to decentralize and redistribute power of stakeholders and resources
3 We want to diversify and provide multiple possibilities and alternatives within production, retail and waste management
4 In addition we want to connect and optimize physical (built environment) and non-physical networks (digital networks and infrastructure)
5 Sustainability (&circularity)

CONSUMPTION

END OF LIFE

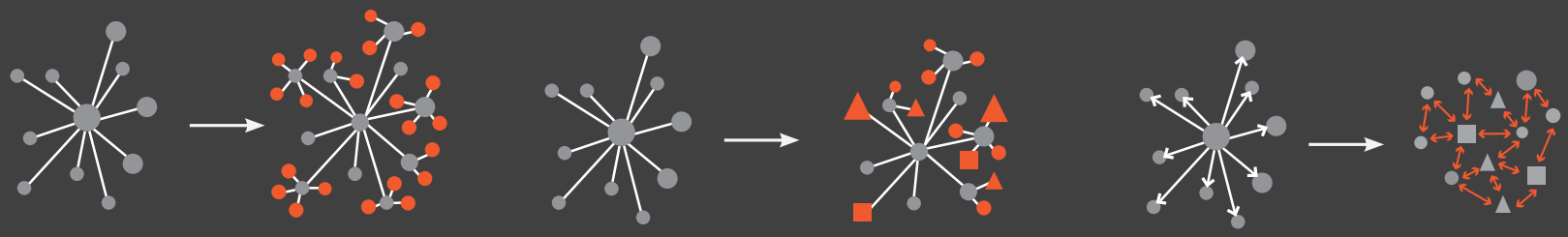
Decentralize:
Increasing exposure and assisting in the growth of sustainable waste management facilities

Diversify:
Supporting existing sustainable waste management facilities and creating opportunities for the development of multiple sustainable waste management

Connect:
Closing the loop between produced waste and food production activities

Food Island emphasizes three key aspects the food system: production, retail and end of life. To condense our research, these three components were selected because they showed the greatest vulnerabilities within the existing food system of the AMA. Key to our research is the argument that the food system is currently unresilient and it is evident in the evaluation and analysis. Three connecting themes emphasized the un-resilient factors of each aspect through centralized systems, lack of diversity and disconnection within the food system.

03.2 CONCEPTUAL FRAMEWORK



DECENTRALIZE

- **P** Creating and improving the networks of food production and transportation.
- **R** Increasing exposure and facilitating growth of small scale retail to increase their competitiveness.
- **E** Increasing exposure and assisting in the growth of sustainable waste management facilities.

DIVERSIFY

- **P** Strategically placing innovative & sustainable new forms of food production.
- **R** Supporting existing small scale retail (with low market share) and creating opportunities for the development of multiple forms of retail.
- **E** Supporting existing sustainable waste management facilities and creating opportunities for the development of multiple sustainable waste management.

CONNECT

- **P** Enhancing the relationship between agricultural areas in the whole region.
- **R** Providing a direct relationship between urban & production areas.
- **E** Closing the loop between produced waste and food production activities.

Centralized Vs. Decentralized

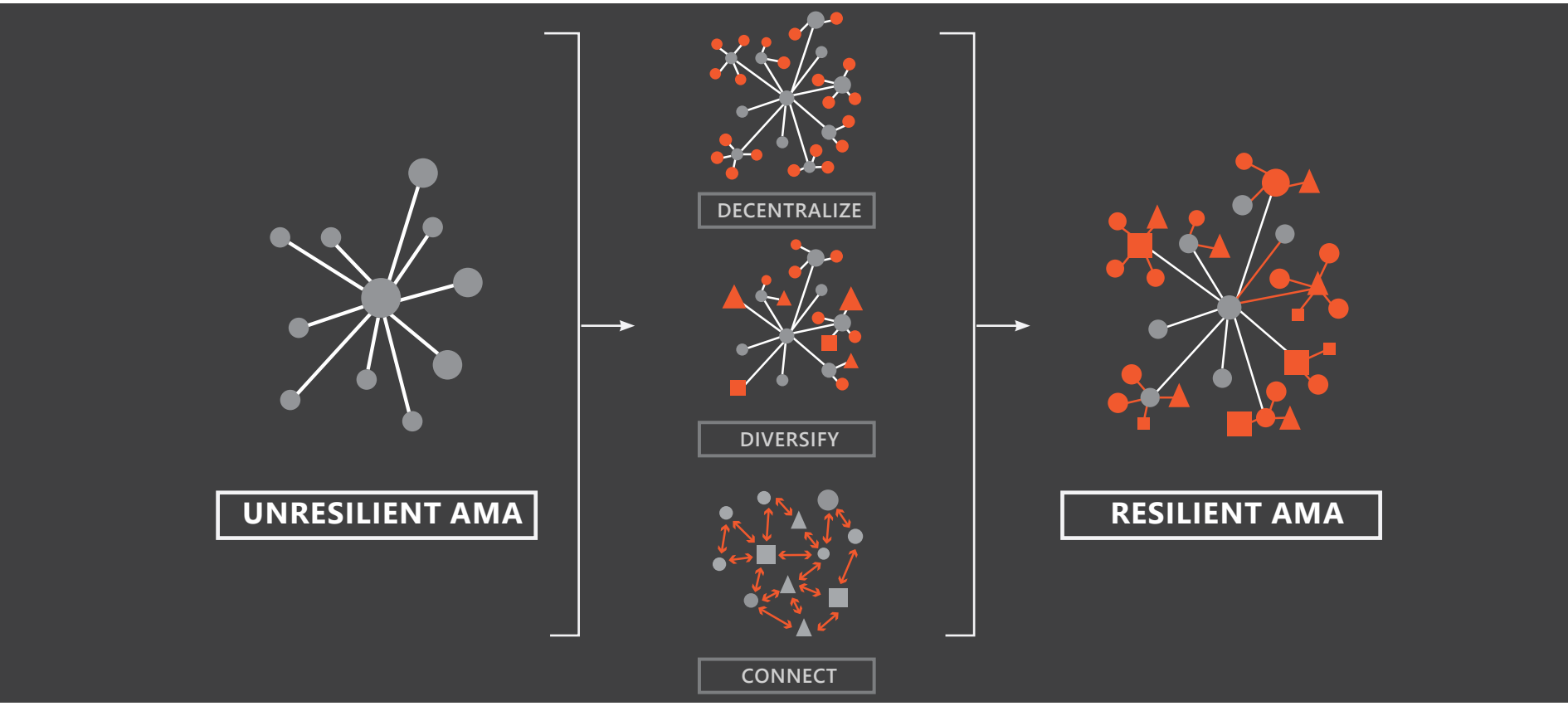
In a centralized organizational structure, decision-making authority is concentrated at the top, and only a few people are responsible for making decisions and creating the organization's policies. For example, a central controller exercises control over lower-level components of the system directly or through the use of a power hierarchy. However, in a decentralized organization, authority is delegated to all levels of management and throughout the organization. The main advantage of decentralization is faster decision making, an ability to adapt and can serve a more localized community independently in a wider network. In contrast to a centralized system, there is more of a distribution of control and each component of the system is equally responsible (Saharidis, 2011).

Diversify

In a diverse system, regions need to take advantage of multi-disciplinary systems and services such as transportation networks. These offer a variety of modes and pathway systems such that if one option is critically impacted or disrupted, another form can be used. As the City Resilience Index (2016) describes, "there is a requirement for a presence of multiple ways to achieve a given need or fulfillment of a particular function". (p.7) As one of the main strategies to create resilience, regions need to construct a built-in diverse and flexible network. In diversifying systems (variety of sustainable forms of retail, production and waste management) it is important to invest in further research and innovation to stimulate growth and create opportunity for further robustness in the system.

Connect

The concept of connections is closely tied to other resilience indicators as well as establishing relationships with each aspect of the food chain. Several resilience aspects includes creating inclusive approaches where local stakeholders and communities work together to build city and regional resilience, coordination between systems, learning capacity and integration across different scales of operation. "Exchange of information between systems enables them to function collectively and respond rapidly through shorter feedback loops" (City Resilience Index 2016, p. 7). Another important note about connecting systems is closing and shortening loops between urban and agricultural systems.



Unresilient to Resilient

The above concept diagram showcases three primary strategies: decentralize, div ersify and connect to create a resilient AMA.

03.3.1 OPPORTUNITIES

Research Method for Strategies

The three main proposed strategies are: decentralizing, diversifying and connecting. Each strategy will require looking into spatial opportunities that involves the three most important and influential aspects within the food system (production, retail and end of life). We set up an analysis framework to map the opportunities for each strategy, see also figure on the right.

Decentralizing:

Scenario planning (explained in Ch.2 Spatial Framework) was the main tool utilized in order to understand feasibility and the amount of stakeholders that will be required to be decentralized in the AMA. For each aspect, we experimented with different ratios to visualize what the spatial implications would be. For example, a 100% self-sufficient food production sounds good, but does it actually fit within the region? How much do we consume and how much space does that take?

Diversification:

In order to know what areas require more diverse sustainable options, we worked with weather mapping. This showcases existing stakeholders and highlights opportunity areas. For example: a 15 minute walk (radius) to a major train station would be a good place to place new retail to accompany transit oriented development.

Connecting:

In order to connect actors within the food system with each other, we map opportunities on a regional, city and local scale, within the current infrastructural network and its nodes. For example, If we want to distribute and trade local production over water, what current and new networks should be used and what new harbours could we propose?

Projects and Partnerships:

A series of new and sustainable alternative projects that could be implemented within these opportunity areas are outlined in a chart. These projects are categorized according to the conditions that we found within each three strategies. In addition these projects are also defined by certain policy characteristics and along with these projects, the interest and support of stakeholders are determined. The stakeholder diagram highlights the current stakeholders, who needs to be empowered and the specific stakeholders that need to be persuaded with a series of incentives and policies.

METHOD

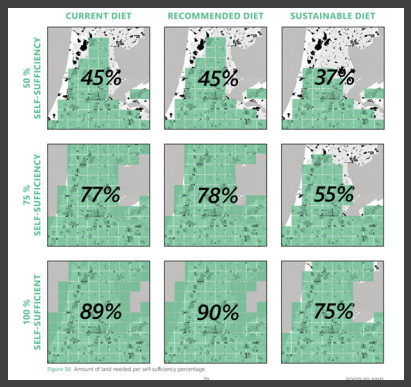
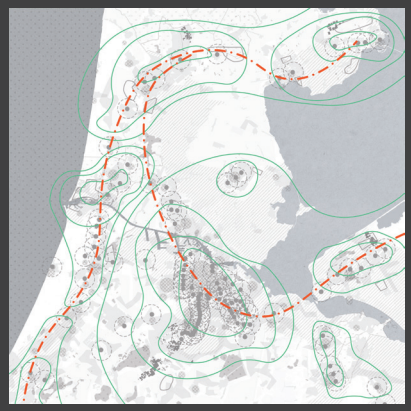
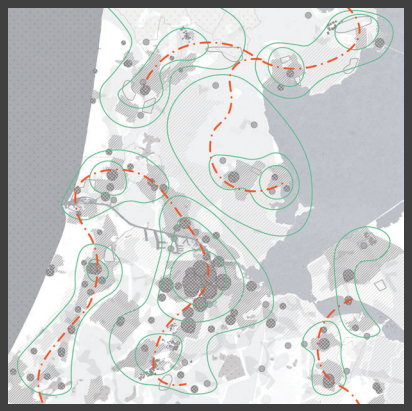
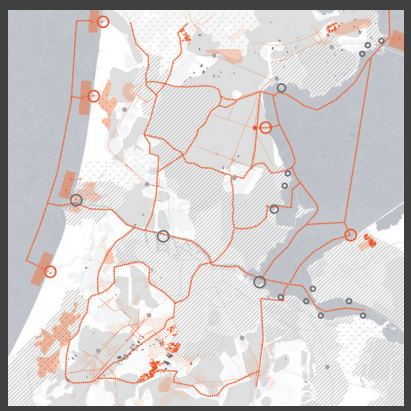
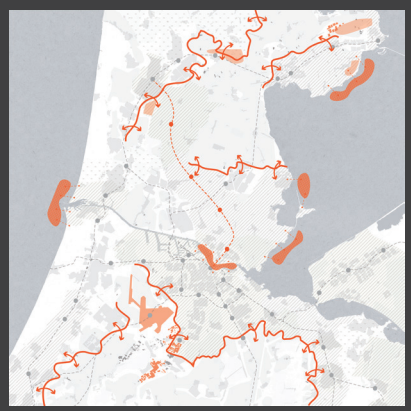
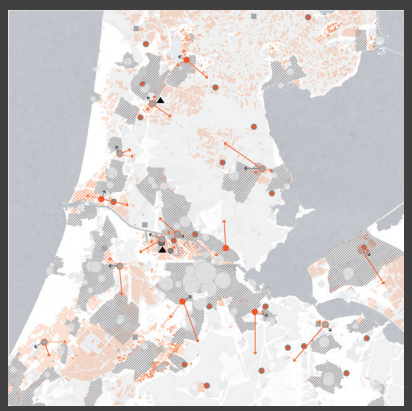
	PRODUCTION	RETAIL	END OF LIFE
DECENTRALIZE RATIOS & SCENARIO PLANNING			
DIVERSIFYING WEATHERMAPS			
CONNECTING RELATIONSHIP MAPS			

Figure 60 Overview of methods used to find opportunities to implement Food Island's strategies in the AMA

03.3.2 DECENTRALIZING PRODUCTION

How much is needed to produce self-suffienctly in the AMA?

Currently, we are highly dependent on the import of food and two points of trade. If the AMA was cut off from the rest of the world and was required to produce everything within the region, there would be severe problems within the food system. First, local production is not enough to sustain all inhabitants. There is also a lack of diversity within what is produced within the region. Thus, in order to see how much land the AMA would require to serve the population, three different scenarios were established in order to evaluate different levels of self-sufficiency.

To compare the land requirements, the existing Dutch diet (PBL, 2016) was the starting point to evaluate how much surface is required to feed the current population based on their needs. This was then compared to the existing production of crops within the region. This raised the question, *How close or how far is the AMA to reach the goal of self-sufficiency?* Secondly, the government has already established a so called 'recommended diet' (source). This diet envisions a healthy population, but is it realistic to be entirely self-sufficient within this recommended diet?

Conclusion

It is impossible to be entirely self-sufficient with both the current as the recommended diet. It would require using all available space within the region, including all public spaces and water bodies. We would also need to reconsider our flourishing horticulture business and replace Schiphol with crop production. This means that in order to be more self-sufficient, we have to change people's behaviour and diet. We created a new model: the ideal diet, which showcases the impact of a more sustainable diet.

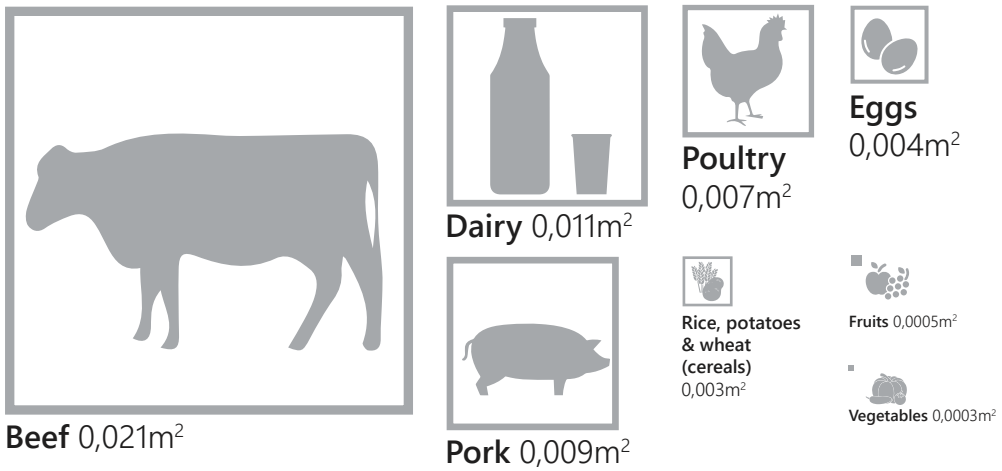


Figure 61 Land (m^2) per food (g) per year to feed the population in the AMA in 2040 (Kastner et. al, 2012, Gerbens-Leenes, 1999)

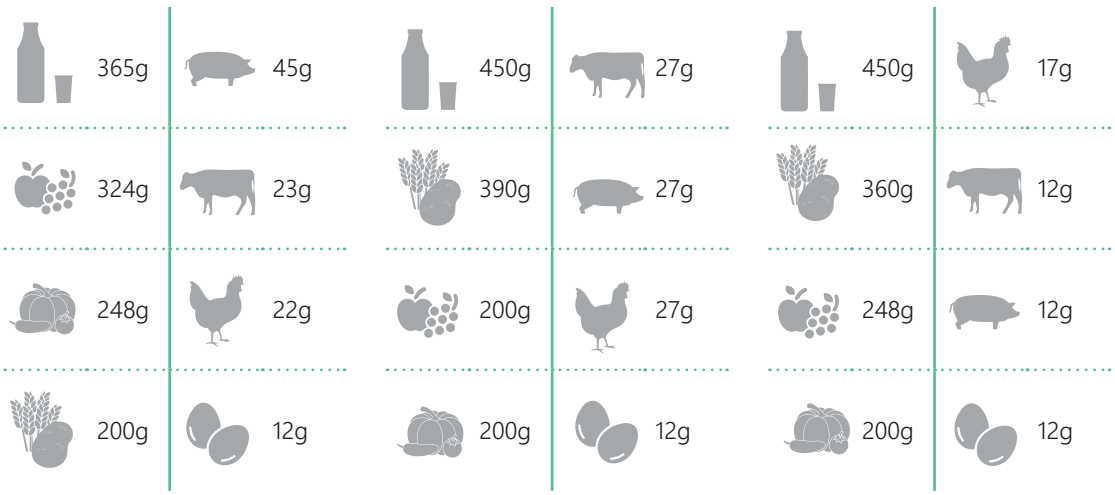


Figure 62 Consuming amount (g) within different diets (PBL, 2012, 2017, Voedingscentrum, 1998)

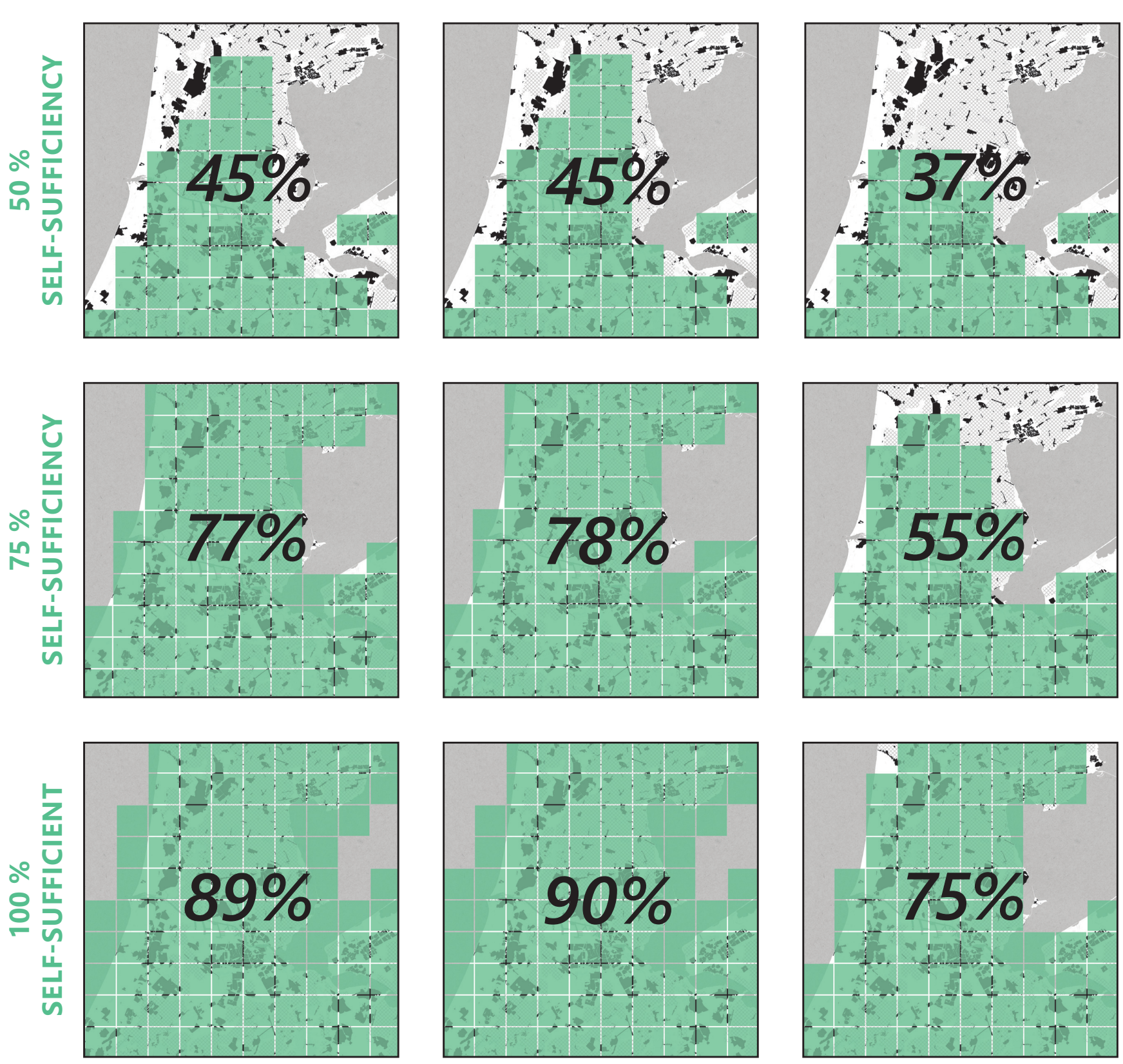
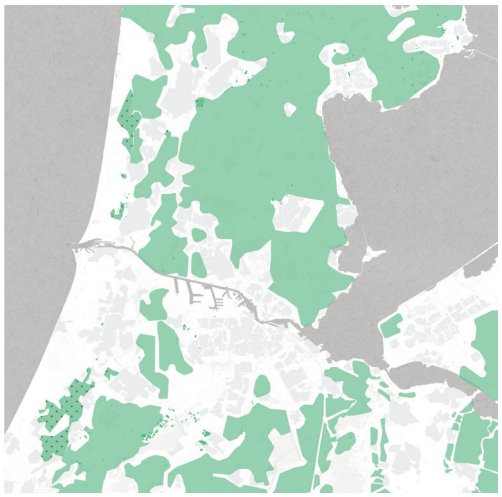


Figure 63 Amount of land needed per self-sufficiency percentage

03.3.2 DIVERSIFYING PRODUCTION

Spatial Conditions

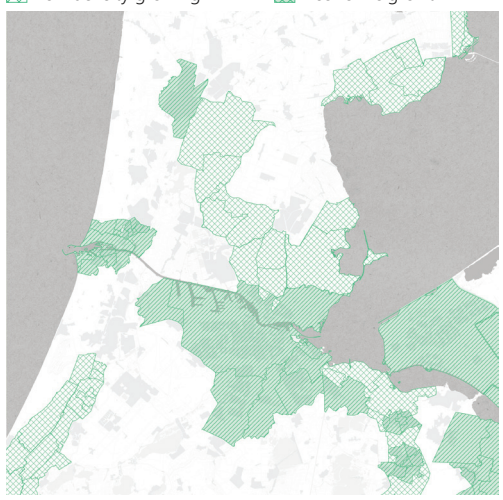
Food production areas (greenhouses, grazing lands, cropland)
Horticulture (flower production)



Existing Agriculture

The AMA heavily depends on existing local agricultural production areas. In a more self-sufficient economy, these areas can be used to diversify food production.

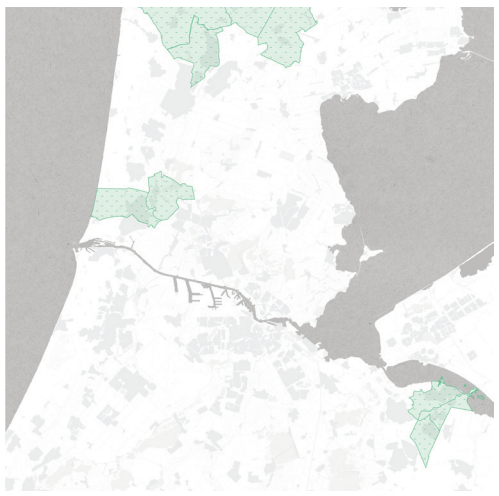
Medium density growing, high density in remain
Low density growing
Economic growth



Growing area

These potential areas can be used to place food production within a higher dense urban environment. For example: urban gardening.

Low density shrinking



Low Density & Shrinking Urban Areas

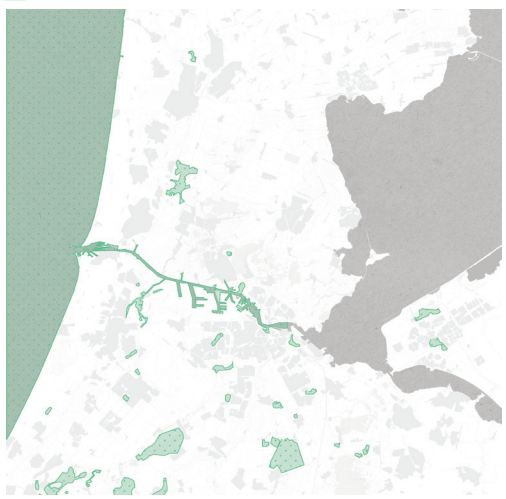
Within these areas, certain (other) agro-food production can added which are the same time beneficial for the area.

Empty sites
Polluted areas
Underutilized greenhouses

Wastescapes

These contaminated, abandoned or underutilized lands have the potential to be remediated and repurposed for innovative agricultural production, such as algae production.

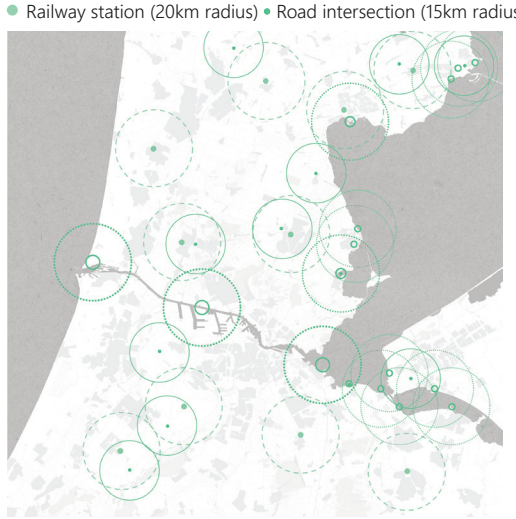
Water bodies



Water bodies

On these large waterbodies new types of production on water can be added.

Harbour/port (20km radius)
Railway station (20km radius)
Road intersection (15km radius)



Transportation

Water, rail and road transportation nodes are key places in placing new production, since it then easier to connect them with eachother to create a dense network of facilities.


High concentration area
Flow

03.3.2 CONNECTING PRODUCTION

Connected trading

The AMA highly depends on Schiphol Airport and the port of Amsterdam as trading mainports. However, in order to be more resilient, other connections need to be explored and existing connections have to be improved. Within production, this concerns the transportation and distribution of certain foods to other areas, specifically where they lack certain types of products. In this case, transportation over water is a great opportunity to increase trade within the region. There are a lot of existing harbours and waterways, but they aren't used to their full potential. Existing production areas near these connection nodes need to be enhanced and new agricultural lands should be strategically placed adjacent to existing and proposed transportation nodes.

LEGEND


Growing urban areas with diversified production


Shrinking urban areas with diversified production


Diversified existing production areas (greenhouses, grazing areas, cropland)


Production on existing horticulture (flower production)


Production on waste scapes (Empty sites, Underutilized greenhouses, Polluted land)


Production on water; connected with retail and transport

Production trade over water on existing network

Important production trade over water on existing network


Existing harbour for production trade

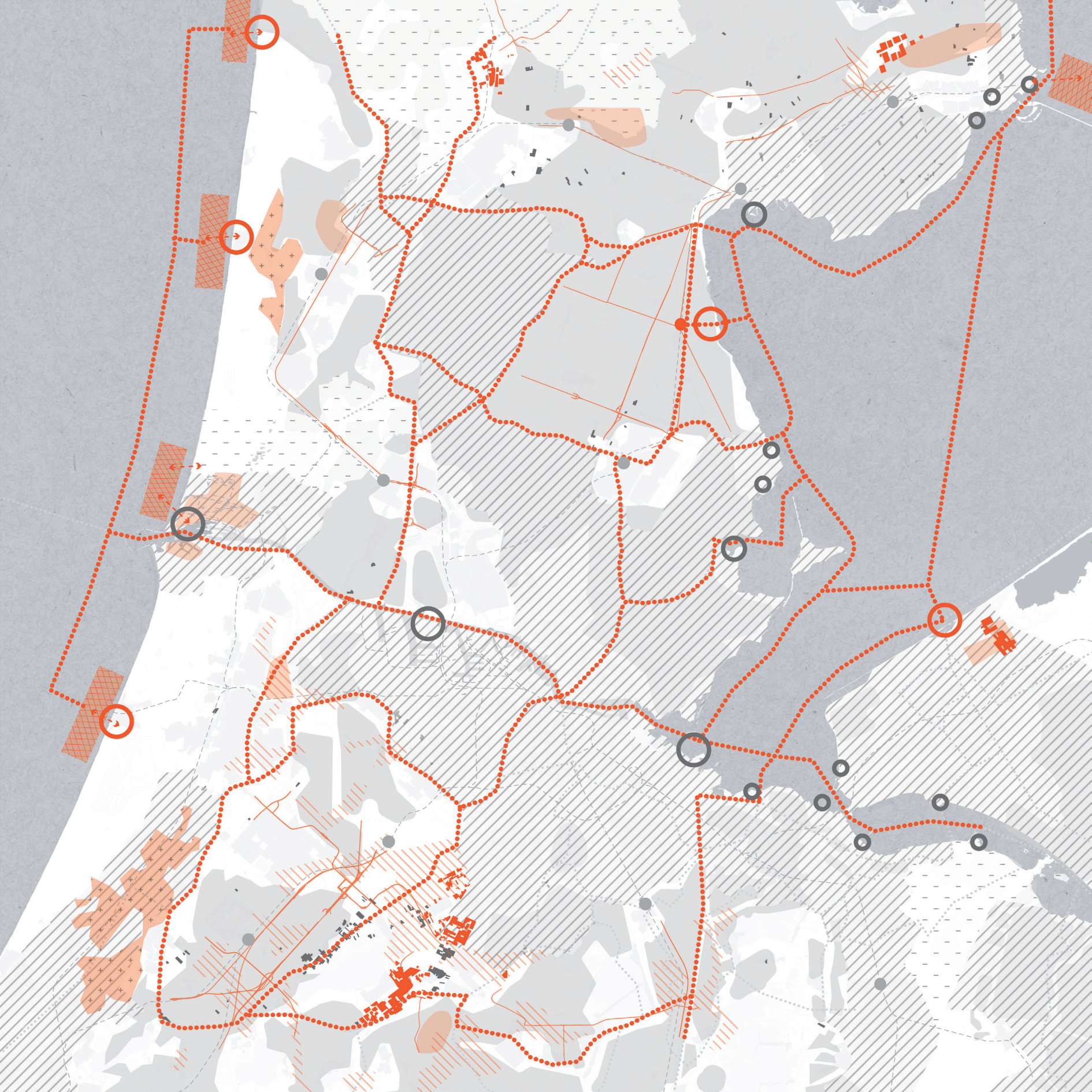

Proposed harbour for production trade

Existing railway for production transportation


Existing railway station for production trade


Proposed railway station for production trade

Important road transportation on existing network



03.3.2 PRODUCTION: PROJECT OPPORTUNITIES

	CONDITION	SCALE	PROJECT	OBJECTIVE	STRATEGIES	POLICY STRATEGIES
SPATIAL	Existing Agriculture	Regional	Diversified Agriculture	Increasing variation by crop rotation and diverse yields	DI DE	3,4,5,6
		Regional	Reduce and utilized horticulture (flower production)	Increasing production on existing horticulture	DI DE	3, 5, 6
	Growing area, high density area	City	Edible Parks	Increasing production by utilizing public space	DI DE	1,2,3,6
		Local	Urban/Vertical Farming	Increasing production into public areas	DI DE CO	1, 2, 3
		City	Algae Farming	Increasing variation with alternative protein production	DI DE CO	3, 4, 5, 6
		City	Aquaponics	Increasing production with reduction of water use	DI DE CO	3, 4, 5, 6
	Low density, shrinking Urban Areas	Local	Community Gardens	Connecting the community with food production	DI DE CO	1, 2, 3
		City	Seed Valley	Increasing variation with innovation and research in agri-food industry	DI DE CO	2, 3, 4, 5
		City	Algae Farming	Increasing variation with alternative protein production	DI DE CO	3, 4, 5, 6
	Wastescapes	City	Remodel Greenhouses	Increasing production in underused greenhouses	DI DE CO	2, 3, 5
		Regional	Remediating Land	Increasing production by using remediated land	DI DE	3, 4, 5, 6
		Regional	Algae Farming	Increasing variation with alternative protein production	DI DE CO	3, 4, 5, 6
		Regional	Aquaponics	Increasing production with reduction of water use	DI DE CO	3, 4, 5, 6
	Waterbodies	Regional/city	Floating Farms	Increasing production on water (cows or crops & fish)	DI DE	2, 4, 5, 6
	Transportation	Regional	Harbours	Connecting production	DI DE CO	3, 4, 5 , 6
		Regional	Railway Stations	Connecting production	DI DE CO	3, 4, 5 , 6
NON-SPATIAL	Online Development	Regional	Production Internet/ App Develpment	Connecting local food production by on-line tracking and organizing	DI DE CO	1, 5
	Importing goods	Regional	Sustainable Goods	Regulating dependency on imported goods	DI DE CO	5

DE Decentralize
DI Diversify
CO Connect

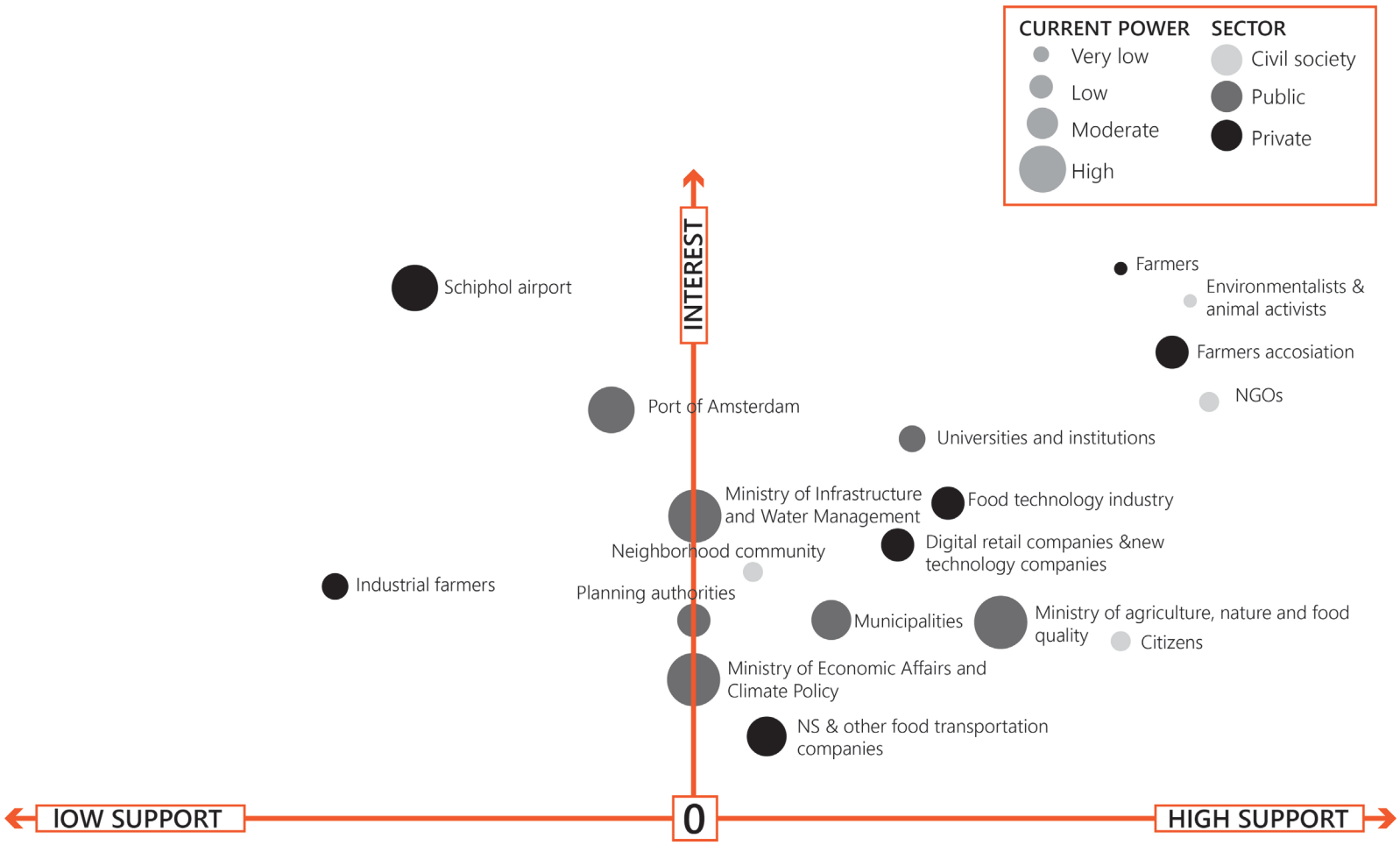
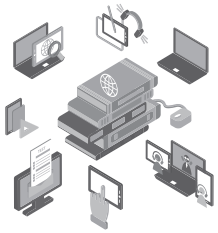


Figure 64 Existing stakeholders' interest and support within production

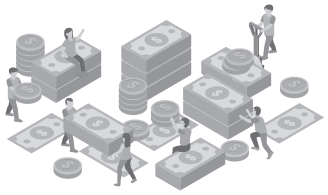
1. Public Participation Policies

Contents of these policies involve the contributions of the community in achieving its service delivery, developmental and strategic objectives.



2. Educational Policies

These policies consist of principles that involve the educational sphere and operation of education systems and institutions.

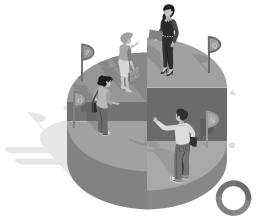


3. Subsidy Policies

This pertains to project that require financial aid or support to an economic sector (ie. business, NGO), these can come in grants or tax-breaks.

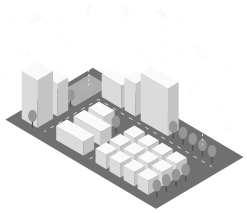
4. Tax and Restriction Policies

Governments will have a choice on selecting which taxes to levy and the amount of impact that can affect businesses or individuals. These will be used to limit as well as create economic efficiency.



5. Regulation Policies

Regulations will be used to impose restrictions and manage complex systems. This would involve certifications, market regulation, or a set of common goals ie. pollution, prices of goods and etc.



6. Integration Into Urban Plans

Some projects require to be implemented into urban plans, guidelines and policies. These are primarily for large infrastructural projects.

03.3.3 DECENTRALIZING RETAIL

Currently, a handful of large supermarket businesses are dominating the retail market with 77% of market share. Consequently, as a growing trend, more consumers are shopping at grocery stores and smaller retailers are shrinking. But how can we replace these dominating stakeholders and what does that mean for our spatial environment? To test this out, we have created 3 scenarios that play with the market share of these retail businesses. Each scenario considers the decrease in the supermarket share and how that would influence the amount of new stores required within each new option (based on adding to existing market shares). In order to decentralize market share, the proposed options enable consumers to have a more diverse set of choices. This also includes a more direct link from production to consumer to raise awareness.

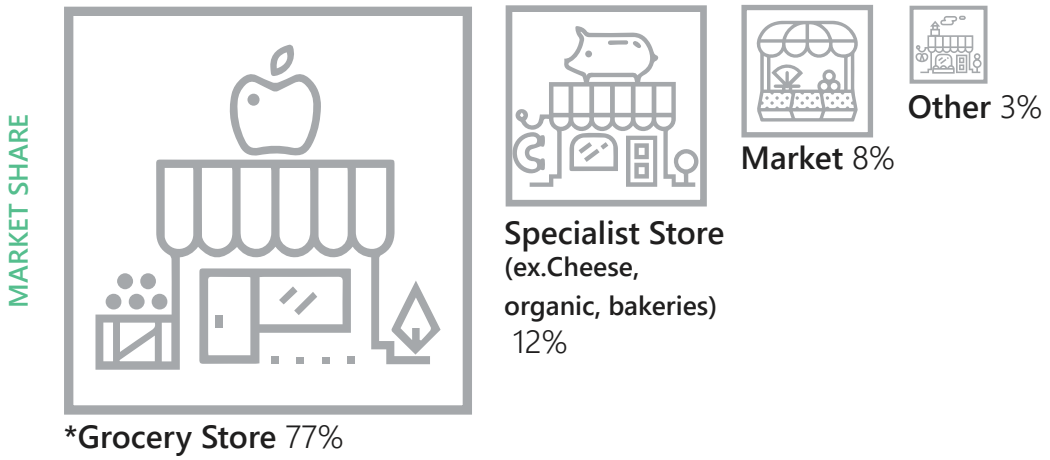


Figure 65 Dutch Retail Market share in the food industry (Food for thought, 2012, Statistics Netherlands)

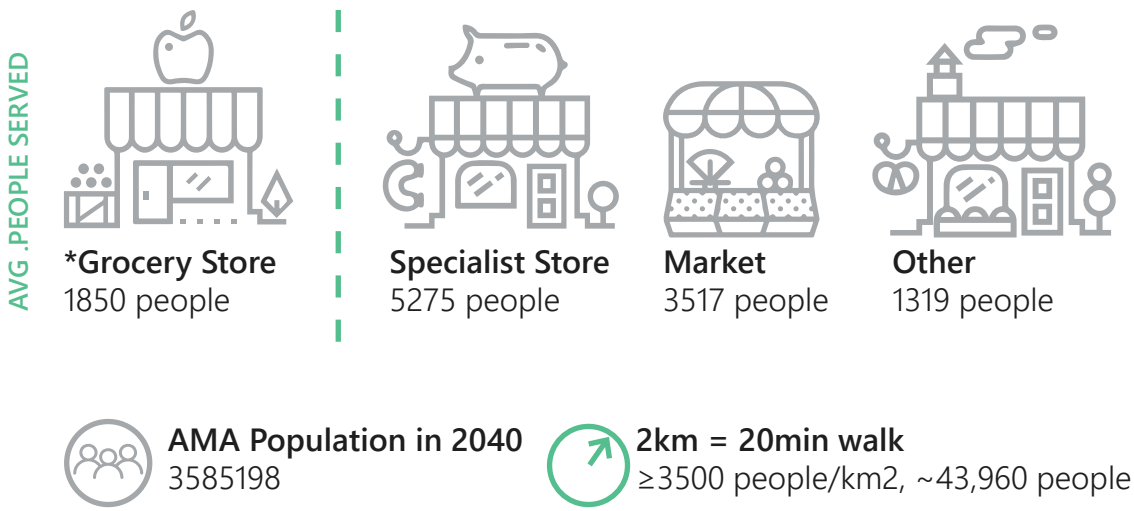


Figure 66 People served on average by store. An average grocery store serves 1850 people (Towards a Food Policy, 2014). However, the other stores are calculated based on a ratio of people living within a 2km radius of a densified area(≥3500/km2)

Conclusion

It is possible to place a variety of more sustainable and direct retail options. However, this does not necessarily mean that this option is feasible. People will inevitably still do their groceries at local supermarkets and other retail options don't have any economic incentive to start their business. Another unrealistic issue is the amount of options that need to be placed if market share decreases significantly. For example, having street markets at every street and square and farmers stalls every 200m would not be realistic, both organizational as planning wise.

So if you can't beat them, work with them.

Decreasing market share is still an important aspect within our vision but we do realize however, that large systems require slow changes. In the meantime, negotiations with supermarkets need to be made to increase awareness of the food system and local production. For example, having more organic and local produced food in supermarkets and also less processed and packaged food.

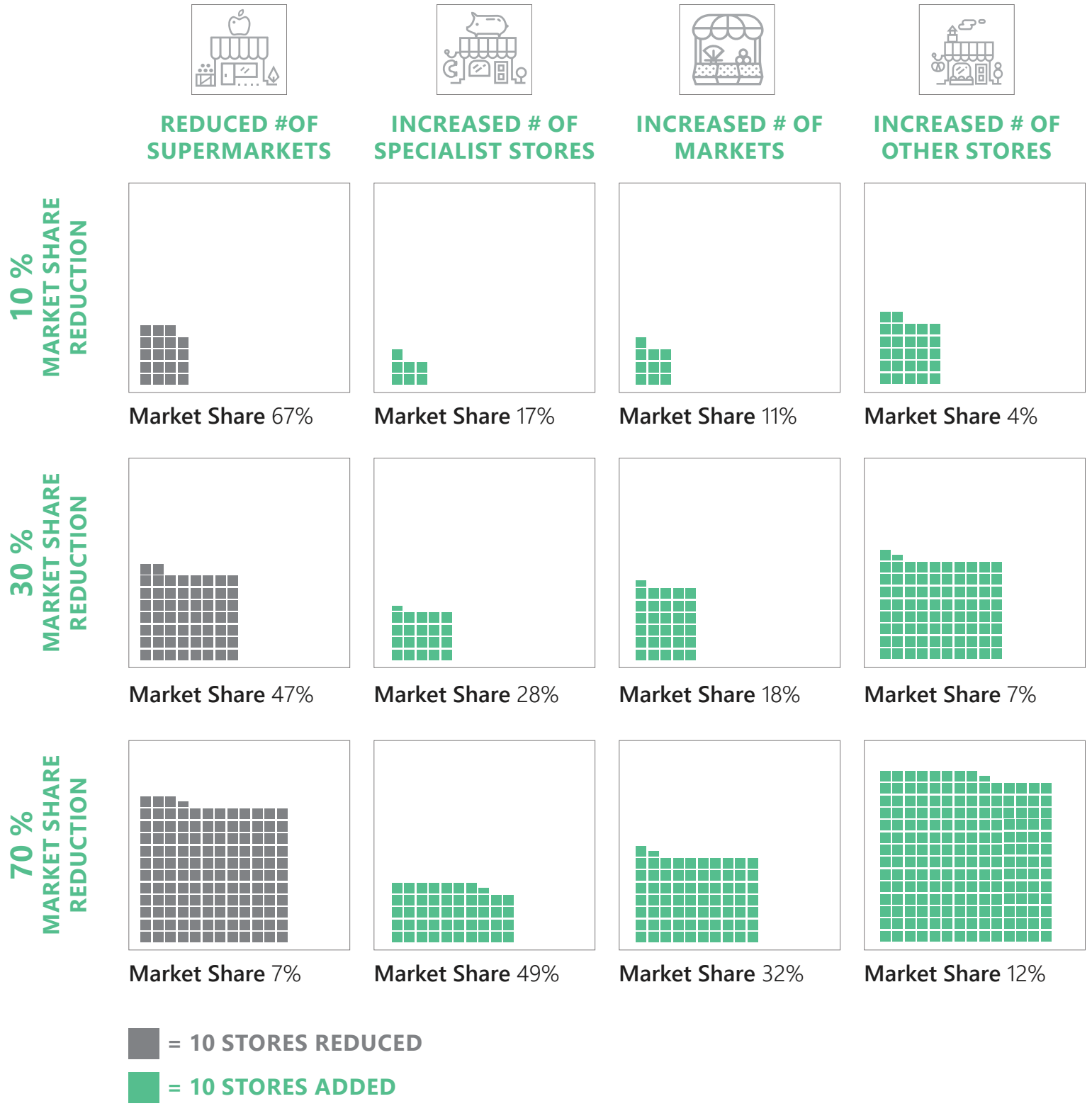


Figure 68 Amount of additional stores needed per retail type with the reduction of the supermarket's market share

03.3.3 DIVERSIFYING RETAIL

Spatial Conditions

Retail density

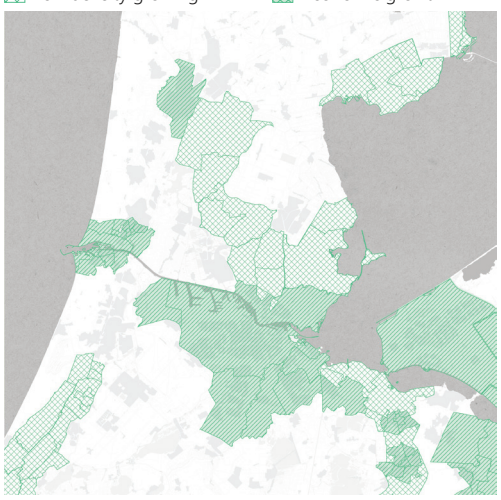
Existing Retail

The AMA is dominated by existing retail options, with more diverse market share and localized network, these facilities could also be diversified by selling local goods.

Medium density growing, high density in remain

Low density growing

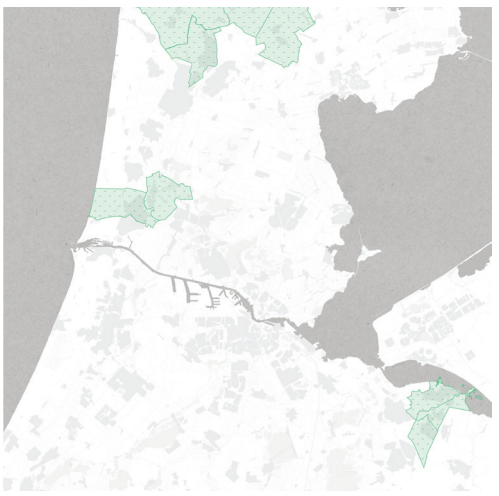
Economic growth



Growing Areas

These potential areas can be used to place new retail within an higher dense urban environments, such as specialized and organic stores.

Low density shrinking



Low Density & Shrinking Urban Areas

Within these areas, retail options which are at the same time beneficial for the area can be added. Predominantly, options that create a stronger connection with local production such as farmer stalls.

Empty sites

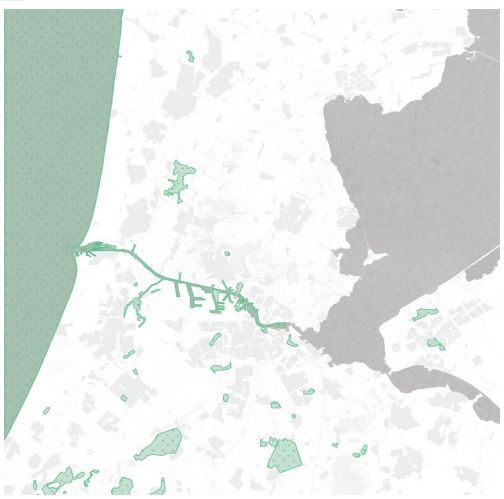
Polluted areas

Underutilized greenhouses

Wastescapes

These contaminated, abandoned or underutilized lands have the potential to be remediated and repurposed for innovative retail events and catering businesses, such greenhouse restaurants and food festivals.

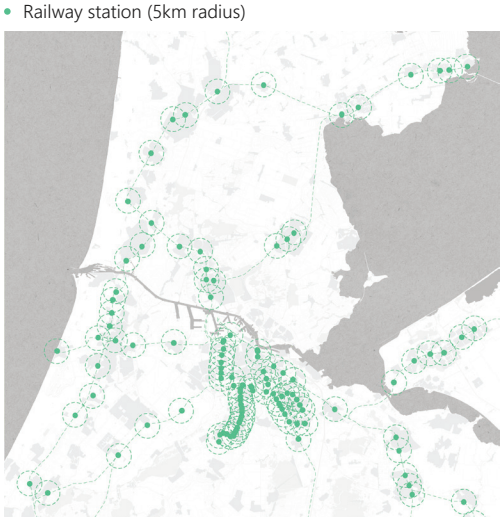
Water bodies



Water bodies

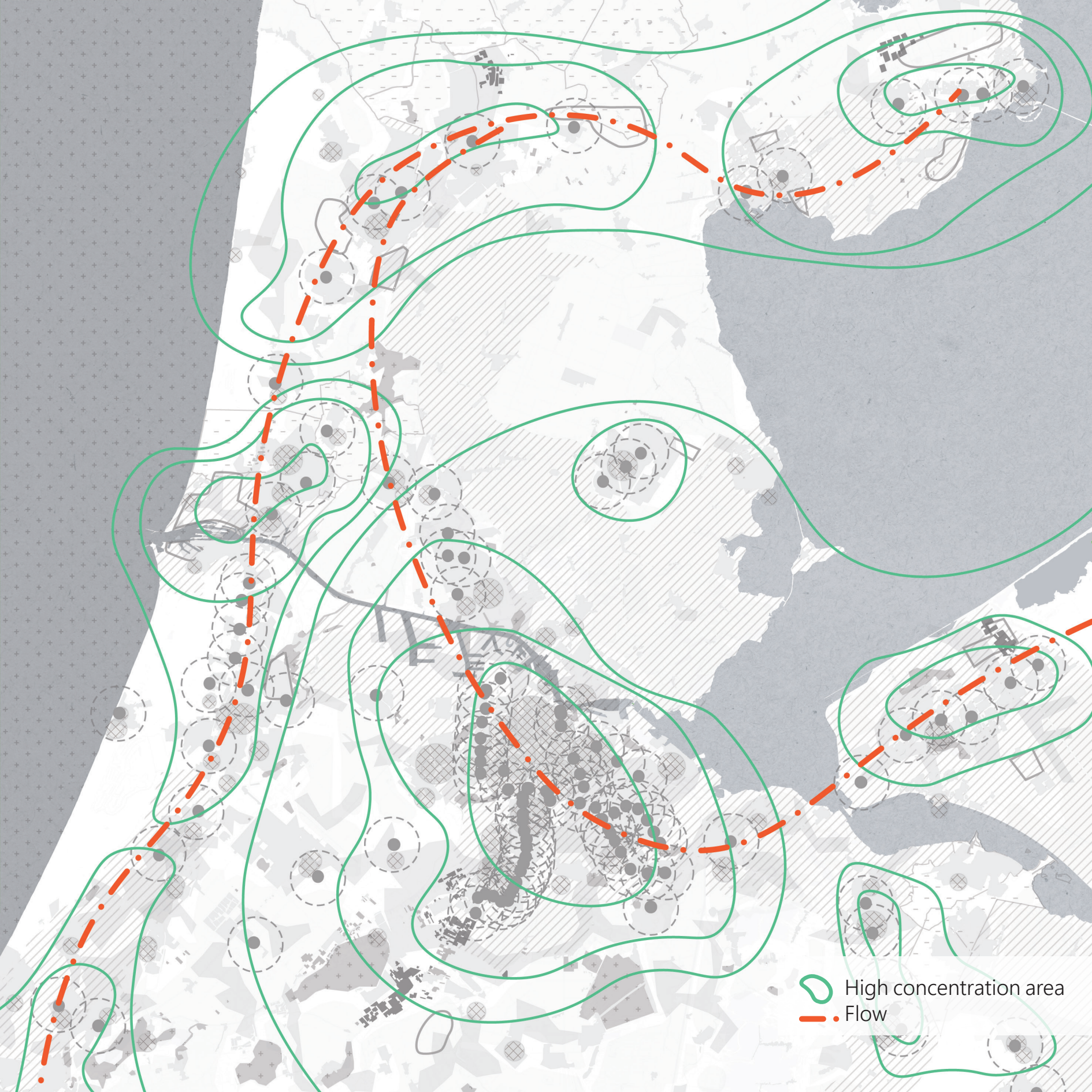
On and adjacent to these large waterbodies, retail can be placed to connected to water production.

Railway station (5km radius)



Transportation

Road transportation nodes are key places to place retail solutions. It can work together with Transport Oriented Design for the region. And creates another incentive to go to easy accessible localized retail options.


High concentration area
Flow

03.3.3 CONNECTING RETAIL

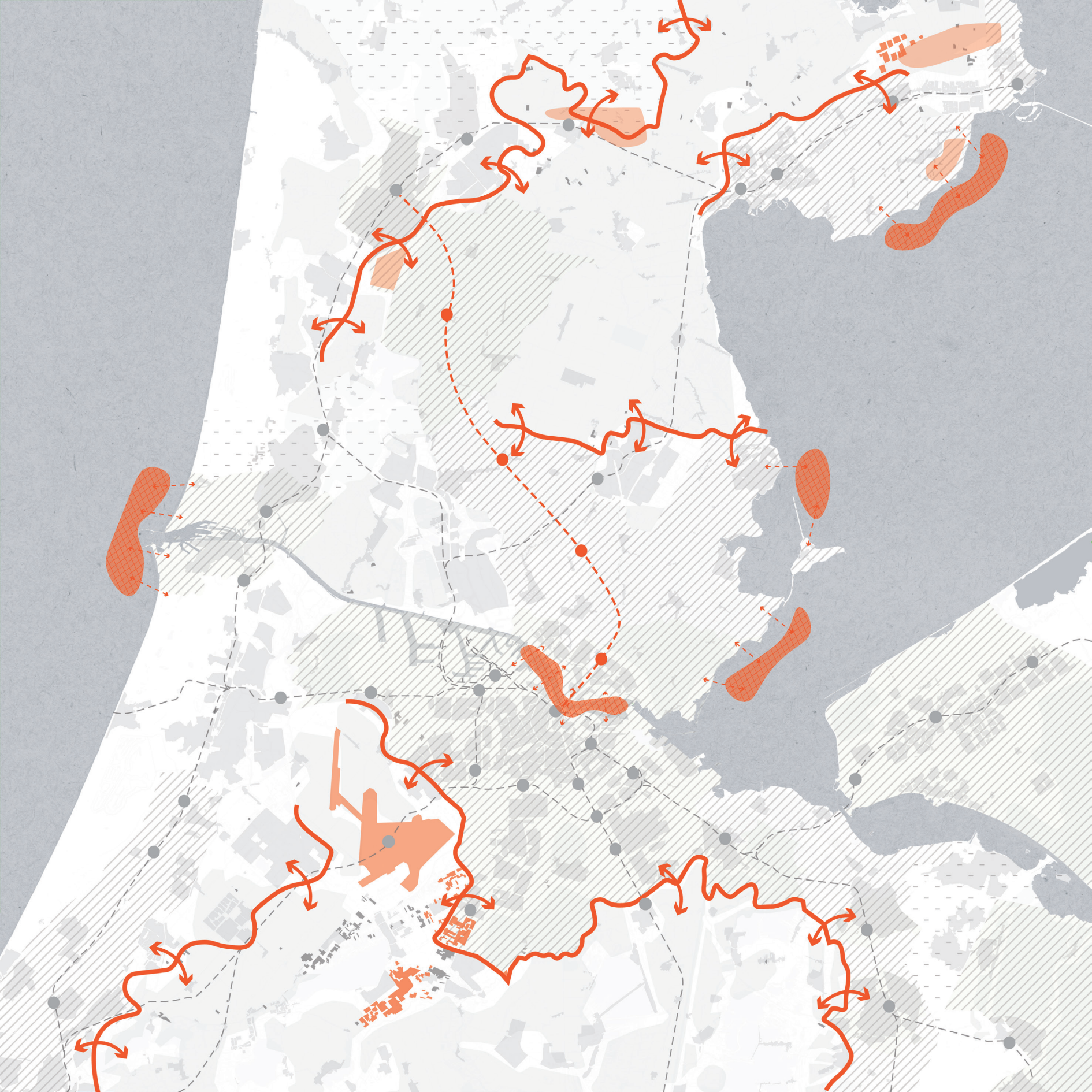
Shortened Network

The current chain is very long and highly vulnerable because of large dependencies within the food system. The aspect of connection is closely tied to establishing shortened and inclusive relationships. In the case of retail, there is a desire to create a closer connection between local production and consumers so that larger dependencies decreases. The integration of consumers within the system also increases awareness and learning capacity within the system. Local scaled connections, however, are difficult to assign and illustrate within a regional vision. Within the map, connection opportunities are made explicit by highlighting larger agricultural production areas and their adjacent residential areas. On a smaller, municipal scale there should then be an improvement in connection by placing more diverse, local and organic retail options on these borders.

Another important aspect within retail is Transit Oriented Development (TOD). Cities with a higher density require a different approach to make diverse retail solutions pliable. Local produce focused retail has to be easy accessible and approachable, This can work together with urban development around public transport nodes. New retail options should therefore be placed in a close proximity of these nodes (see also weather map within the previous chapter)

LEGEND

- Residential areas
- Growing urban areas with diversified retail
- Shrinking urban areas with diversified retail
- Current production areas (greenhouses, grazing areas, cropland)
- Proposed waste scapes for retail (empty sites, underused greenhouses)
- Retail on water; connected with urban area
- Border local production - urban areas
- Local scaled, low transportation connection
- Existing railway
- Proposed railway connection
- Existing important public transport stations (TOD)
- Proposed railway stations (TOD)



03.3.3 RETAIL: PROJECT OPPORTUNITIES

	CONDITION	SCALE	PROJECT	OBJECTIVE	STRATEGIES	POLICY STRATEGIES
SPATIAL	Existing Retail	Regional/city	Diversified retail	Connecting production and retail by selling local and less processed food	DI DE	4, 5, 6
	Medium/ high density growing, high density in remain Urban Areas	City	Specialized organic stores	Increasing variation with multiple specialized stores (greengrocery, butcher, cheese stores)	DI DE	4, 5, 6
		City	Indoor market	Connecting local production and retail with both selling and consuming options	DI DE CO	4, 5, 6
		City	Traditional street/square/ harbour market	Increasing variation with cheaper local products	DI DE CO	1,4, 5, 6
		City	Farmer stalls	Increasing variation and connecting local production and retail with easy accessible and cheaper road stalls	DI DE CO	1,3,4,5
		City	Local food delivery services	Connecting local production and retail with delivery service trend	DI DE CO	4, 5
		City	Ugly products store	Increasing variation by selling mismatched foods	DI DE	5
		Local	Smart vending machines	Connecting local production and retail with diet complemented foods	DI DE	3,4,5
	Low density, shrinking Urban Areas	City/Regional	Picking farms	Increasing connection and economy by using 'pickable' fruit and vegetables for locals and as a tourist attraction	DI DE CO	1, 2,5
		Local	Farmers stalls	Increasing variation and connecting local production and retail with easy accessible and cheaper road stalls	DI DE CO	1,3,4,5
		City	Traditional street/square market	Increasing variation with cheaper local products	DI DE CO	1,4, 5, 6
		City	Specialized organic stores	Increasing variation with multiple specialized stores	DI DE CO	4, 5, 6
	Wastescapes	Local	Greenhouse restaurant	Connecting production and retail by transforming underutilized greenhouses to restaurants with local produced food	DI DE CO	1,2,3,5
		Regional/city	Food festivals	Increasing variation and connection with re-using waste scapes for temporary food festivals	DI DE CO	1,2,3,5
	Water bodies	Local	Floating retail/catering	Increasing variation and connection with re-using waste scapes for temporary food festivals	DI DE CO	6
	Transportation	City	Infrastructural slow traffic transition between production and cities	Increasing connection by improving slow traffic connections and local produced retail on urban edges adjacent to production	DI DE CO	4, 5, 6
		Regional/city	Transit Oriented Retail Development	Adding new options near public transportation nodes to increase connectivity and economy	DI DE CO	5, 6
NON	Online Development	City	Retail Internet/App Develpment	Cheaper excess and local food	DI DE CO	1, 5

DE Decentralize
DI Diversify
CO Connect

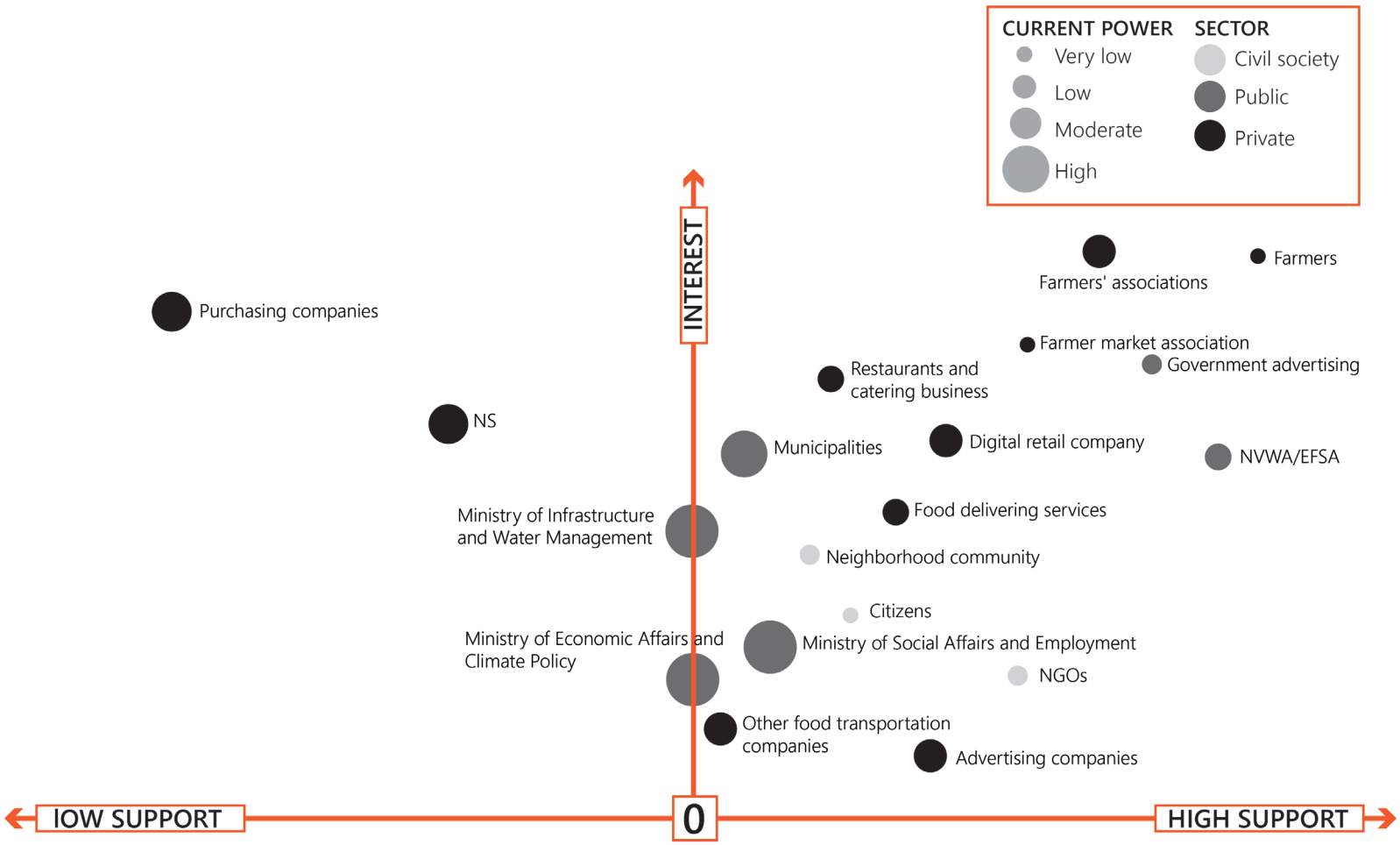
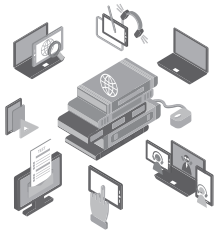


Figure 69 Existing stakeholders' interest and support within retail

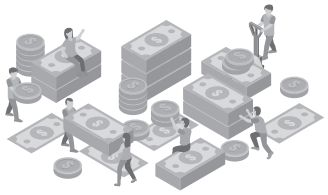
1. Public Participation Policies

Contents of these policies involve the contributions of the community in achieving its service delivery, developmental and strategic objectives.



2. Educational Policies

These policies consist of principles that involve the educational sphere and operation of education systems and institutions.

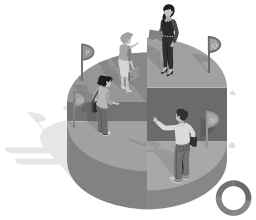


3. Subsidy Policies

This pertains to project that require financial aid or support to an economic sector (ie. business, NGO), these can come in grants or tax-breaks.

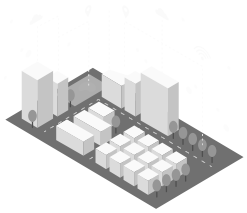
4. Tax and Restriction Policies

Governments will have a choice on selecting which taxes to levy and the amount of impact that can affect businesses or individuals. These will be used to limit as well as create economic efficiency.



5. Regulation Policies

Regulations will be used to impose restrictions and manage complex systems. This would involve certifications, market regulation, or a set of common goals ie. pollution, prices of goods and etc.



6. Integration Into Urban Plans

Some projects require to be implemented into urban plans, guidelines and policies. These are primarily for large infrastructural projects.

03.3.3 END OF LIFE: OPPORTUNITIES FOR DECENTRALIZING

At the moment, food waste is mainly being incinerated followed by composting, animal food, fermentation and a very small part is directed to landfills (see figure). The incinerators are predominatly fed by food waste from consumers as well as retail and other sources of food waste production already have a relatively sustainable food waste management. However, food waste is still a valuable resource to only be incinerated together with other waste streams. To look for other, more circular options of food waste management the 'ladder of Moerman' is consulted (Teuling, 2014). According to the 'ladder of Moerman' (see figure below) there is a hierarchy of sustainable food waste management. This is used to explore other options of food waste management which can be implemented spatially as well as with policies and regulations.

Conclusion

According to research from Wageningen University (2013), it is possible to reduce 20% of food waste from consumers. This would already imply a large reduction of incinerated food waste. There is not a large potential to use more food waste for animal food. Fermentation however, can be upscaled to meet a larger amount of food waste. Since the by-product of fermentation is compost both will have the same amount of facilities. In 2040 it would be reasonable to suggest that all current composting facilities are equipped with a fermentation facility as well as create 5 new fermentation/composting facilities within the area. This would create a reduction of around 50% of food waste incineration.

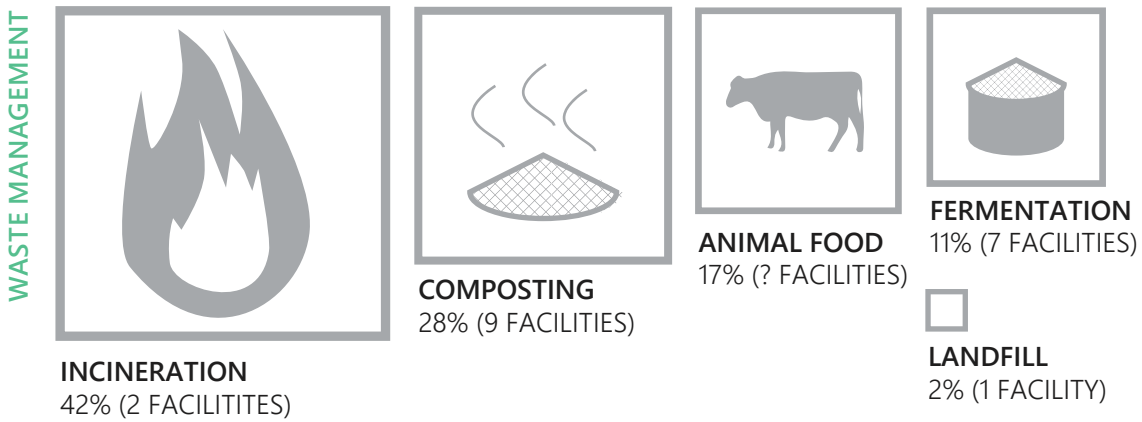


Figure 70 Amount of foodwaste (kg) from incineration that can be managed elsewhere (WUR, 2013)

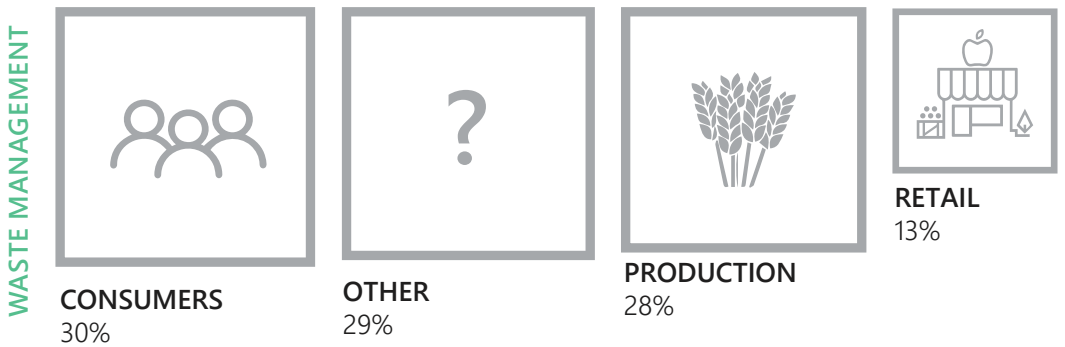


Figure 71 Dutch food waste producers (Teuling, 2014)

Figure 72 Food waste management ladder (Teuling, 2014)

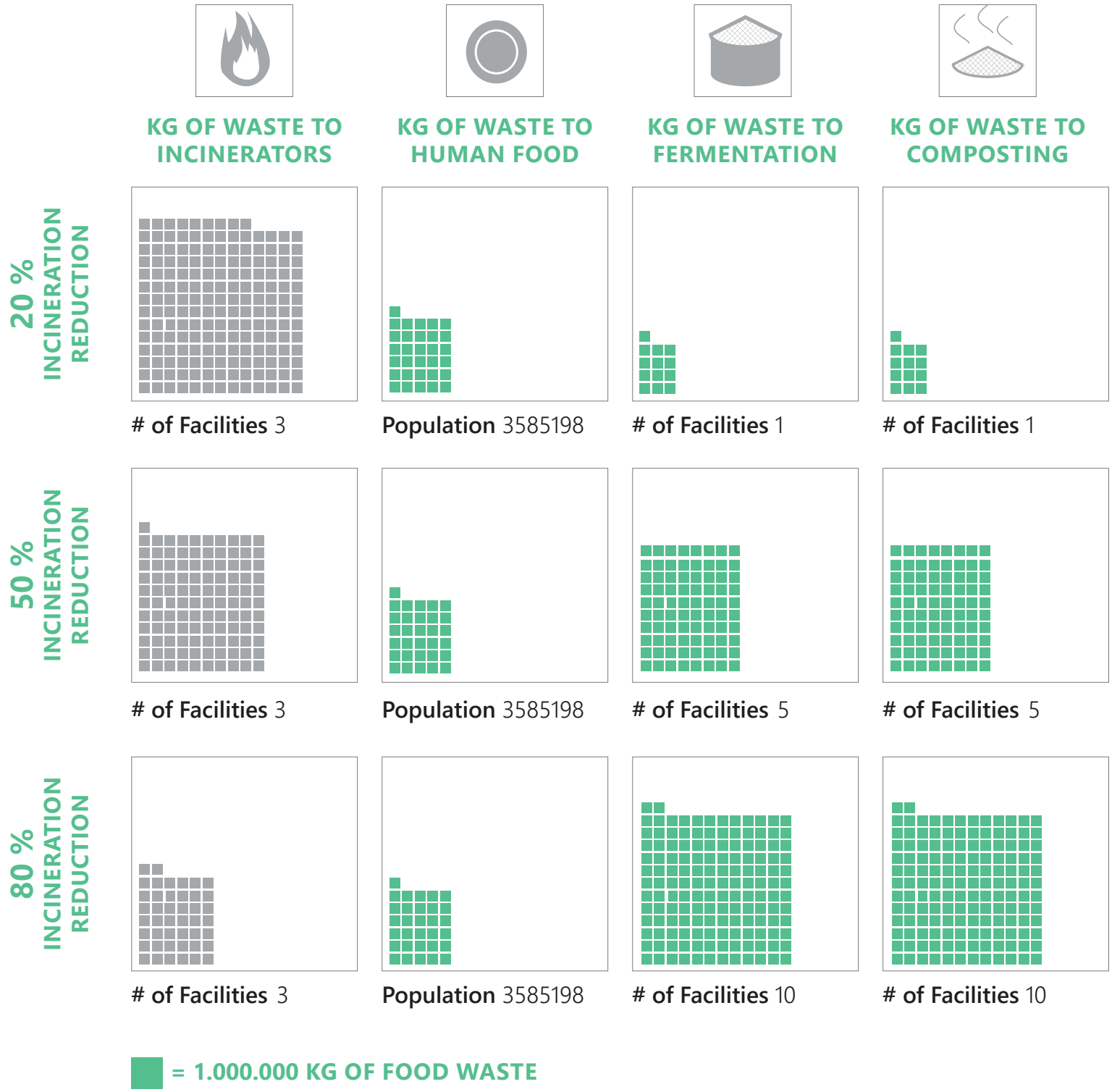
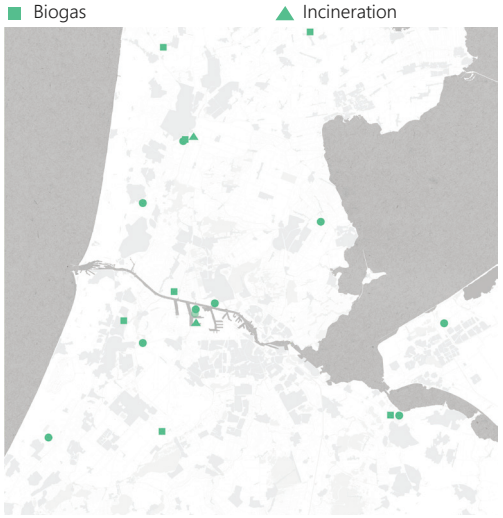


Figure 73 Amount of foodwaste (kg) from incineration that can be managed elsewhere

03.3.3 DIVERSIFYING END OF LIFE

Spatial Conditions

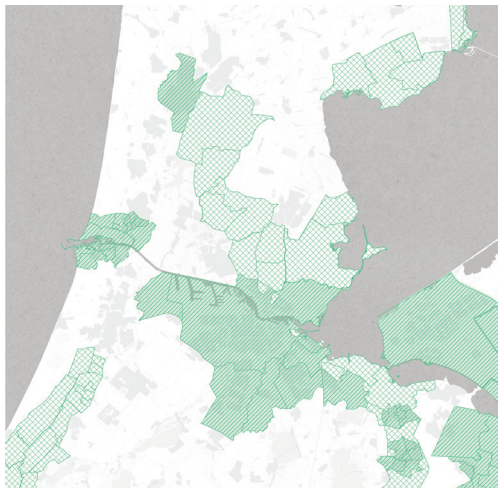
Composting
Biogas
Phosphorus
Incineration



Existing Waste Management Facilities

The AMA heavily depends on incinerating food waste. Other existing sustainable facilities can be empowered for diversified food waste management

Medium density growing, high density in remain
Low density growing
Economic growth



Growing Areas

These potential areas can be used to place innovative solutions to food waste separation and to create awareness.

Low density shrinking

Low Density & Shrinking Urban Areas

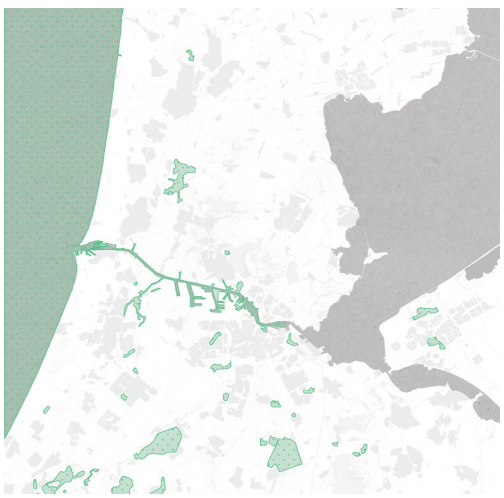
Within these locations, a larger connection with the input and output of food waste facilities can be implemented which is also beneficial for the area.

Empty sites
Polluted areas
Underutilized greenhouses

Wastescapes

Contaminated, abandoned or underutilized lands have the potential to have a better connection between food waste facilities and local production. Diverse options can be placed in these locations.

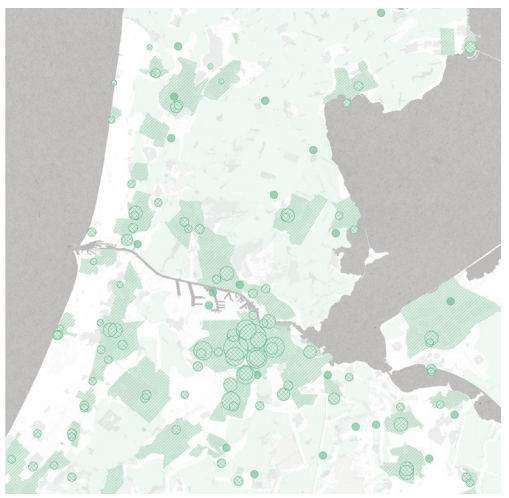
Water bodies



Water Bodies

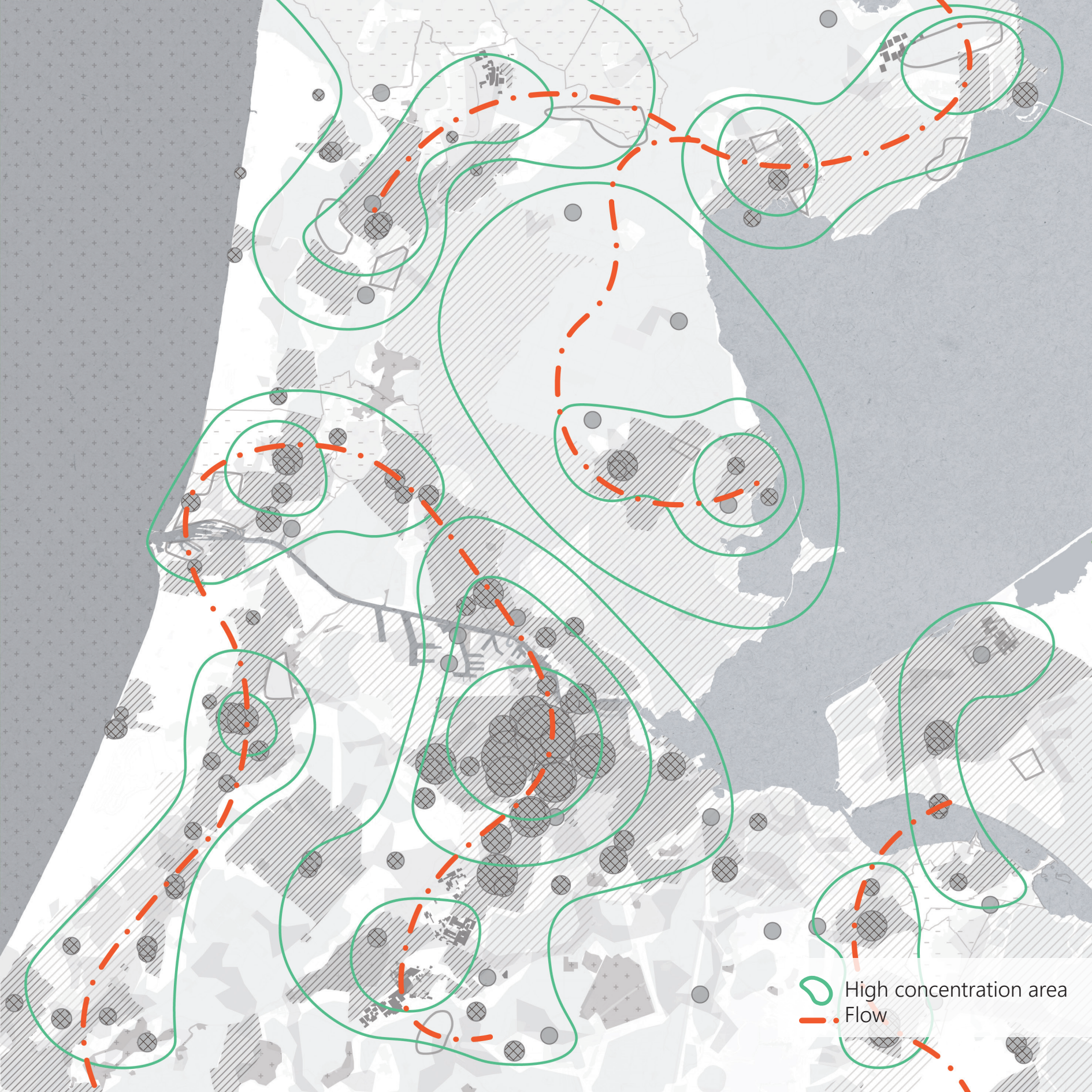
Production on water will inevitably mean more and new food waste. Areas adjacent to these water bodies can have new food waste management facilities.

High density household waste
Manure production
Retail food waste
RWZI (sewage treatment)



Transportation

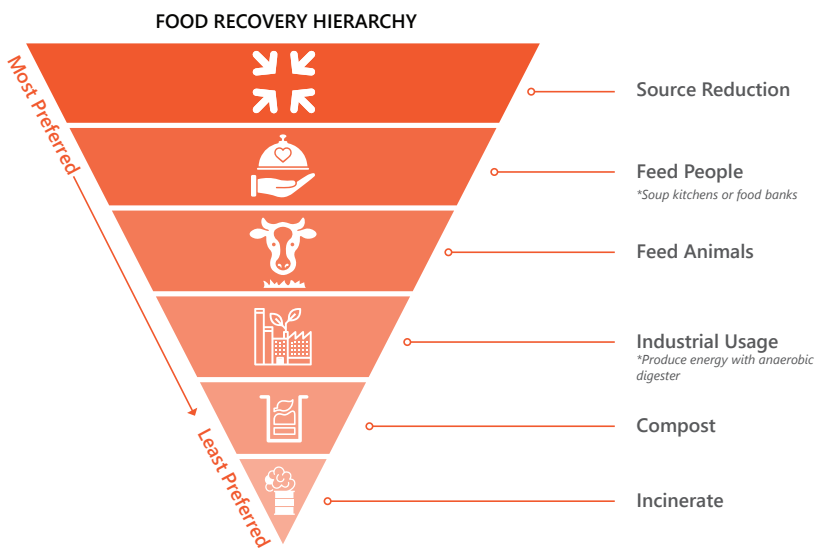
Transportation of food waste facilities lies in their location to the input of food waste. It is recommended to place new facilities and empower existing ones that are in close proximity to these areas. For example, biogas facilities should be placed near high density cities that produce a lot of household food waste.


High concentration area
Flow

03.3.4 CONNECTING END OF LIFE

Connective loops

An important note about connecting systems is to create a more resilient network that closes loops in multiple ways. Within waste management, connections are not so much about infrastructural connections but rather the connections that can be made with input and output of resources. Within the regional network of the AMA, there are two primary options to deal with food waste. The two sustainable options are composting and fermentation. To effectively deal with the waste, there needs to be strategic placements of facilities within close proximity to where their specific output can go. For example: biogas facilities produce energy from manure of agricultural areas which can be connected to new systems within developing residential areas. Therefore, the placement of new facilities should be in zones that transition from agricultural to residential areas.



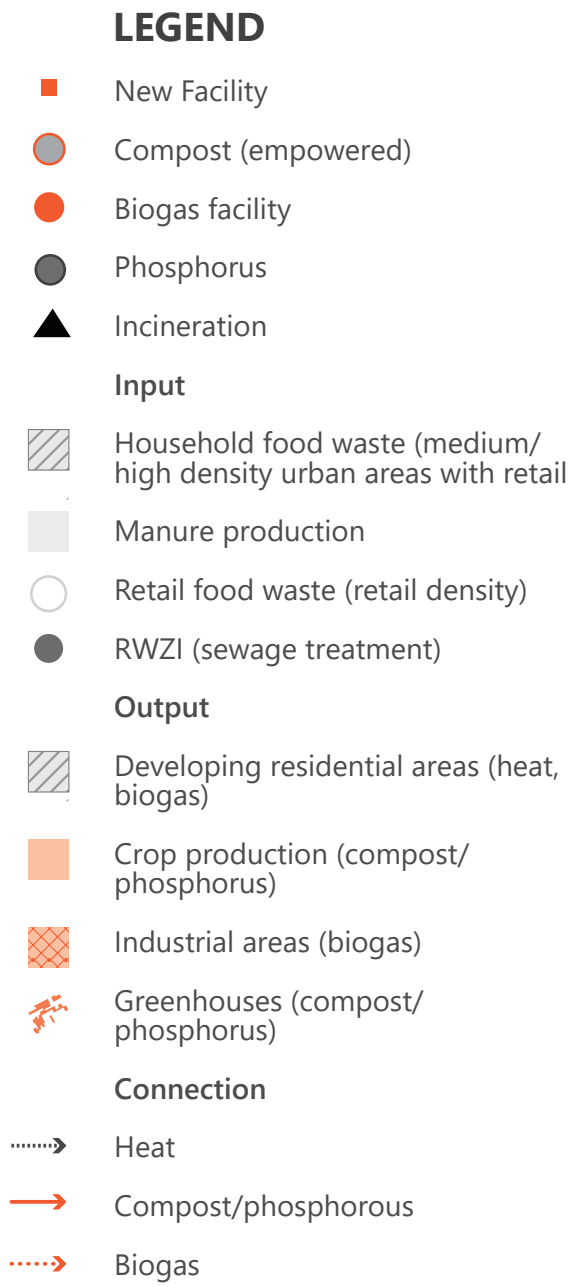
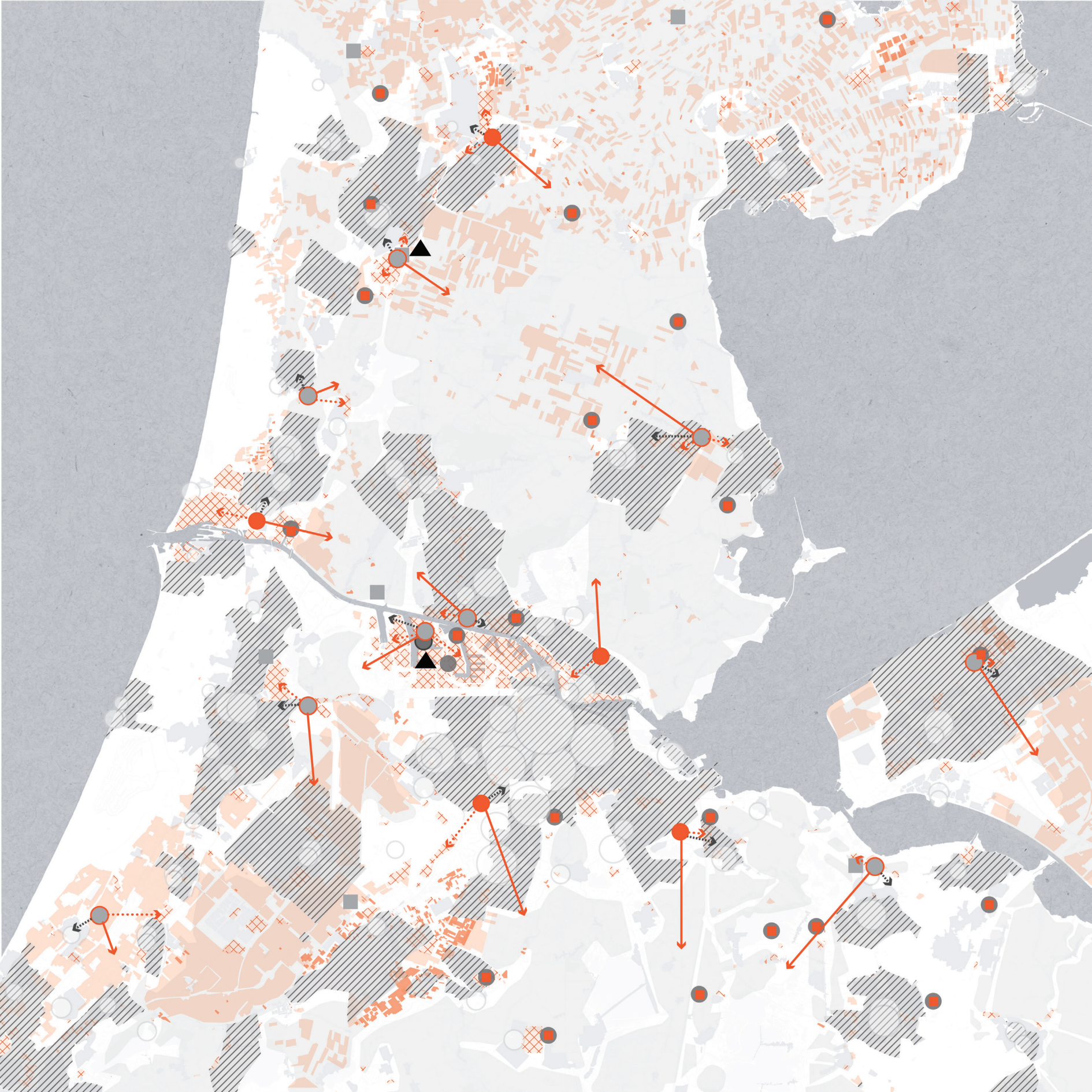


Figure 74 Food Recovery Hierarchy (https://www.rit.edu/affiliate/nysp2i/food/diversion-overview)



03.3.4 END OF LIFE: PROJECT OPPORTUNITIES

	CONDITION	SCALE	PROJECT	OBJECTIVE	STRATEGIES	POLICY STRATEGIES
SPATIAL	Existing Waste Management facilities	Regional	Reduced and utilized incineration facilities	Increasing sustainability: Reducing volume of organic waste within current stakeholders	DI DE	4, 5, 6
		Regional/city	Sustainable diversification	Promote existing and increase of sustainable waste management facilities	DI DE CO	5, 6
	Medium/high density growing, high density in remain Urban Areas	Local	From waste to table	Edible food waste recovery of restaurants and catering	DI DE CO	2, 3, 4, 5
		City/local	Public biomass	Biomass within public areas to create awareness	DI DE CO	1, 2, 3, 4, 5, 6
		City	Food waste buildings	Organic waste as building materials within developing areas	DI DE CO	3, 4, 5, 6
		City/regional	Waste separating systems	Introducing waste collection and separation infrastructure ie. Collecting trash by vacuum	DI DE	4,5,6
		City	Waste powered supermarkets	Increasing variation	DI DE CO	2,4,5,6
	Low density, shrinking Urban areas	Local	Compost hub	Communal waste separation	DI DE	1,2,3,5,6
		City/local	Home biogas	Biodigesters in households to promote self-sufficiency within shrinking the city	DI DE CO	1,3,5
	Expansion into wastescapes (test facilities)	Regional	Biogas Facility	Industrial biogas plants, organic waste currents are digested without the addition of manure	DI DE CO	4, 5
		Regional	Algae farms	Increasing variation by using organic waste for algae growth	DI DE CO	3, 4, 5, 6
	Water	City	Biogas boat	Increasing sustainable options: transforming organic waste streams into fertilizer and energy	DI DE CO	2,3,5
	Input and Output/ Transportation		(High temperature) industries		DI DE CO	
			Urban areas: Foodwaste for energy		DI DE CO	
			Cropland production: manure as fertilizer	Contribute to adding an organic fertilizer in agriculture.	DI DE CO	
			Sewage facilities		DI DE	
NON-SPATIAL	Online Development	City	(Food) waste app	Increasing connection by creating awareness of food waste	DI DE CO	1,2,5

DE Decentralize
DI Diversify
CO Connect

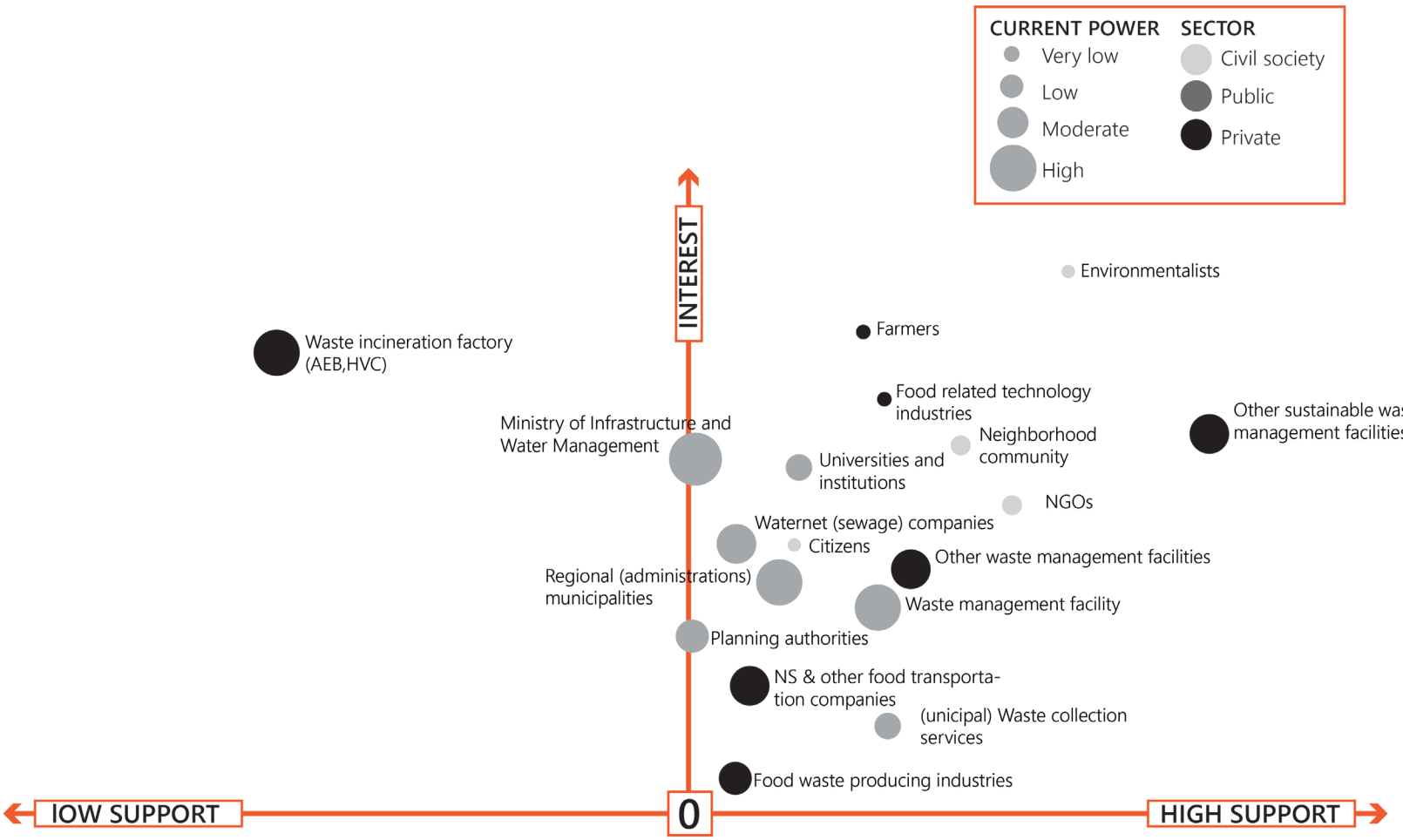
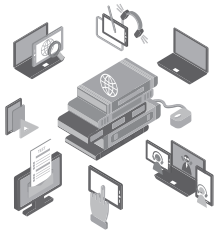


Figure 75 Existing stakeholders' interest and support within end of life

1. Public Participation Policies

Contents of these policies involve the contributions of the community in achieving its service delivery, developmental and strategic objectives.



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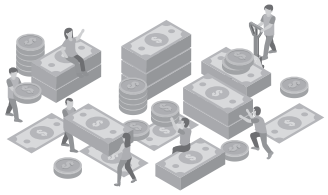

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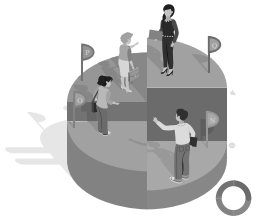

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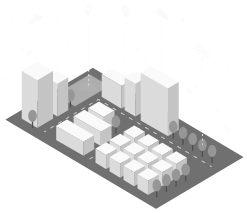


6. Integration Into Urban Plans

Some projects require to be implemented into urban plans, guidelines and policies. These are primarily for large infrastructural projects.

04.0 CHAPTER

04.1.1 FINAL VISION

Decentralized, diversified and connected system

As mentioned in our vision statement, we aim for a decentralized system within the AMA that contains a dense network of diverse and independent stakeholders. Different actors within the food system will be regarded and involved with the development of integrative sustainable solutions. So that not only a healthy and durable circular economy is developed, but also a resilient food system.

Our final vision map is a combination of the key solutions found within the opportunities in the chapters before. The main focus on these projects lies within the aspect of food production, retail and consumption. However, our final vision for the food system is integrative and collaborative. There will be zoomed in on three areas within the AMA in order to show how this dense and connective system works on a smaller and more local scale. These 'zoom-ins' highlight the areas that are a key factor within the regional vision and showcase the combination of our strategies, stakeholders and flows the best. The following chapters will elaborate on the areas: Seed Valley, Amsterdam City and Schiphol Area. This will then be concluded within a final timeline and complimentary policies.

LEGEND

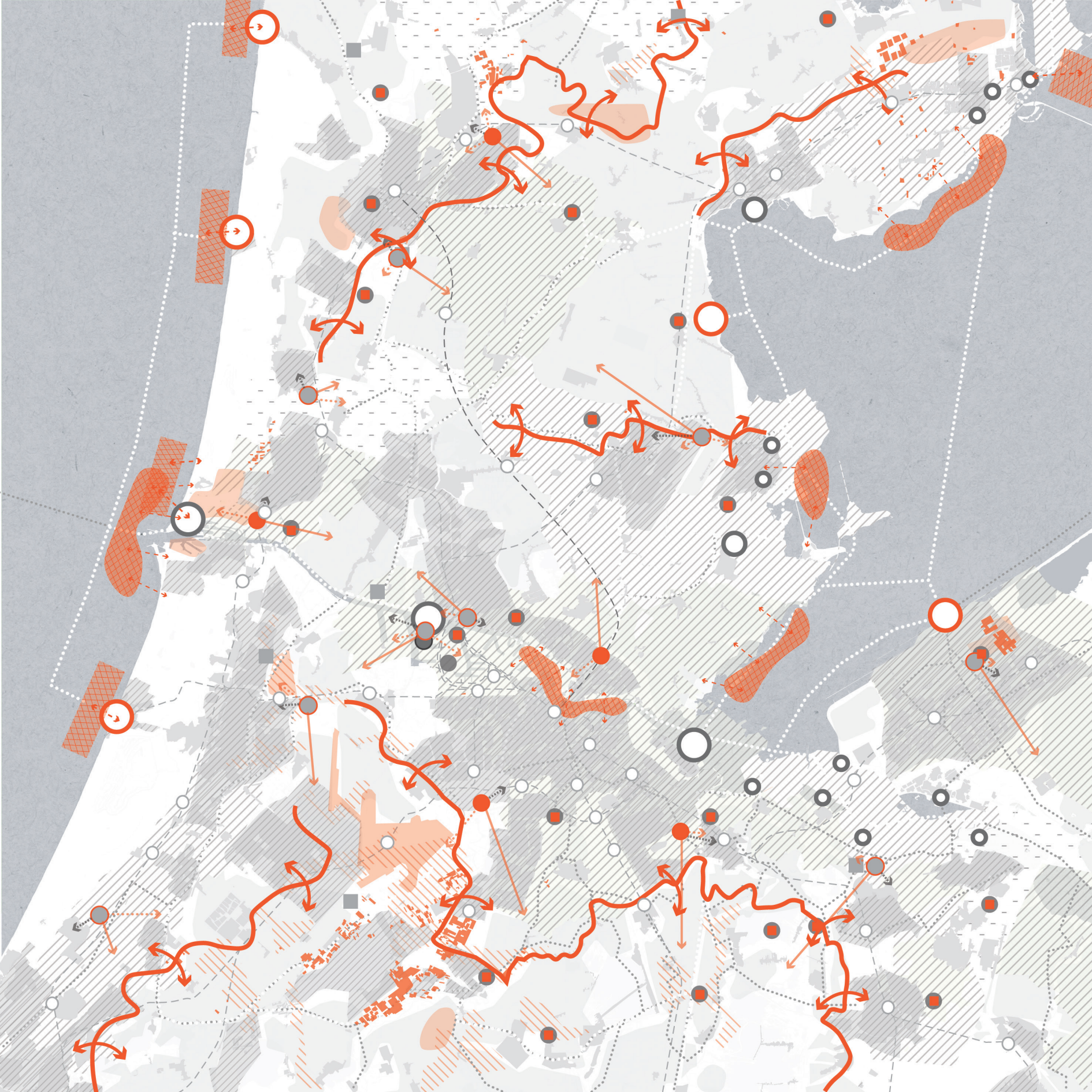
- Residential areas
- RWZI (sewage treatment) (direct waste management input)
- High density residential areas (Food waste management input)

Diversification and decentralization

- Growing urban areas with diversified retail, production and waste management solutions
- Shrinking urban areas with diversified retail, production and waste management solutions
- Diversified production areas (greenhouses, grazing, areas, cropland)
- Waste scapes for production, large retail projects and placement of waste management facilities (empty sites, underutilized greenhouses, polluted lands)
- Retail on water, connected with urban area
- Production on water; connected with retail and transport
- Composting facility (empowered)
- Biogas facility
- Phosphorus abstraction facility
- New waste management facility

Connecting

- Border local production - urban areas
- Local scaled, slow transportation connection
- Railway network
- Water network
- Important public transportation nodes (TOD for retail and production trades)
- Important and proposed harbour for production trade
- Heat connection (waste input vs. output)
- Compost/phosphorus connection (waste input vs. output
- Biogas connection (input vs. output)



04.1.2 ZOOM IN - SEED VALLEY

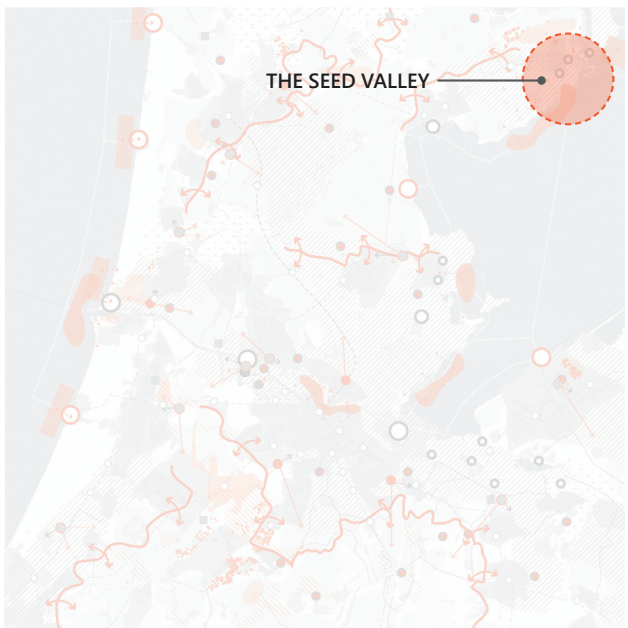
Rationale

One of the key areas that should be focused on is the northern portion of the AMA. The Seed Valley is area for the development of plants and seed technology. It is also widely known to be a district home to dozens of innovative companies that develop new innovative technologies for plant and seed technology, agro-food as well as flower cultivation. An analogy of the seed valley is the Silicon Valley in California. Specialists in this area are developing on horticultural crops, experimenting with crop yields and optimization of production under certain climate conditions.

It is a healthy and thriving area that the AMA needs to continually focus on. The feedback loop of innovation, education and technology is important in creating resilience for the food system.

Based on our analysis and opportunities, the Seed Valley was also chosen as a focal point due to:

- Opportunities for re-purposing waste scapes and "Leftover" land for new forms of production
- Large swathes of agricultural lands and greenhouses. There is a opportunity to reduce the distance of production to consumption
- An urbanized area that has low-density but is growing
- Adjacent to large water bodies; opportunity to showcase floating farms and water transportation routes for trade
- Creation of "Food hub"- New form of retail
- The Seed Valley has many institutes that can build on knowledge, education and culture for the AMA



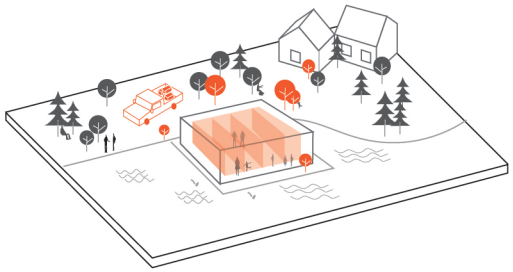
LEGEND

- Residential areas
- Current production areas (greenhouses, grazing areas, cropland)
- Proposed waste scapes for retail (empty sites, underused greenhouses)
- Retail on water; connected with urban area
- Innovation Zone (aquaponics, markets, algae)
- Border local production - urban areas;
- Proposed Retail Development (2km) from railway stations (TOD)
- Proposed Satellite Seed Valley Institutes
- Existing Seed Valley Institute
- Existing Harbours
- Existing railway
- Important production trade over water on existing network
- Sustainable Waste Management Facility (Compost, biogas)
- Market
- Existing areas with supermarkets, to implement specialized stores


PICKING FARM
LOCAL RETAIL
(ORGANIC STORES)
FLOATING FARM
INNOVATION ZONE
GREENHOUSES
M
M

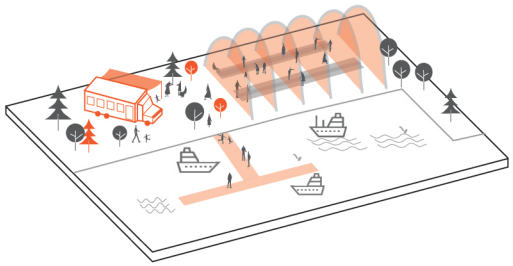
04.1.2 SPATIAL INTERVENTIONS

SUPER CLEAN TOOLKIT FOR THE SEED VALLEY



1 Floating Farms

SCALE Regional/City
AIM Increasingproduction on water (cows or crops & fish)

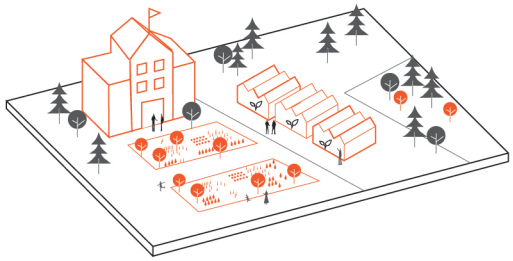


2 Harbour Indoor Market

SCALE City
AIM Increasing variation with cheaper local products

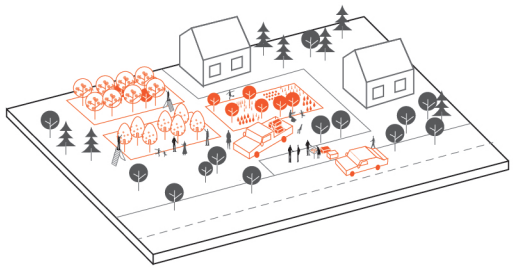
3 Algae Farming

SCALE Regional
AIM Increasing variation by using organic waste for algae growth



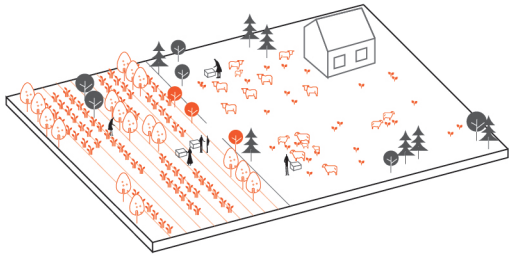
4 Seed Valley

SCALE City
AIM Increasing variation with innovation and research in agri-food industry



5 Picking Farm

SCALE City/Regional
AIM Increasing connection and economy by using 'pickable' fruit and vegetables for locals and as a tourist attraction

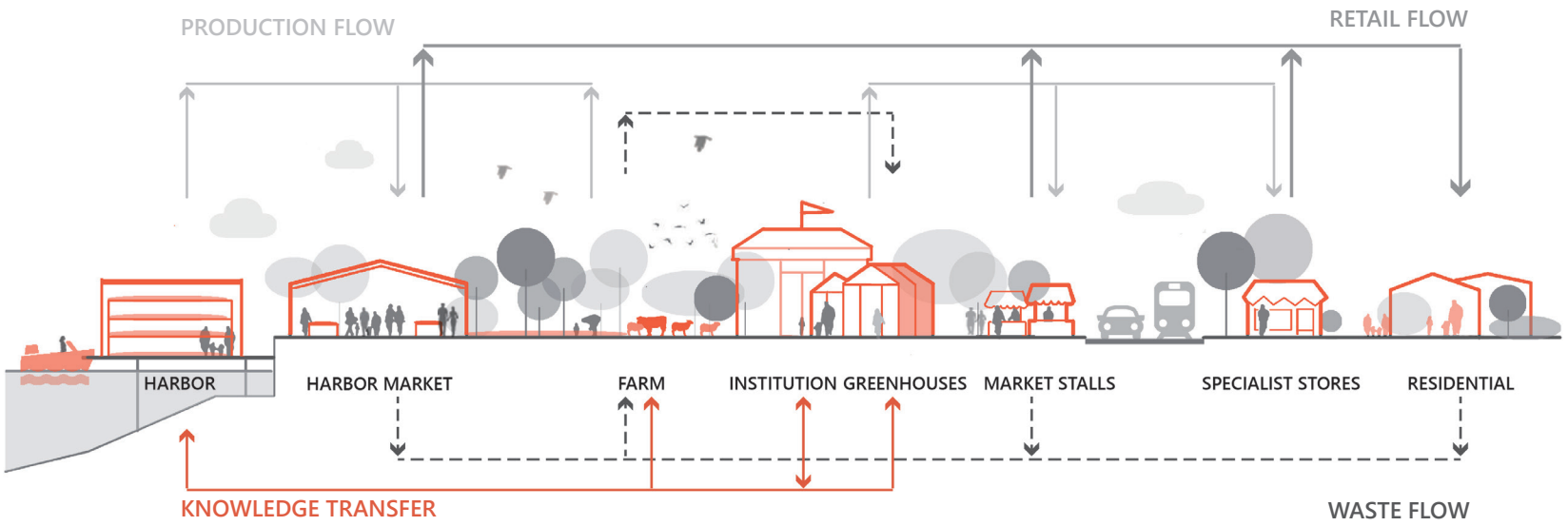


6 Manure as Fertilizer

SCALE City
AIM Contribute to adding an organic fertilizer in agriculture.

04.1.2 SPATIAL INTERVENTIONS

SAMPLE SECTION EXEMPLIFYING FLOWS

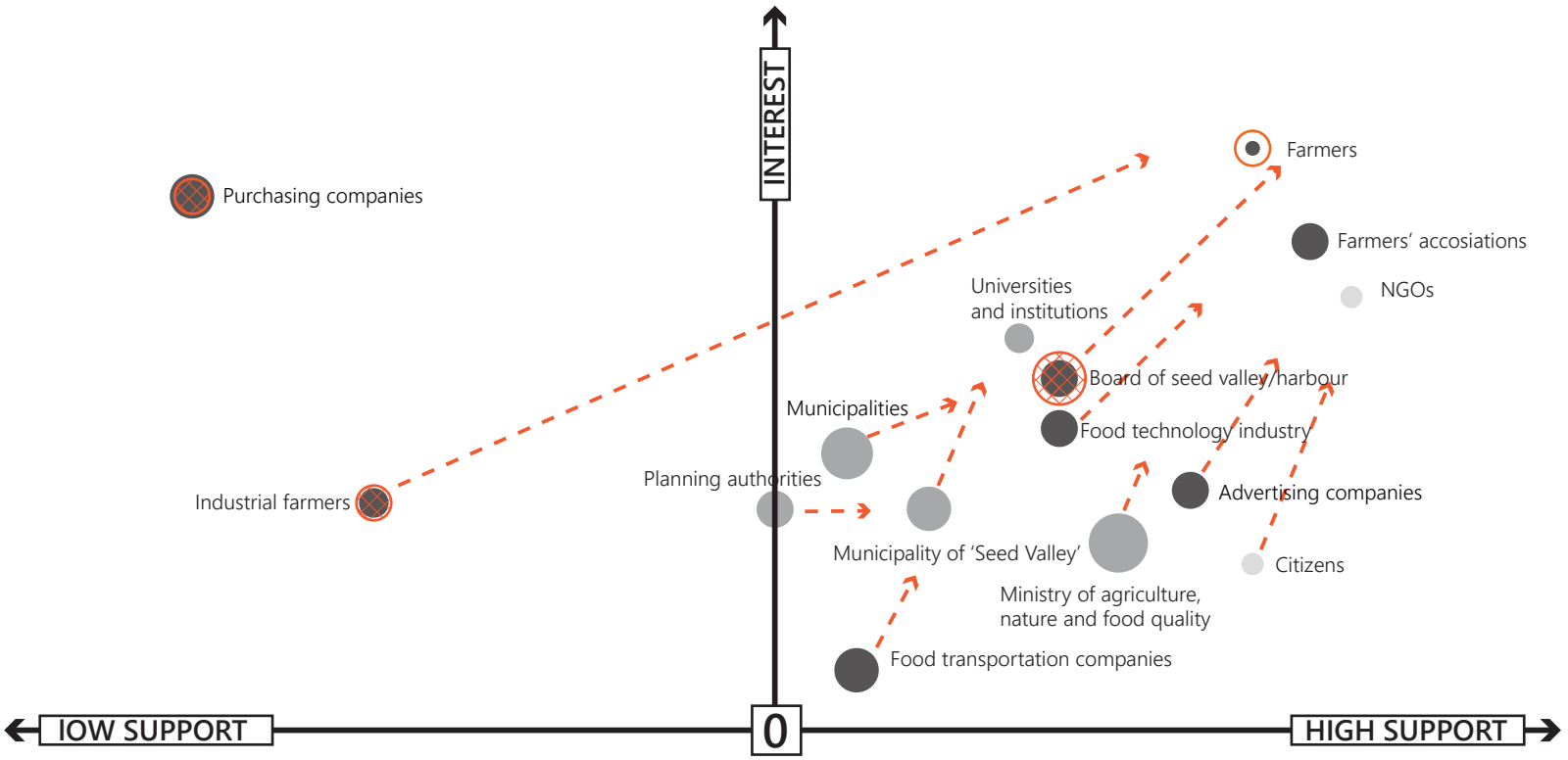


Seed Valley

Seed valley is a representative area where local production is prosperous in new forms and multiple aspects within the sector support each other. Projects such as floating farms and local harbours can work together to form a circle of trade. Local produced food from farms and pasture can either be sold directly via markets and farmers' stalls or it can be transported on water or rails to organic stores near cities and towns. Underutilized greenhouses can be transformed for education, working closely together with knowledge and innovation institute 'Seed Valley'. Waste that is produced can also be reduced efficiently within the area by returning compost or manure back to production land.

04.1.2 STAKEHOLDERS

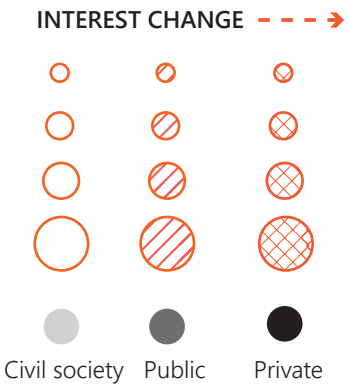
SEED VALLEY



The Food System in the Seed Valley & Stakeholders

The Seed valley is a knowledge and technology hub and will likely become a key player that will help small and medium scale producers to make better use of their resources and be more competitive on the market.
The national government and municipalities will facilitate innovation in food system practices by implementing subsidies and programs that increase interaction between stakeholders. Below are some key interventions:

- Ports become important in the food economy. They connect the production from floating farms with retail in cities and create a new system of trade
- The system would improve the circular relationship between food waste being used to feed animals and manure used to fertilize crops
- Knowledge is used to improve efficiency and quality of food related activities in every scale
- Education and awareness are key to influence dietary preferences. Accounting for people in the beginning would enable more sustainable decisions



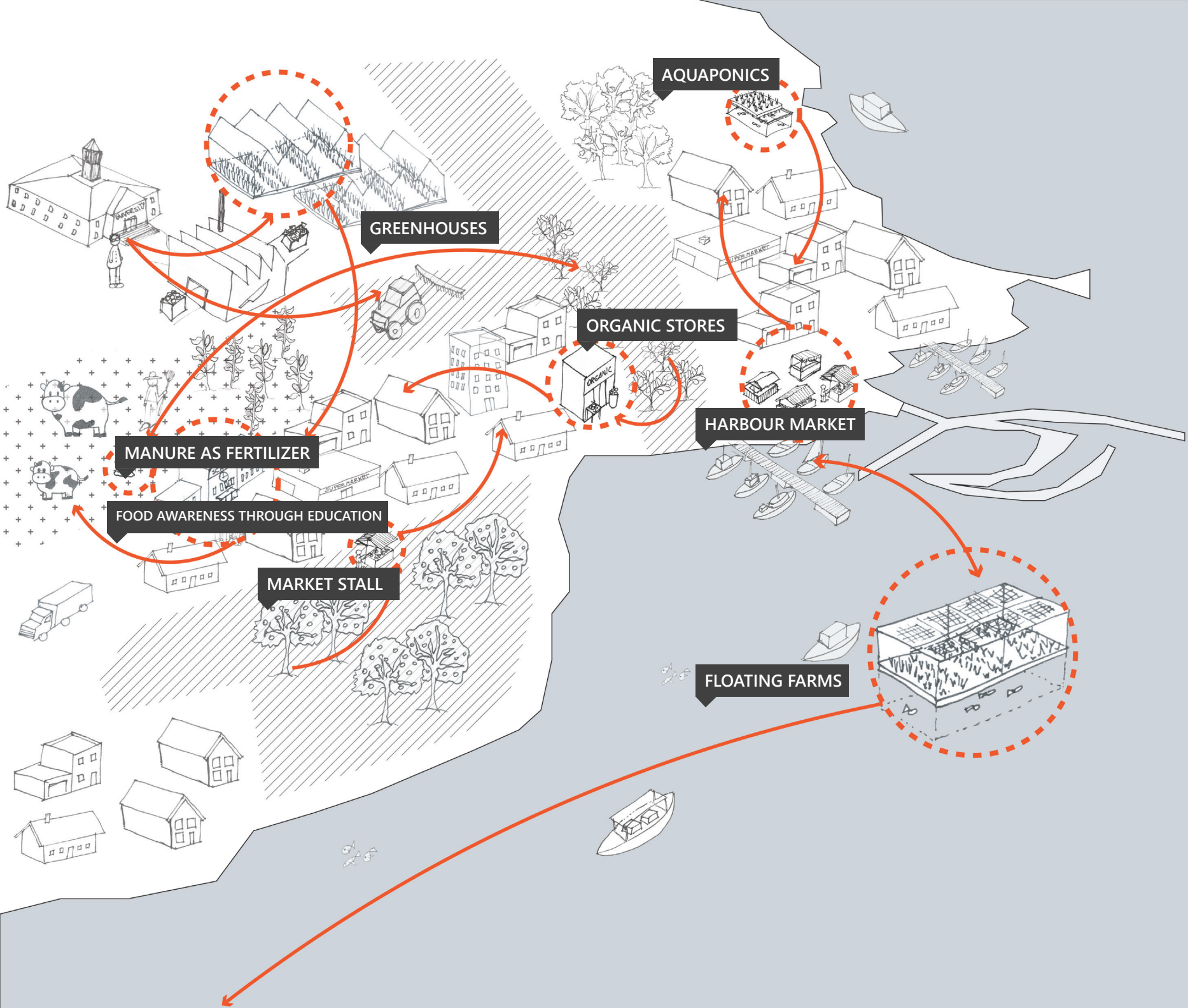


Figure 76 Food system diagram of proposed interventions in the Seed Valley

Figure 77 Impression of the food system in the Seed Valley

Within the Seed valley the emphasis is on innovation and food technology. There are already numerous knowledge institute and businesses related to food production within the area. Using this as a base the area will take the leading role in food research and innovation. The implementation of new kinds of farming such as floating farms but also new kinds of retail such as farmers markets and waste management in the form of manure to fertilizer.

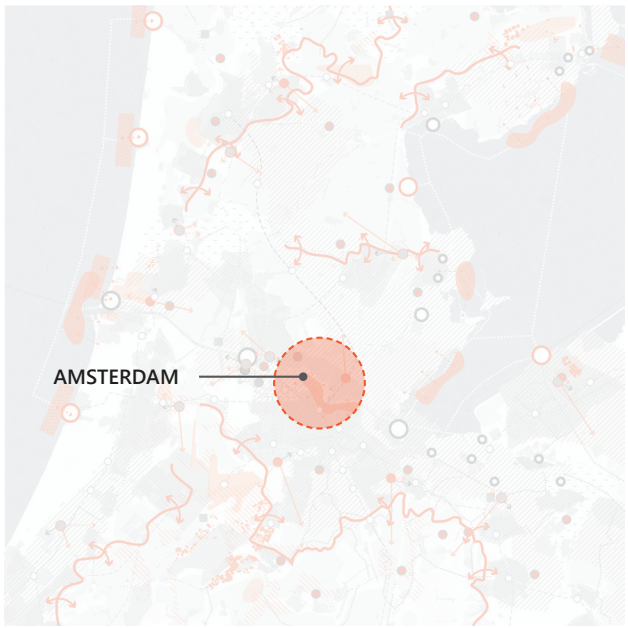
04.1.3 ZOOM IN - AMSTERDAM

Rationale

The second key area that was selected was a portion of Amsterdam Noord and the historic city center.

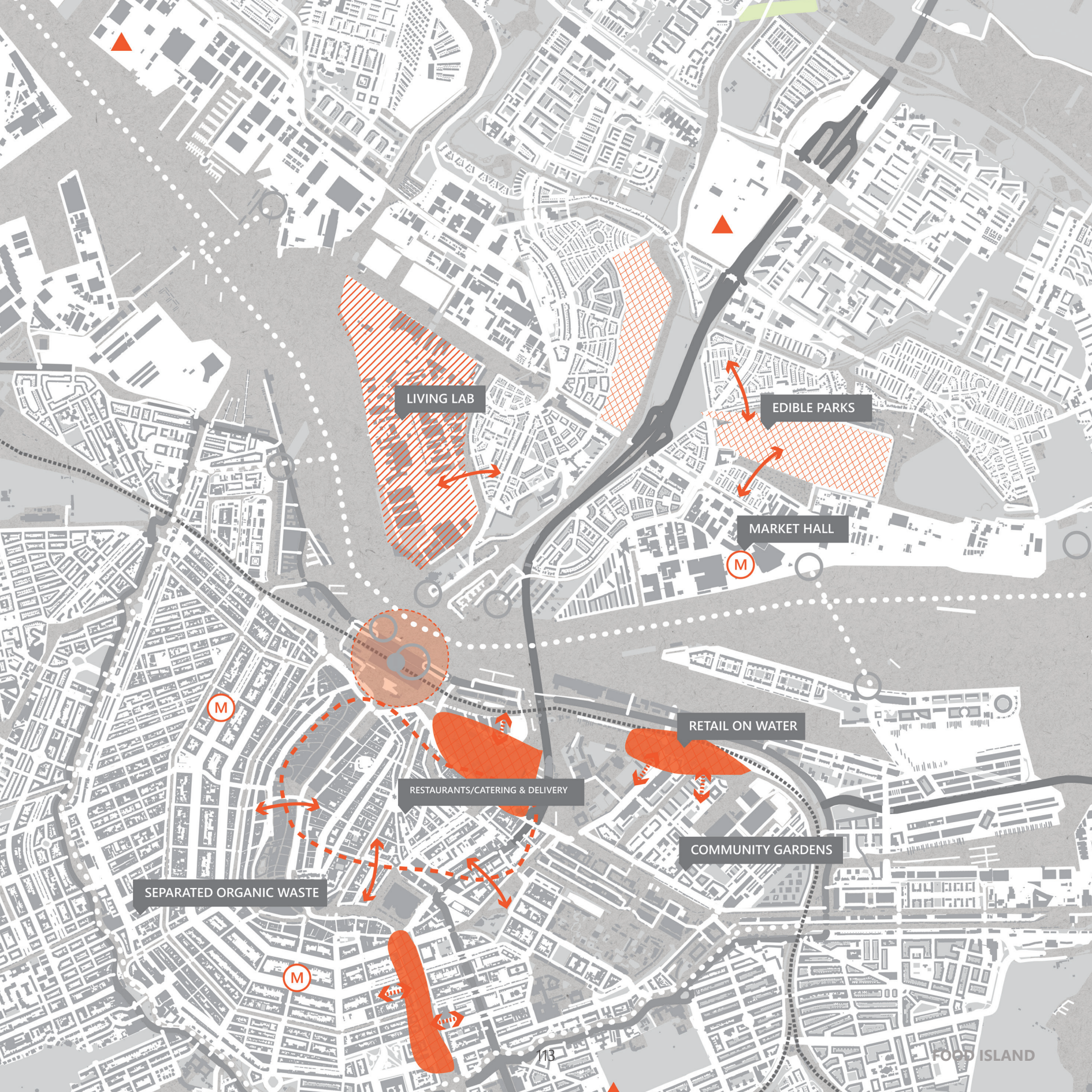
Based on our analysis and opportunities, (a portion) of Amsterdam was also chosen as a focal point due to:

- Opportunities for re-purposing waste scapes and "Leftover" land for new forms of production
- Amsterdam is a high density development that is continually growing. However, in Amsterdam Noord, it still contains low density areas that could be used as opportunities for production, waste management and diverse retail options
- New urban development is occurring on the western corridor near existing waterways
- Waterbodies and harbours are key in improving the transportation and trade of food production
- Contains a large cultural center which can be used to also be used to implement more educational facilities about food
- Opportunities to showcase urban farming



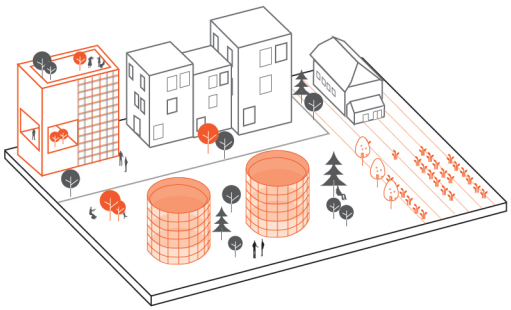
LEGEND

- Residential areas
- Retail on water; connected with urban area
- Living lab (for vertical farming, aquaponics and new technology)
- Edible Parks
- Proposed Retail Development (2km) from railway stations (TOD)
- Connections between production and urban areas
- Existing Harbours
- Existing railway
- Important production trade over water on existing network
- Sustainable Waste Management Facility (Compost, biogas)
- Market
- Existing areas with supermarkets, to implement specialized stores


LIVING LAB
EDIBLE PARKS
MARKET HALL
M
RETAIL ON WATER
RESTAURANTS/CATERING & DELIVERY
COMMUNITY GARDENS
SEPARATED ORGANIC WASTE
M
M

04.1.3 SPATIAL INTERVENTIONS

SUPER CLEAN TOOLKIT FOR AMSTERDAM

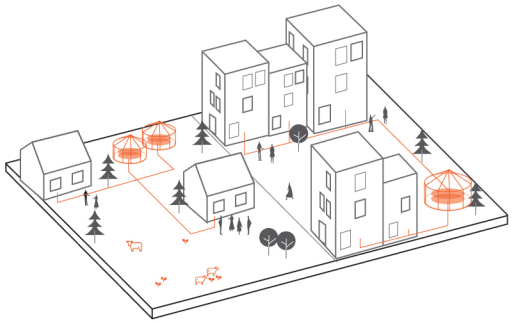


1 Vertical Farming

SCALE Local
AIM Increasing production into public areas

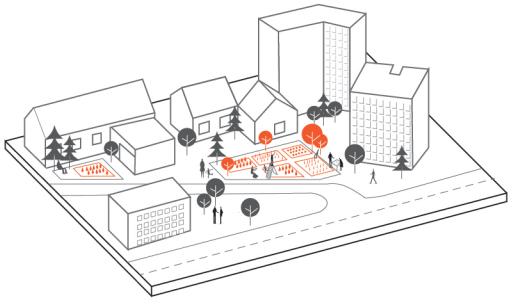
2 Food Delivery Service

SCALE City
AIM Connecting local production and retail with delivery service trend



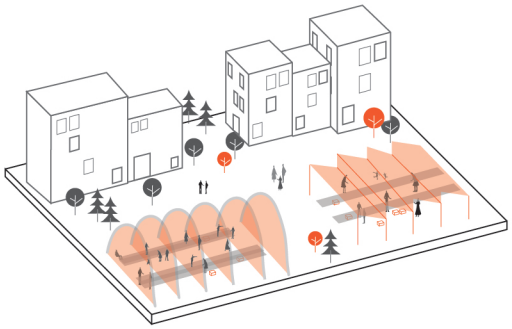
3 Home Biogas

SCALE City/Local
AIM Biodigesters in households to promote self-sufficiency within shrinking the city



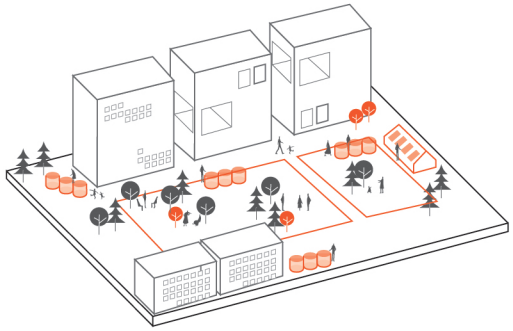
4 Urban/Community Garden

SCALE Local
AIM Increasing production into public areas



5 Farmers Market/ Market Hall

SCALE City
AIM Connecting local production and retail with both selling and consuming options

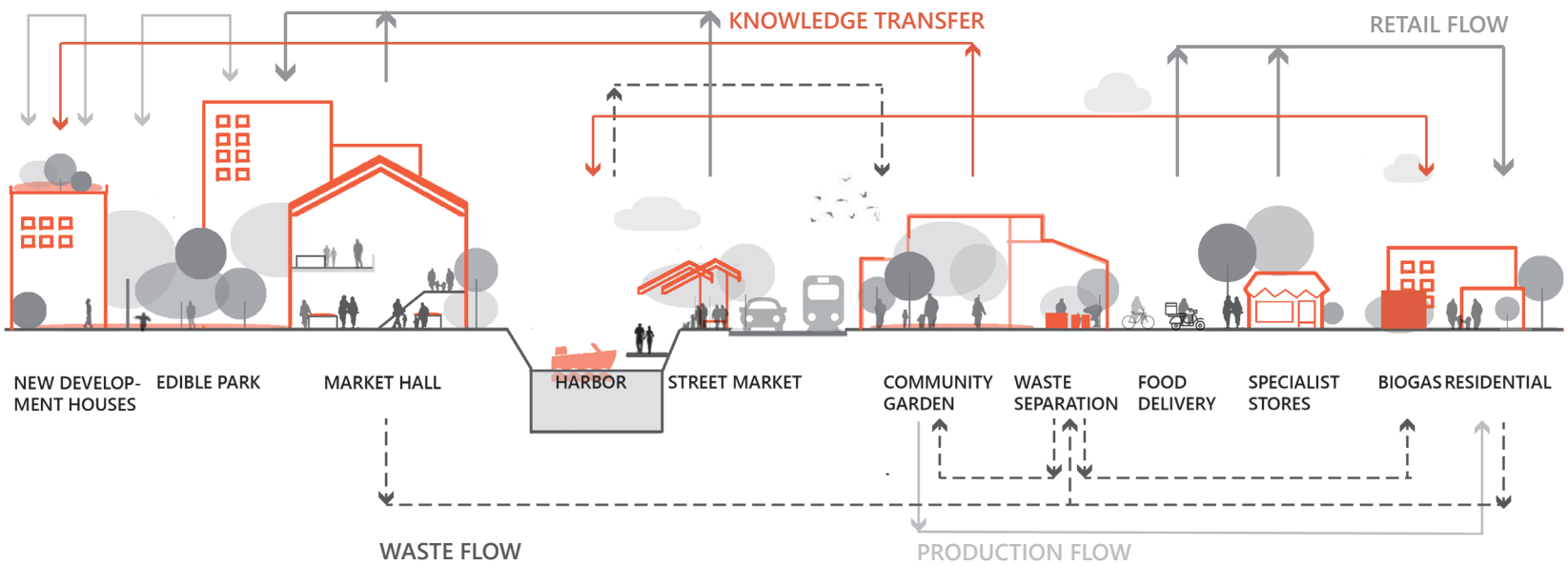


6 Waste Separation

SCALE City/Regional
AIM Introducing waste collection and separation infrastructure ie. collecting trash by vacuum

04.1.3 SPATIAL INTERVENTIONS

SAMPLE SECTION EXEMPLIFYING FLOWS

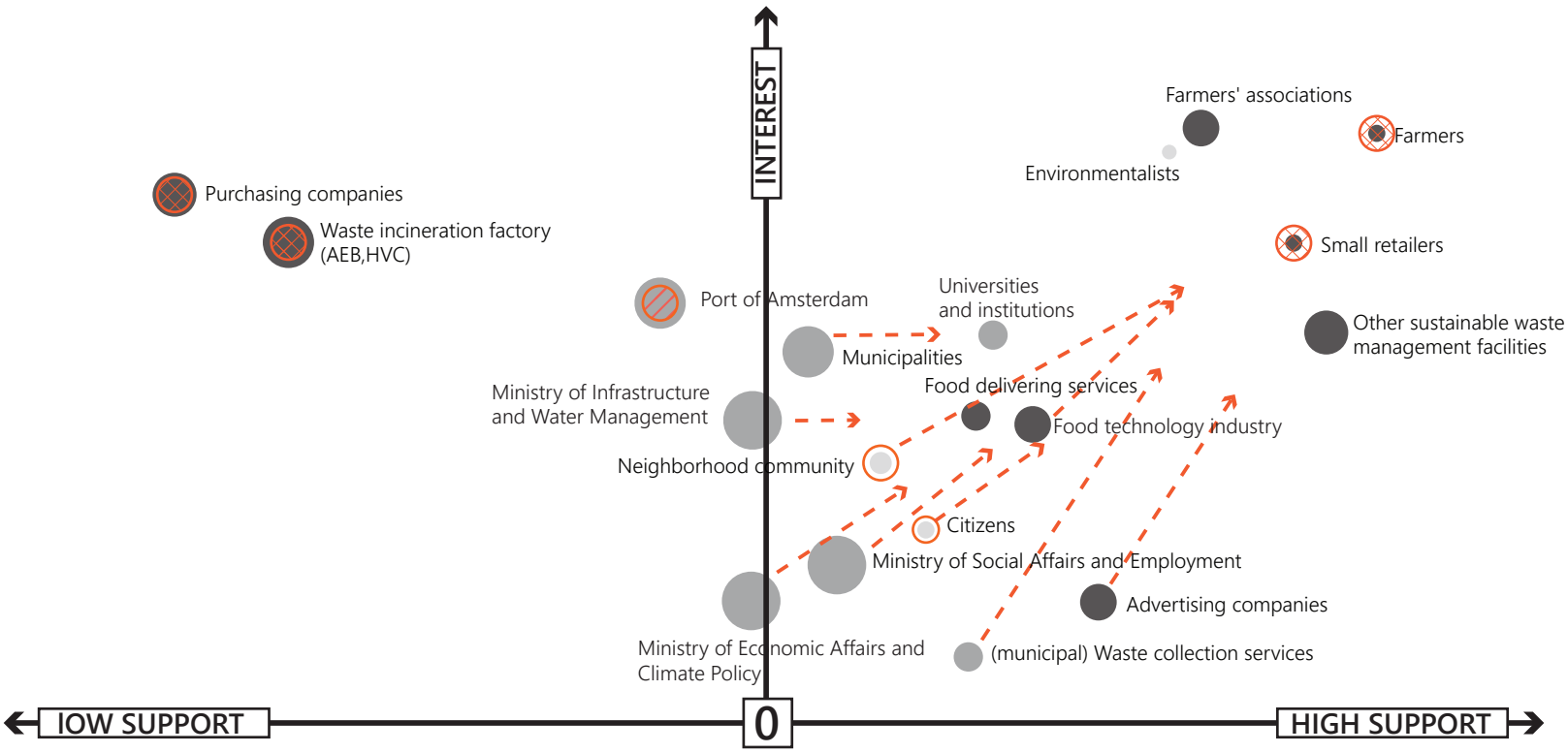


Amsterdam city

The city of Amsterdam is a highly dense center in the AMA and has an abundance of options and resources. In the northern part of the area, existing large green public spaces can be transformed into edible parks, but also smaller community spots can be transformed food production activities such as roof top gardening. Amsterdam port will now have its economic benefits from the trade of local production together with new and existing market halls and street markets on both sides of the river. Since the area is so densely populated, there can be experimented with new forms of local produced retail. Local food delivery services as well as various specialist stores have a bigger market to set grounds. Lastly, future Amsterdam city is ought to be a pioneer in food waste separation as well. With its quickly expanding urban areas, advanced separation facilities can be implemented to prevent losses of valuable food waste resources. Next to that, the city produces a large amount of food waste within the retail and consumption phase of the chain. Through separation facilities and a better organised waste collection system, this can be turned into biogas or energy to eventually serve the population in return.

04.1.3 STAKEHOLDERS

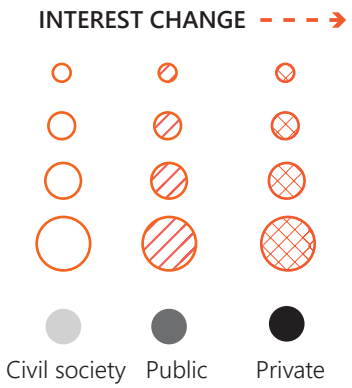
AMSTERDAM



The Food System in Amsterdam & Stakeholders

With the implementation of more small scale alternatives of production, retail and waste management; big centralized stakeholders will lose power but will still be important in the overall network. Stakeholders will less power will increase the interest of advertising, delivery and communities to create new networks and as a result the structure becomes more complex and flexible. Below are some key interventions:

- Areas of city expansion and new developments are ideal places to foster innovative designs that incorporate productive, commercialization and waste management related with food.
- Highly urbanized areas can incorporate many options of retail that can compete with supermarkets
- Implementation of a decentralized system for food waste separation and collection
- Using multiple transportation systems to distribute food products in a more efficient way.



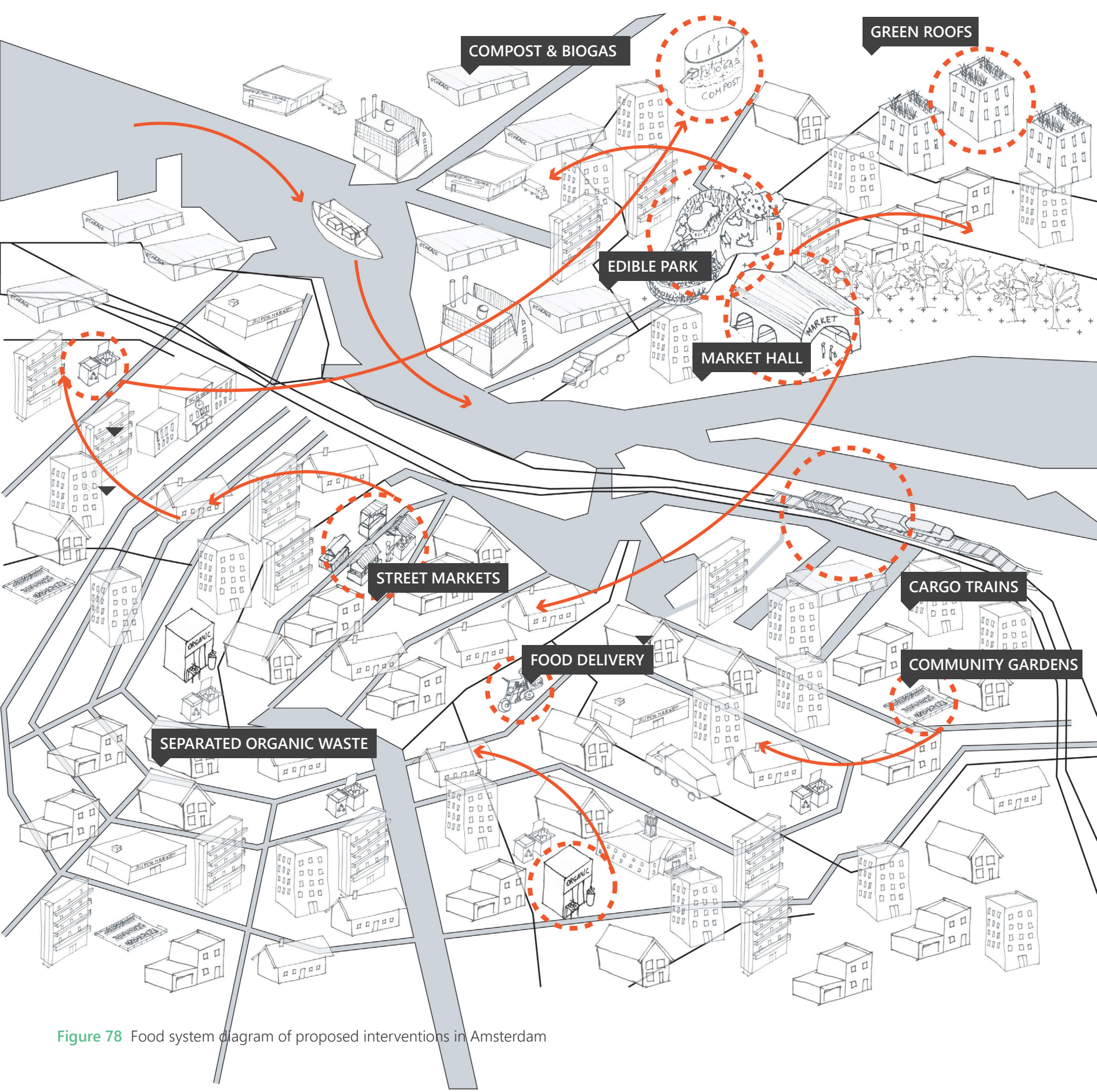


Figure 78 Food system diagram of proposed interventions in Amsterdam

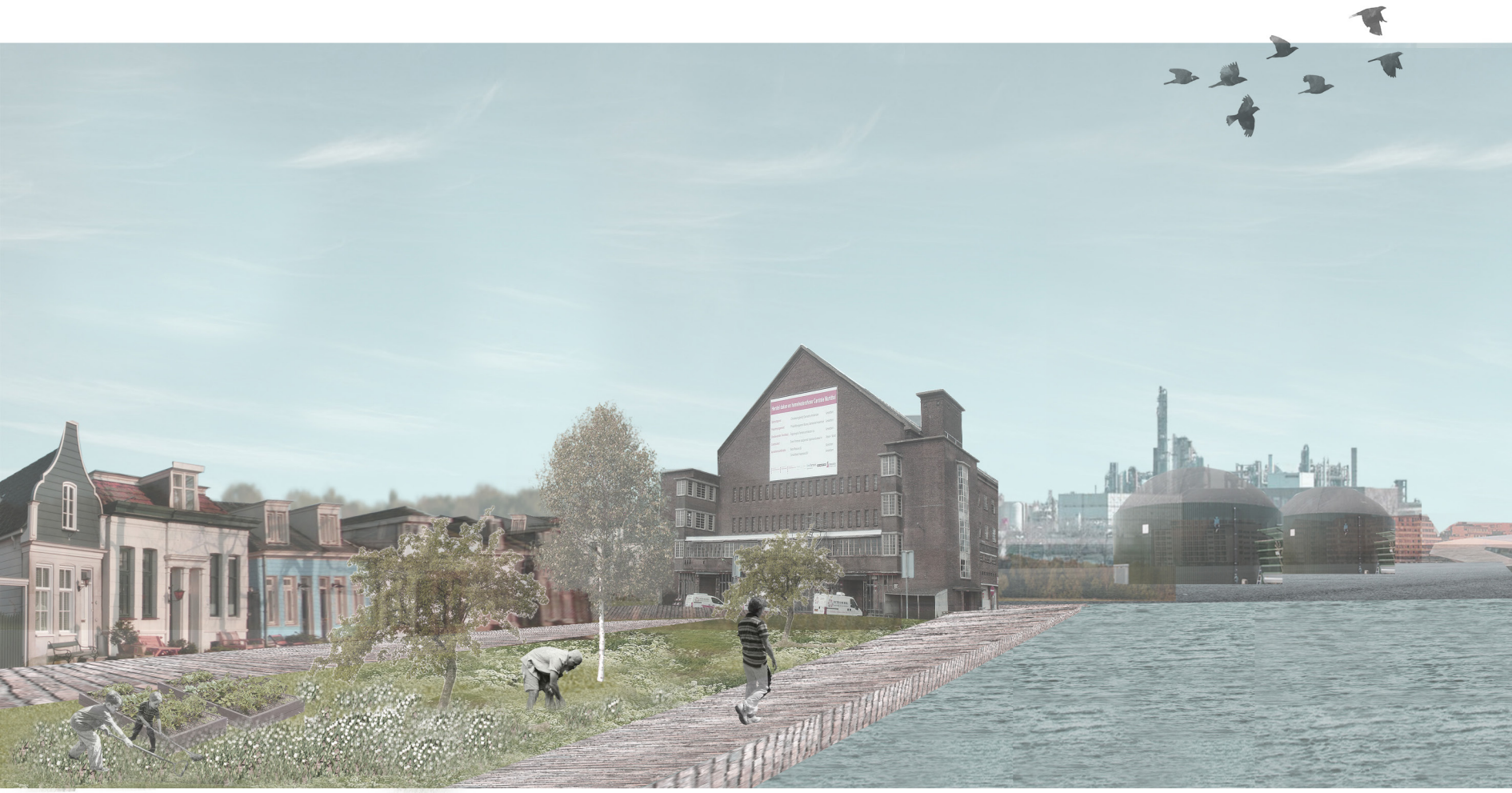


Figure 79 Impression of the food system in Amsterdam

Amsterdam holds a lot of opportunities with its fast growing population as well as a high density of people. This means a high concentration of businesses, communities and knowledge institutes which evidently means a high demand for food, retail and waste management. This is the perfect base to test and implement new solutions for the food sector but above all the perfect base for the creation of awareness. This is done through the implementation of urban farming, edible parks, an automated organic waste system and through the usage of apps that facilitate a local food delivery system.


Domino's

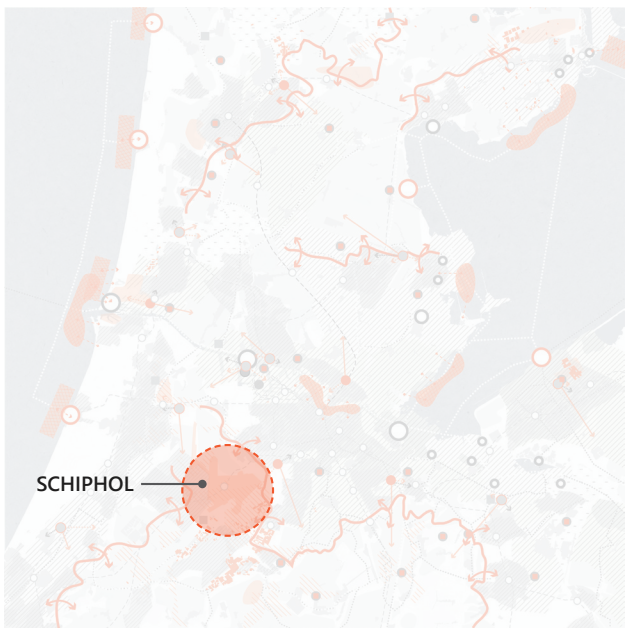
04.1.4 ZOOM IN - SCHIPHOL

Rationale

The third key area that was selected was the area within the vicinity of Schiphol Airport. In the previous chapter, the scenario outlines the possibility of reducing food being imported from external regions. Thus, this leaves the possibility of reduced use of food storage at the airport and can be used for other purposes while still maintaining trade within the region.
We consider this as a high "leftover" large impact area.

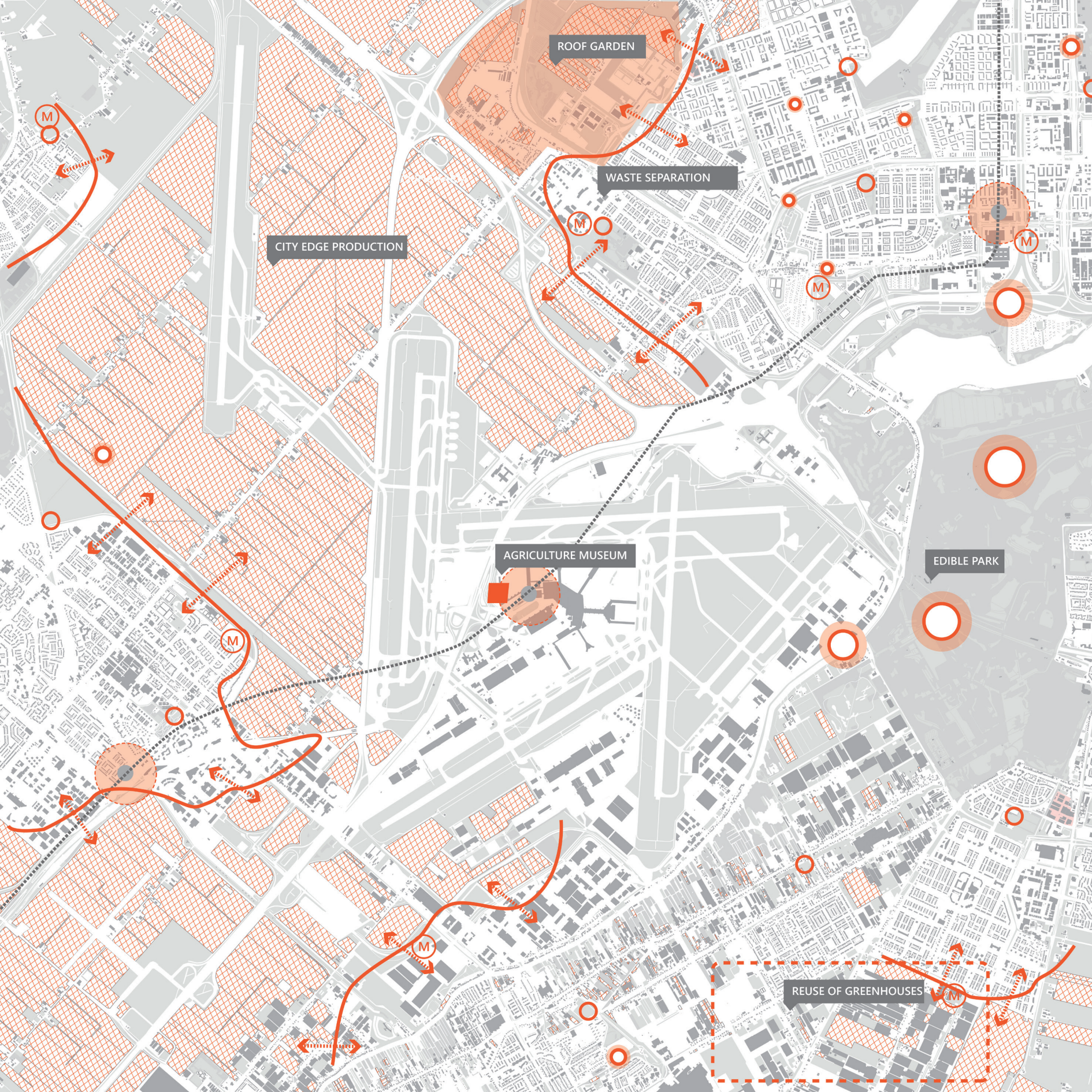
Based on our analysis and opportunities, Schipol was also chosen as a focal point due to:

- Opportunities for re-purposing waste scapes and "Leftover" land for new forms of production
- Opportunity to create a cultural "food hub" and more economic development within the area
- New opportunities for waste management facilities such as composting and biogas hubs
- Residential Areas can start implementing household biodigesters to produce biogas
- Waste collection and separation infrastructure can be implemented also in lower density areas
- Opportunity to be a self-sufficient little island
- Large swathes of land are underutilized and can be used for diverse methods of production. The area is closely linked to the high density area of Amsterdam, opportunity to experiment with from food to table principles



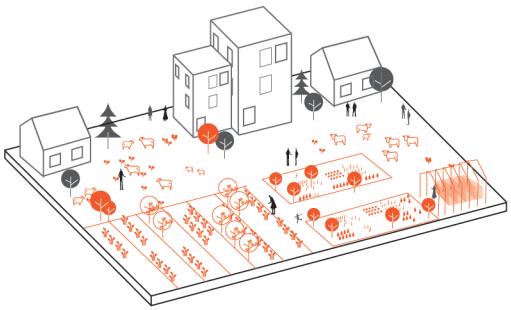
LEGEND

- Residential areas
- Open spaces
- New development areas
- Potential city edge production area
- Reuse of green houses
- Border local production - urban areas
- Main transportation
- Existing railway
- Existing important public transport stations (TOD)
- Proposed edible parks
- Markets
- Neighborhood waste collection centers
- Agriculture museum


ROOF GARDEN
WASTE SEPARATION
CITY EDGE PRODUCTION
AGRICULTURE MUSEUM
EDIBLE PARK
REUSE OF GREENHOUSES
M

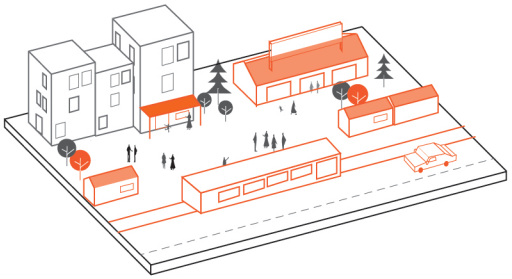
04.1.4 SPATIAL INTERVENTIONS

SUPER CLEAN TOOLKIT FOR SCHIPHOL



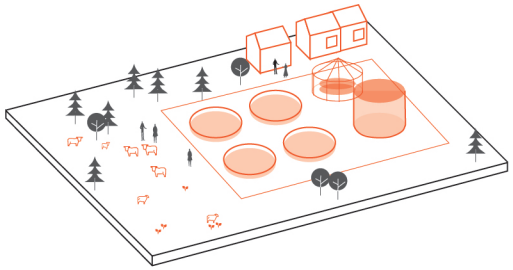
1 City Edge Production

SCALE Regional/City
AIM Increasing variation by crop rotation and diverse yields



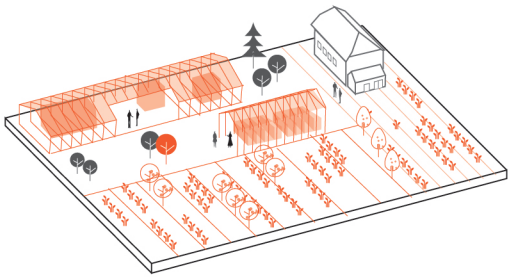
2 Specialized Stores

SCALE City
AIM Increasing variation with multiple specialized stores



3 Biogas Facilities

SCALE City/Local
AIM Industrial biogas plants, organic waste currents are digested without the addition of manure

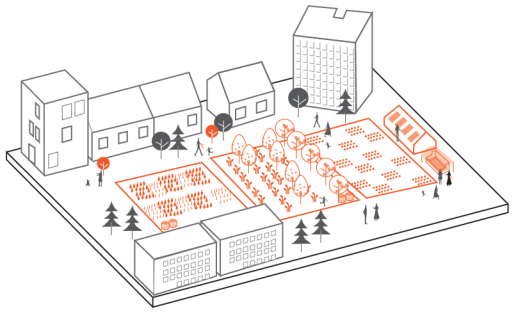


4 Greenhouses

SCALE City
AIM Increasing production in underused greenhouses

5 Farmers Stalls

SCALE City
AIM Inreasing variation and connecting local production and retail with easy accessible and cheaper road stalls

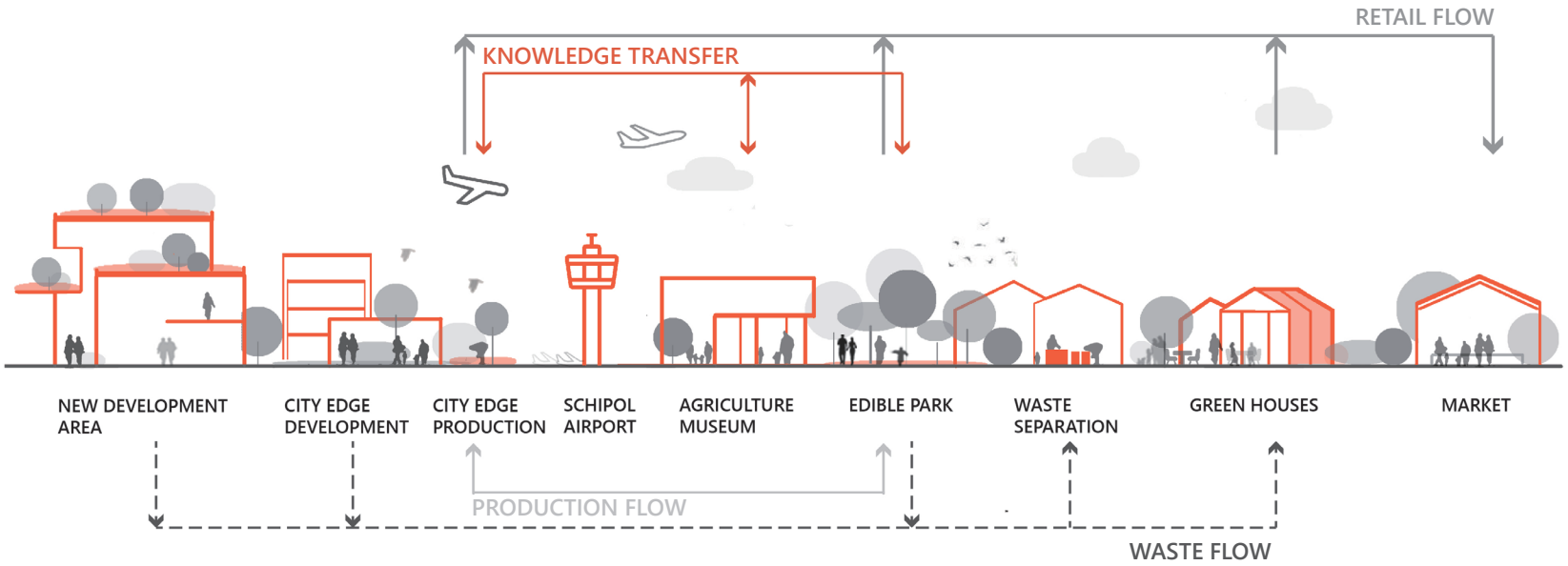


6 Compost Hub

SCALE Local
AIM Communal waste separation

04.1.4 SPATIAL INTERVENTIONS

SAMPLE SECTION EXEMPLIFYING FLOWS

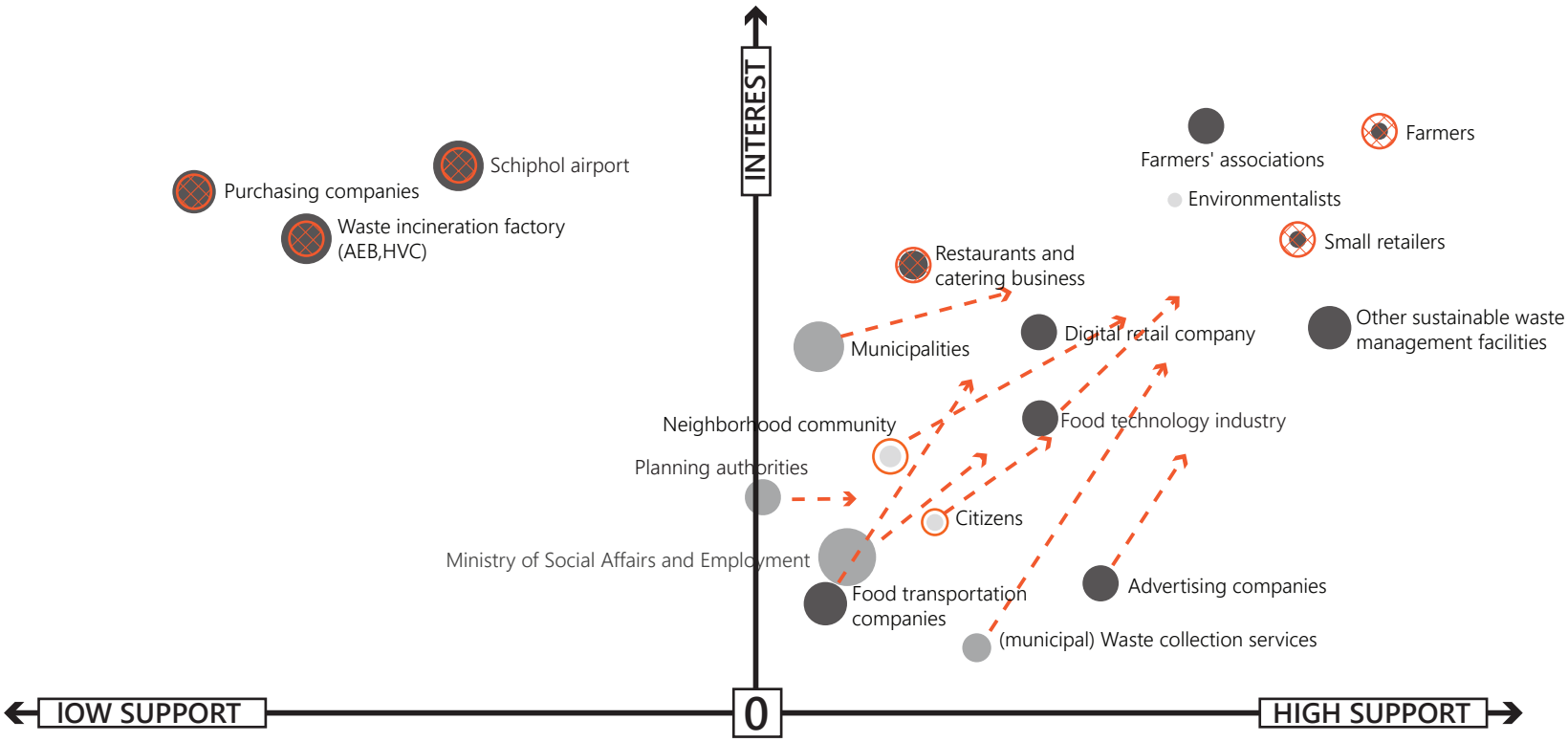


Schiphol area

Now that the AMA has become less dependent on import and export, new changes can be made to Schiphol Airport and its surrounding area. This area can serve as experimental and cultural zone, a food hub which showcases the entire system. This food hub will work together with trends and facilities, such as amount of people that travel by airplane and the businesses of other industries already working within the area. One of the solutions includes adding an agriculture museum as touristic attraction point. And the surrounding developing and growing areas allow production to occur on the borders. These areas are be closely related to adjacent technology industries and businesses and projects such as vertical farming can be worked with. The surrounding urban areas of Schiphol Area are much lower in density compared to Amsterdam centre, these areas are an ideal place for interventions for food production and waste management that are beneficial for the community, such as community gardening and biodigesters, but require larger spaces.

04.1.4 STAKEHOLDERS

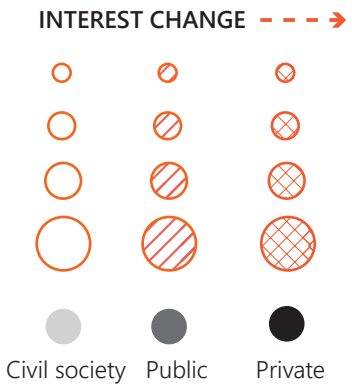
SCHIPHOL



The Food System at Schiphol & Stakeholders

The stakeholders in which the centralised food system depends to exchange products and resources will lose power. This can be an opportunity for them to diversify and participate in other sectors such as education, culture and recreation. Once again, new small stakeholders in production, retail and waste management will be added to the current system. The public sector has a big role in creating conditions to support innovative business models. Below are some key interventions:

- Edges between urban and agricultural areas can become a place for diversified production and retail
- Underused greenhouses can be transformed into mixed use buildings that incorporate housing, work, cultural as well as productive functions
- With the reduction of imports and exports, part of the areas designated to food storage in Schiphol Airport will be empty. These can then can be repurposed with recreational or cultural functions



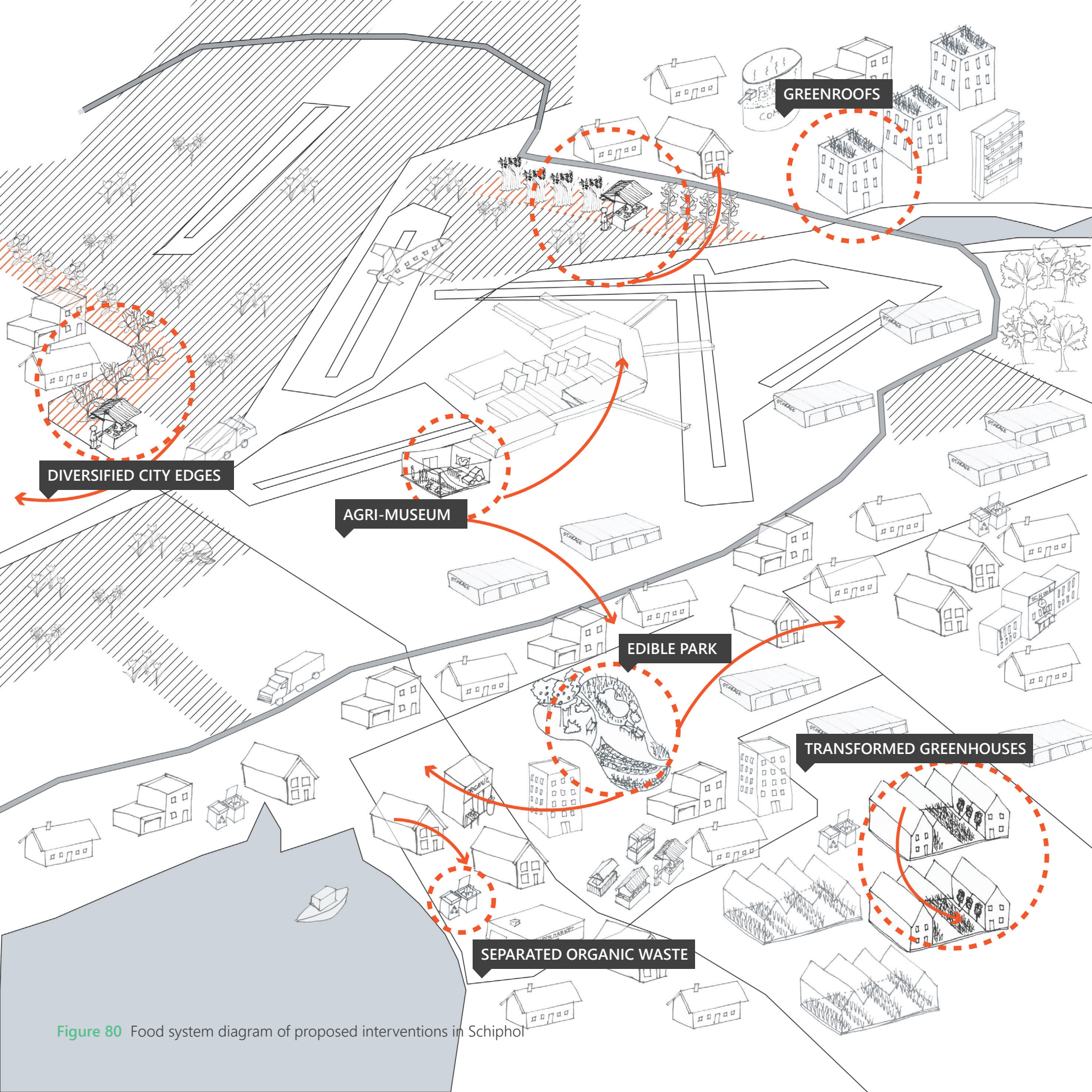


Figure 80 Food system diagram of proposed interventions in Schiphol

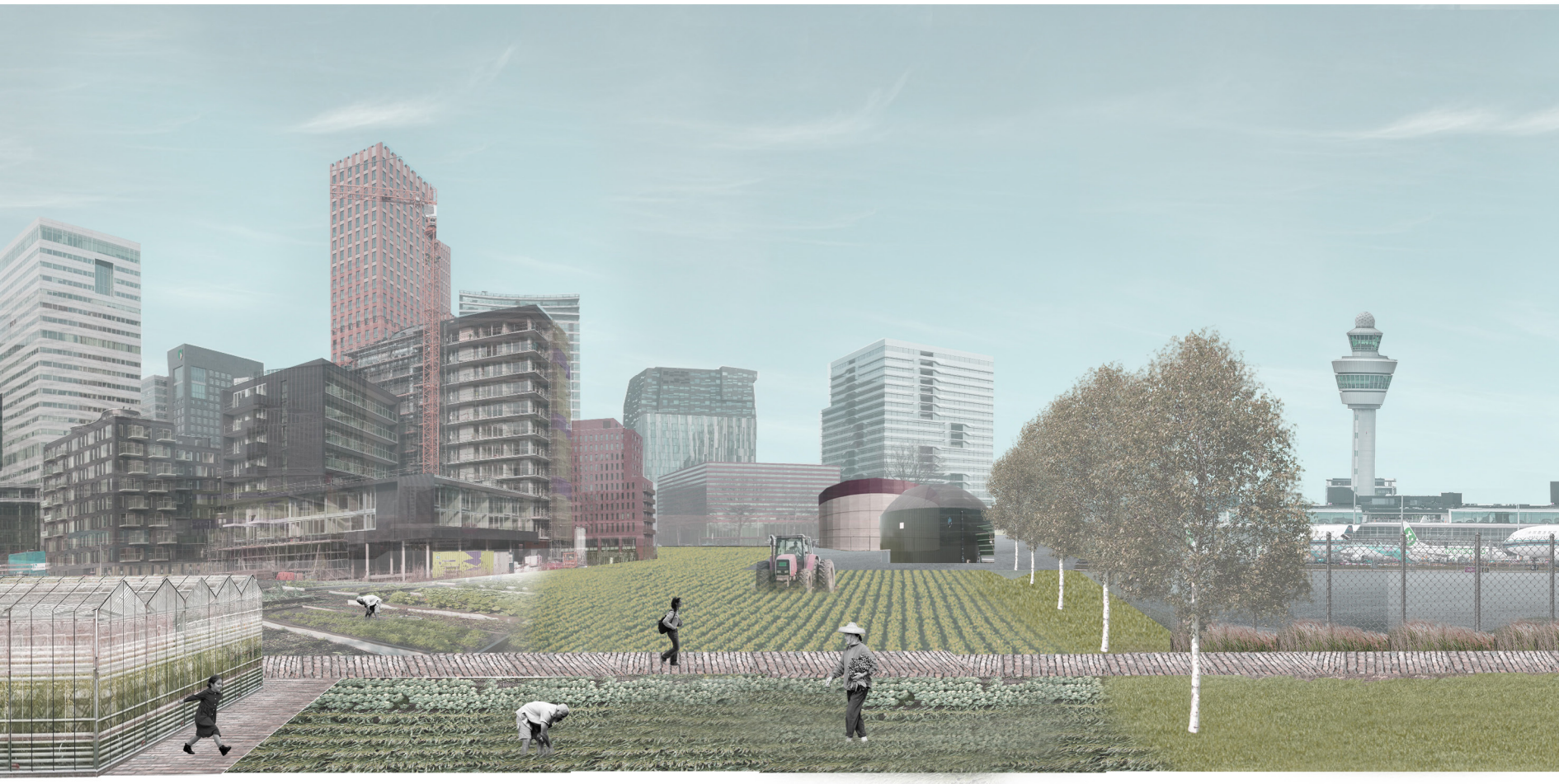
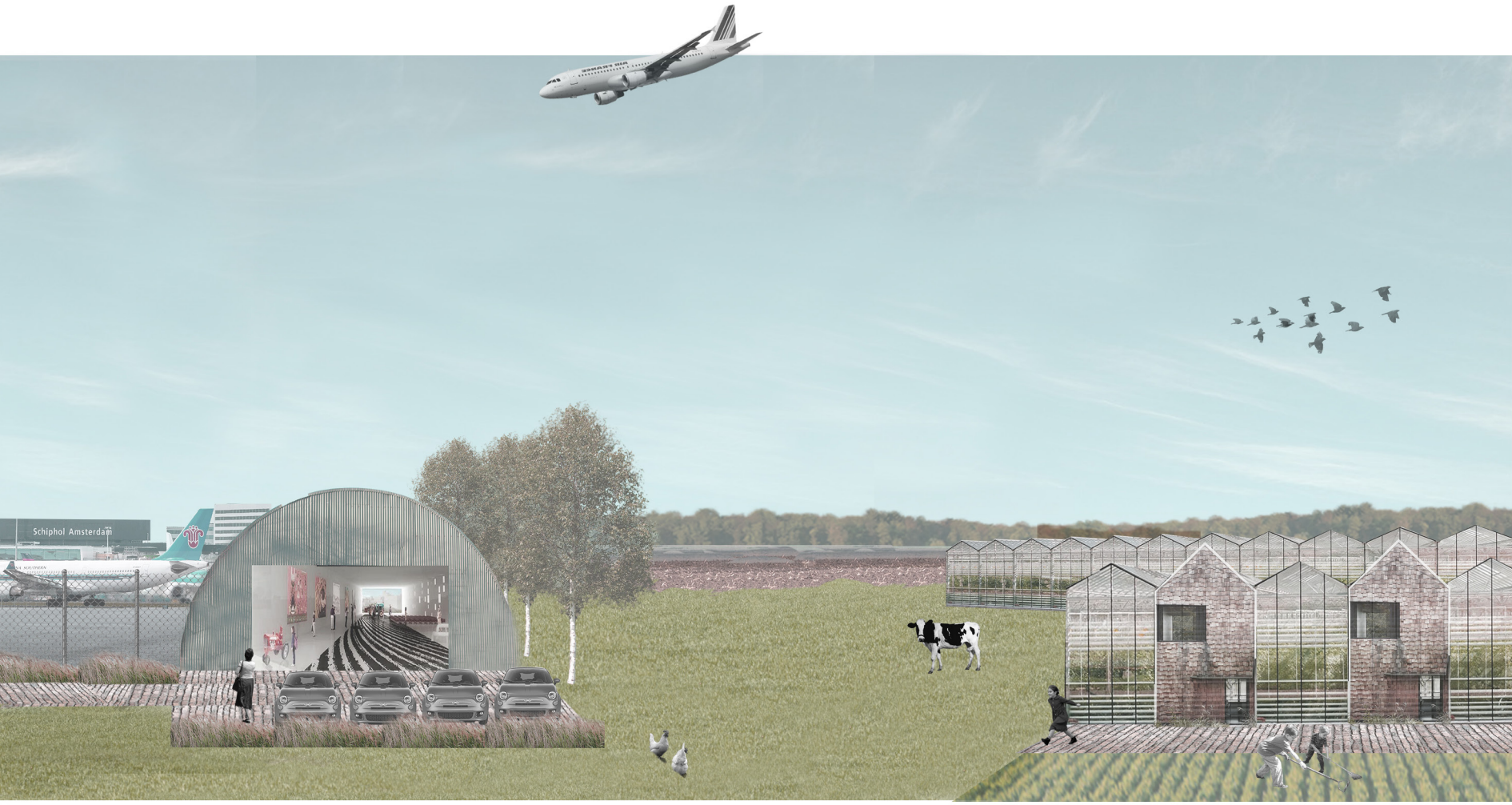


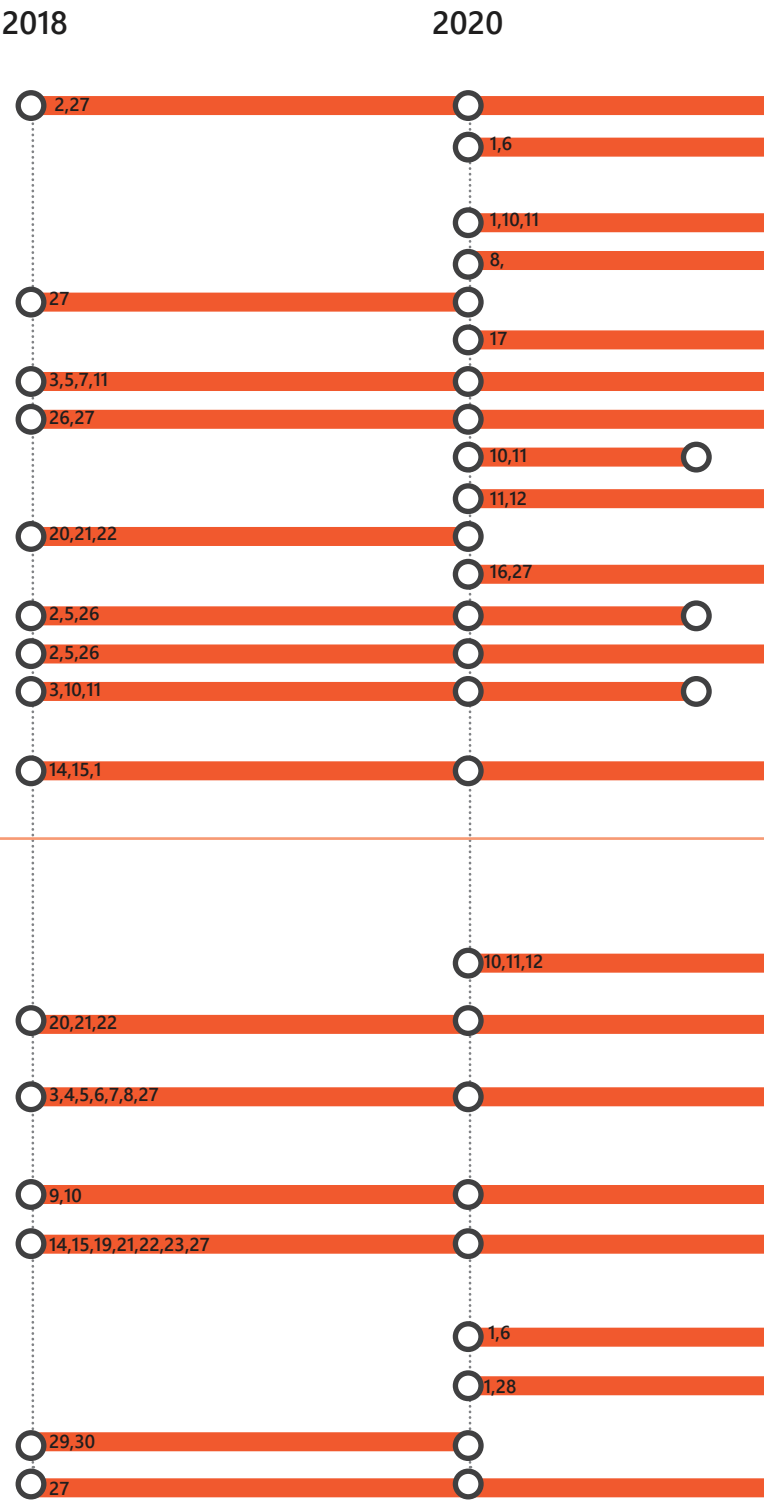
Figure 81 Impression of the food system in Schiphol

Within the Schiphol area there are many opportunities for the regeneration and usage of waste scapes. Not only will parts of Schiphol become empty due to the increasing local food production, there are already numerous abandoned greenhouses within the area as well as an accumulation of waste scapes around the city border. These different spaces can all be regenerated into local farming within the city edges, farming communities within greenhouses and for example an Agrimuseum in the empty pilots around Schiphol.


Schiphol Amsterdam

04.1.9 TIMELINE & PHASING

Location	Aspect	Project
Seed Valley	Production	Seed Valley
		Floating farming
	Retail	Harbour market
		Picking farms
	End of life	Algae farming
		Manure & fertilizer
Schiphol	Production	City edge production
		Greenhouse transformation
	Retail	Specialized stores
		Farmer stalls
	End of Life	Biogas facility
		Compost hub
Amsterdam	Production	Vertical farming
		Urban/community farming
	Retail	Food delivery services
		Farmers market
	End of life	Home biogas
		Waste Separation
Regional	Decentralizing	Reducing power of import/export through mainports
		Reducing marketshare of dominating retail
		Reducing power of waste management incineration facility
	Diversifying	Diversified, expanded agriculture on multiple sites (+reduced horticulture, production on waste scapes, polluted lands etc.)
		Connecting existing retail with local food
		Empowering sustainable waste management facilities
	Connecting	Production trade on water
		Transit Oriented Retail Development
		Input output placement for new waste management facilities
Online	Connecting	Production & Waste Database
		Retail App (Food)/ Waste App




NUMBER
POLICIES INVOLVED
2025
2030
2035
2040
26,27
1,3,28

05.0 CHAPTER

05.1.1 ASSESSMENT FRAMEWORK

RESILIENCY INDICATORS AND ANALYSIS

CATEGORY	METRIC	POLICIES	PROJECTS	LEVEL OF IMPORTANCE	MAIN STAKEHOLDERS	FIGURE OF 2018	2030 MILESTONE	2040 TARGET FIGURE	TREND SINCE 2018
ROBUSTNESS									
PRODUC-TION	% of food transported by local harbors and waterways	1	Floating farms, Aquaponics	3	Distributors, Port Business	0	10%	25%	↗
	% of local food being produced	9	Floating farms, urban farming, edible parks	4	Farmers, Communities, Municipalities, Farmers Association	45,25%	47%	50%	↗
RETAIL	% of local food sold within AMA	11	Farmers markets	3	Farmers				↗
END OF LIFE	% of waste managed by sustainable waste management infrastructure	20,21,22	Compost hub, Fermentation	5	Waste management facilities, Municipalities, Waste collectors	20%	40%	60%	↗
	Number of waste management infrastructure	16,	Compost hub, Fermentation	2	Waste management facilities, Municipalities, Waste collectors	5	20	39	—
REDUNDANCY (SPARE CAPACITY)									
PRODUC-TION	The increased amount of m2 cropland being produced in AMA	4,5,6,7,8	Edible parks, urban farming, floating farms, community gardens	2	Farmers	337	360	392	↗
	The decreased amount of land used for meat production per person per year within AMA	4	Edible parks, urban farming, floating farms, community gardens	2	Farmers, Government	175,45 m2/p/yr	145,27 m2/p/yr	114,43 m2/p/yr	↙
RETAIL	% of market share of small scale retail in AMA	10,11	Local food shop, farmers market, specialized shops, organic shops, on-line shops	3	Retailers	23 %	30 %	43 %	↗
END OF LIFE	m^3 of biogas produced	20,21,22	Fermenting facilities, waste separation system	3	Composting facilities, Sewage treatment plants, Municipalities, (High temperature) Industries	5191168	9182268.5	13173369	↗
FLEXIBILITY AND DIVERSITY									
PRODUC-TION	% of food produced by sustainable methods	5,6,8,27	Aquaponics, floating farms, future innovations	3	Farmers, Knowledge institutes	3%	8%	15%	↗
	% of food transportated by new systems	1,28	Harbour transformations, incorporated train stations	4	Transportation companies, Municipalities	2,5%	16%	27%	—
RETAIL	% of food sold via new retailers	11,27	Farmers market, Specialized shops, Local food store, 'Feed me' app	2	Food delivery services, restaurants, Advertisement companies	10%	13%	16%	↗
END OF LIFE	% of food waste being managed in a sustainable way	14,27	Waste separation systems, compost facilities, fermenting facilities	5	Composting facilities, Sewage treatment plants, Municipalities, Industries	56	68	79	↗

RESILIENCY INDICATORS AND ANALYSIS

CATEGORY	METRIC	POLICIES	PROJECTS	LEVEL OF IMPORTANCE	MAIN STAKEHOLDERS	FIGURE OF 2018	2030 MILESTONE	2040 TARGET FIGURE	2018 TREND
RESPONSIVENESS (CONSTANT LEARNING)									
PRODUCTION/RETAIL	Number of schools connected to the food educational program	24	-	2	Marketing company, Schools, Municipalities	5	20	100	↗
END OF LIFE	Number of programs and activities held by a municipality that showcases food and its importance	25	-	4	Marketing company, Schools, Municipalities	4	7	12	↗
COORDINATION									
RETAIL	The number of train stations to be used to support small scale retail	28	Transformation of stations, local food shops	4	Transport companies, empresas de transporte, goats,	93	95	97	↗
	Amount of people exposed to new retail in 15mins walk	12	Local food shops, farmers market	4	Retailers	0%	10%	30%	↗
END OF LIFE/PRODUCTION	% of reduced CO2 emissions from transporting food products&waste	1,3,5,6,7,8,16	Farmers market, composting facilities, urban farming	3	Transporting companies, Ministry of Economics and Climate, NGO's, Environmentalists	0%	25%	50%	↗
	% of food waste being used back in agriculture area	17,22,23	Composting facilities, phosphorus abstraction, manure	4	Composting facilities, Sewage treatment plants, Municipalities, Industries	28%	41%	53%	↗

**For additional information on the resiliency indicators, please refer to chapter 02.2 Theoretical Framework. The policies for each metric is listed on pg. 136*

05.1.2 POLICIES RELATED TO ASSESSMENT FRAMEWORK

PRODUCTION

1 Municipalities adjacent to large water bodies have to implement harbour infrastructure that can facilitate productive activities

2 Government should create funds to help knowledge institutes to incorporate extension programs (such as workshops and lectures) that help small-scale food producers to gain knowledge and support innovation.

3 Productive areas within 2 km distance of urban areas have to provide a diversity of crops. The plots within this area have to produce more than one type of crop.

4 Livestock farmers have to produce at least 100 kg of protein per square meter. If livestock cannot provide this ratio, the farmer has to complement with high protein crops.

5 Municipalities are to encourage and provide subsidies for implementation of urban farming in social spaces.

6 Municipalities adjacent to water bodies have to subsidise projects that involve farming on water (such as floating farms or aquaponics).

7 Contaminated soil has to be cleaned through an organic process (such as phytoremediation) to be able to use the space for local production.

8 Municipal urban greenery plans shall allocate 20% of edible parks into sections of their public parks.

RETAIL

9 All retailers have to sell a 25% minimum of food produced within the AMA area

10 Municipalities shall support local retailers (Farmer markets, specialty food stores and organic food stores) to expand by providing financial support and tax reductions.

11 Farmer markets shall be encouraged to be implemented in transition zones between urban and agricultural areas. These are heavily emphasized near major transit infrastructure.

12 Every household should have access to local food within a 15 minutes walking distance.

WASTE

13 Municipalities should invest in campaigns and strategies to inform citizens about the value of food in order to reduce disposal of food within households with 20% by 2040.

14 Food waste and other organic waste has to be separately collected within households to reduce 50% of food waste incineration.

15 Companies and industries that violate food waste separation standards are met with an economical penalty.

16 New composting facilities can only manage waste within 10 km distance.

17 50 % of phosphorus used in food production needs to come from an organic source (such as compost or manure).

18 Farmers should reduce their food waste with 15% by 2040.

19 Municipalities should encourage citizens to separate food waste by providing an economical bonus that can be used in local food shops.

20 All sewage sludge from sewages has to be fermented to create biogas.

21 Municipalities have to ferment and compost all food waste they receive.

22 All food waste that is not suitable for human or animal consumption should be fermented and 100% of fermented food waste has to be composted.

23 40% of phosphorus needs to be abstracted from sewage treatment facilities by 2040.

ALL

24 Schools are encouraged to develop an educational system to help children have an increased awareness of the food system and for them to understand the relevance of dietary preferences and needs.

25 Municipalities should advocate for sustainable food practises.

26 Future buildings that incorporate production of food, commercialization of food and sustainable food waste management get an increase of 5% in their total gross area.

27 Municipalities should encourage innovation within food production, retail, waste management and connections between these stages of the food sector through subsidies.

28 Train stations within 20 minutes drive of agricultural and urban areas will be equipped to transport food.

29 Food producers should be transparent on what they produce and have to report their crop production in a new governmental database.

30 Waste management facilities should be transparent and measure the amount of food waste they process.

05.1.3 SCIENTIFIC AND SOCIETAL RELEVANCE OF PROJECT

Societal relevance

Societal relevance concerns the creation of public goods. What are we bringing to society with our project and what public goods do we improve or strive for? A couple of the most important aspects within our project are explained in the next few paragraphs. The overarching goal of this project was to improve sustainability within the region. For this reason, we connected our strategies to some of the key Sustainable Development Goals within our project.

We are encouraging the region to continue thriving as a key player within the food industry, yet doing this in a more sustainable way. Our future vision includes options and solutions for all and enable people to advance socially and economically in a more resilient an sustainable way.

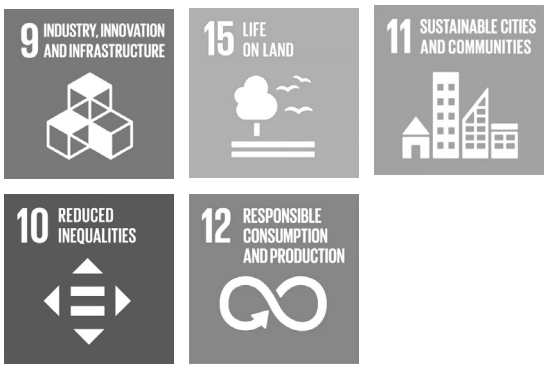


Figure 82 Key Sustainable Development Goals connected with Food Island

Decentralized system

A decentralized system which is connected and incorporates diverse sustainable options, will reduce inequality. With having more local actors, competitiveness can increase, controlling stakeholder decrease and therefore prices can lower as well, without affecting the quality of products. This is achieved both spatially and non-spatially within our project. For example by improving slow traffic infrastructural connections between local production and consumer which is also spatially connected to local retail options, new connections can be made.

In addition, by implementing more alternatives to local food production such as rooftop farms, community gardens or edible parks we are increasing the capacity of the region to feed its population. This will increase the identity, sense of belonging and responsibility of the population towards these public and collective spaces, but it also makes the system transparent and accessible which expands equality.

Closing loops

An important aspect with trying to create more sustainable cities is the aspect related to knowledge and education. In order for sustainable systems to be durable, awareness and participation within society needs to be addressed. Since education is largely non-spatial, we created policies and incentives for people to increase participation. By exploring all different stakeholder, actors and their power within different parts of the food system, it is more clear how to address them.

In addition, the development of on-line applications and websites make it easy accessible for the larger public to learn and do more within the sustainable food system. Using education as part of the strategies aims to have a society that makes responsible choices when it comes to the consumption of food. Another side to responsibility is changing production patterns and informing worker within the agricultural sector. Our project aims to have a more transparent system, which improves the knowledge and awareness within the system. One of the strategies includes the involvement of the agri-food industry in urban initiatives. So that the overall community improves and therefore responsibility increases.

Accessibility from different angles

As part of our strategies related with accessibility is the implementation and improvement of infrastructure. Certain railway, highway and water nodes, improve the connection and trade. For retail these nodes are located in high density areas and work together with Transit Oriented Development. For production, this is the use of waterways and harbour structure. Production is adjacent to these nodes, even on the water itself with floating farms. These ways of overall trade of production is more efficient and diverse. Within food waste management, accessibility lies in the direct connection between input and output. Placing new facilities near these locations and creating a regional system makes it better accessible.

In addition, by promoting initiatives based on shorter and flexible chains in the food system, we significantly reduce the distances that resources need to travel between their production, processing, consumer, consumption and disposal. This translates in energy and water savings, reduction in CO2 emissions and fresher food products. Less transportation can even impact noise contamination and traffic conditions in a positive way.

Halting and preventing environmental loss

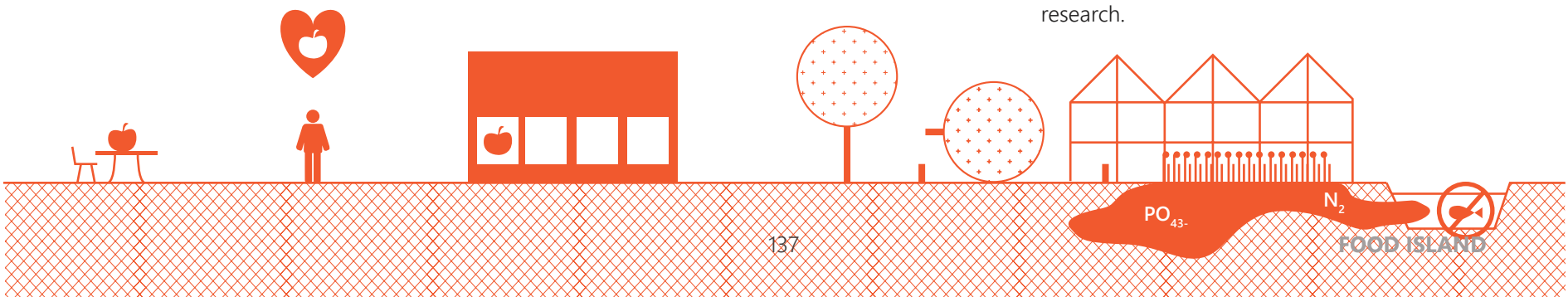
Another set of strategies involve the diversification of local production. With the fight of land within this region (and within many other areas), one could argue that biodiversity therefore only decreases and impact on the environment is raising. However, the possible solutions and diversification of local production, are all met in a more sustainable way. For example, new production will not be placed within conservation areas, but rather on remediated polluted lands. Also, by having a more self-sufficient system, the intensification of production can decrease, which is beneficial for the environment.

In relation to the end of life of food related products, our strategies increase the percentage that is managed in highly sustainable ways, such as feeding animals or creating compost instead of opting for incineration. This will involve increasing the amount of waste bins that are specifically for organic waste and are accessible to everybody as well as creating a smart collection system for this kind of waste.

Scientific relevance

As mentioned in the first chapter within our motivation, there is currently a lot of research and initiatives being done in order to improve sustainability (Derissen, 2009; Jonkhoff, 2012; Rood, 2017). Within our project, we are exploring, explaining and demonstrating the relevance of resilience in the circular economy and showcase different ways to improve it. In order to create a more sustainable economy, this should be in a close relationship with and connected to resilience. This is especially important for the food system in the AMA, since it highly depends on certain stakeholders and aspects within the chain. There are some key elements within our research which can be scientifically relevant.

Firstly, since our project is highly theoretical, other research can draw upon ours and with that a database on key aspects of resilience and approaches to improve sustainability can be set up. This helps not only governing bodies, but also private and non-profit organizations in effectively developing sustainable goals. Secondly, our project has a large political message, which in our current urban and economically focused environment might not be instantly implemented. However, it can open up eyes and minds and with small steps have a relevant impact on scientific research and governmental regulating and coordinating. And lastly, another aspect on which we elaborated in multiple ways is the methods of researching. By implementing scenario planning within our project and by working with tool such as weather mapping, our research is quite broad. It allowed us to go into detail in what the problems were and where opportunities could be found, but this same method of conducting a research can be applied to other flows and systems as well. The structured way of working within our project and therefore large exchangeability factor of researching can be easily adapted and enhanced in order to serve other scientific research.



05.1.2 ETHICAL CONSIDERATIONS

DO WE HAVE THE RIGHT TO DECIDE THE PUBLIC INTEREST BEING FOOD?

Our strategy aims to create a more resilient food system in the AMA and considers food being involved in new urban developments, transformation of public spaces, new infrastructure and even education. The AMA, as any other region, has to deal with multiple problems. So why should so much priority be given to improve only the food system?

However, a sustainable food system is an important public interest. It not only feeds the population, but it impacts other sectors significantly as well. Food also has a high societal relevance, it is part of people's daily life and it plays a major role in social interactions.

In addition, food is one of the biggest sectors in the Dutch economy and very competitive in the global market. It leads in innovation and agro-technology, which creates many job opportunities, specialized knowledge for the educational sector and benefits for the overall economy. By improving the possibilities to divert the flows of food products we can reduce CO^2 emissions and water and energy consumption. This has a direct positive effect on the environment and people's health.

In conclusion, there is not really "Choosing food over other aspects in a society" By working on improving the food system we can also improve other aspects of our environment.

CAN WE ENFORCE DIETS?

One of our most important strategies in order to make the food cycle more sustainable in the region involves using education and public agendas to influence the food consumption and habits of society. But to what extent should this influence be implemented and does will it create conflicts with the personal freedom to choose what to eat?

We are using the notion of awareness to make people understand the importance of choosing certain types of food over others. Some arguments of why we should do this relates to the environmental impact and carbon footprint of certain food types and produce methods. Other arguments like animal welfare, use of chemicals and working conditions can also privilege some food products over others. So in this case, influencing the food consumption is meant for a larger public good and can therefore be seen as ethically correct.

The book "Food ethics" from Gottwald F. and Werner H. (2010) explains that by using food traceability we are able to learn about the history and processes that food goes through, which allows us to make a better informed choice when it comes to food. With this and other sources of knowledge, consumers can take the role of citizens and shape the contemporary food supply chain. At the same time, citizens would be informed about food products that are more sustainable and can maintain a balanced and healthy diet. Awareness helps people to understand what is involved in producing the food they are choosing to consume. This can lead to a change of diet based on interest and not a forced change.

DO WE HAVE THE RIGHT TO CHOOSE ACCESS TO FOOD WITH SPATIAL IMPLEMENTATIONS?

In centralized systems, the tendency is to have the most options in places with high density and fewer options where there are not that many people. This can be seen as ethical inequality. In these centralized structures, it is expected that population would just regularly travel to the "center" where most services are located. As a consequence, people spend a lot of time commuting and not all food is available to everybody. However, with proposing new and better connections within our vision, we are implying the same possibilities of inequality.

We analyzed the region and realized that sometimes food travels long distances to get to the consumers and the processes within the chain are very complex and more times than not, unnecessary. Food is actually being produced much closer and could be directly purchased if connections allowed this. Our proposal still provides multiple options in areas with high number of inhabitants, but we are including complementary options for the surrounding neighborhoods. These areas have the privilege to be located not only relatively close to centers, but also to productive areas. We are transforming productive city edges, increasing the diversity of food products and options for retail that connect directly producer and consumer. They overall accessibility to food therefore improves by these spatial implementations, so it is ethically a more open system.

CAN WE CREATE A REGIONAL SYSTEM WHILE EXCLUDING ITS GLOBAL ECONOMIC POSITION?

In the current model, the role of the global economy is significantly high. Within the food sector, it involves the import and export of large quantities of food, which is large part of the Dutch economic model. In the case of the Netherlands, there is also a high dependency on imports, since there is a mismatch with local production, which isn't feeding it's own population. However, within our vision we are trying to improve this dependency by creating a more self-sufficient system, which inevitably means excluding the global economic position. Is this allowed?

The idea behind testing the food system in the AMA region and increase its level of self-sufficient is not because we believe that the region should become independent from a global economy, but it is to increase resilience. Knowing that the region can increase its level of self-sufficiency would help it to adapt and function despite external changes. This also makes the global network less dependent on this import and exportation of food. Which is better for the environment as well.

This same concept is addressed by the FAO, (2011) concluding in one of their reports called Food self-sufficiency and international trade: A false dichotomy? 'The aim is not to produce 100 percent of their food on domestic soil, but rather to increase domestic capacity to produce food, even if the country engages in food imports and exports'. This provides the AMA the power to play with the level of interaction in the global economy. The relationships, imports and exports will not be based on dependency, but based on optimizing benefits for the economy, environment and society.

CAN WE PRIORITIES PRODUCTION AT THE COST OF OTHER ACTIVITIES?

The scenario explores the possibilities of transforming the AMA region, primarily based on the improvement of the food system and food related activities. But can we say that this is the most important activity?

Some common sense is required to keep the different functions of the region in balance. We propose to increase the productive surfaces, but not to an extreme where other aspects of human live will be deteriorated. Maintaining conservation areas, implementing production alternatives that benefit biodiversity, prioritizing new development areas to incorporate urban production of food and finding ways to re-purpose underused facilities related with the food industry are some examples of implementations that could increase productivity without limiting other functions in the AMA region.

In addition, multiple options were explored by using the scenario tool. Aiming for a 100% self sufficiency of the region while maintaining current dietary demands would require alterations in the use of land that would cause more harm than benefits for the economy, people and environment. Therefore, opting for a moderate increase of this self-sufficiency aspect will be the ideal scenario to implement in the AMA region.
Likewise, we thought about other aspects of the food system and starting out with drastic thinking is very helpful to look for unseen opportunities. So before narrowing down a concept to it's ethical requirements it is beneficial during the process to start begin with extremes.

SHOULD WE CREATE JOBS IN THE FORM OF A DECENTRALIZED SYSTEM WHILE LIMITING LARGER BUSINESSES FROM GROWTH?

The projects and policies involved in our strategy aim to give more power to local and small scale stakeholders, while limiting the control that centralized parties currently have. This inevitably means that the businesses will be economically limited, which can impact jobs and profit.

It is possible that a powerful centralized stakeholder is not only profit oriented, but also attempts to create good working conditions and limiting the environmental impact. However, there is a big risk in depending so heavily on a limited amount of parties to make the food system function. The interest and priorities of these stakeholders can change and disrupt the entire system.

By opting for a decentralized system, many parties are able to collaborate within the system. This means, that there is not only a bigger pressure on them to perform well, but it also allows them to learn from each other with creating more opportunities for new parties to get involved. This aspect is also confirmed by Johnson and Minis, 'the transfer of responsibilities to local units of government can result in significant benefits in terms of accountability, transparency, problem solving and citizen participation" (1996). Under these conditions, it would be difficult for large stakeholders to dominate the food system, because of the increase in transparency, which makes make the system ethically more correct.

05.1.3 CONCLUDING REMARKS & GROUP REFLECTION

Concluding Remarks

Our analysis highlighted three aspects within the food system (production, retail and end of life) that are largely dependent, unsustainable and showcased opportunities to change. We regarded these as the most important within the region and our vision elaborated mainly on these three aspects. This of course doesn't incorporate and encompass the food system to its' full extent, such as the unsustainable aspects within processing and distributing food. The projects and policies that we chose, align with the best practices and applicable situations regarding our strategies.

In addition, we didn't take other systems or flows into account which are also applicable within the region and could impact the food system as well. It is generally understood that building construction, energy and water flows are heavily involved with the food industry but due to the condensed time frame and the want to go into further depth with just the food flows, there is less of an emphasis on the other flows. Another issue with doing such a specific research topic is that some urban and food related trends might have been overlooked. This is also a negative implication of regional planning in general and specifications on certain areas might change on a more local scale. Another element that was also excluded was the national and international impacts and how that may impact of our vision, which we excluded by setting a certain boundary.

Our project tries to objectively pinpoint the problems within the food system and it highlights a set of issues within a broader urban context. It also showcases possibly crucial areas to put more focus and coordination on within the region while planning.

Lastly, with the way that the research was set up, the analysis and strategies can be continued and elaborated following the same structure. The research method is also an applicable tool for analyzing and designing other systems and within other areas which makes, in our opinion, the project quite intricate and comprehensive.

Group Reflection

Spatial planning

Neither of us was very familiar with the scale and methodology of spatial planning when begun the project. However, throughout the weeks of exploration, researching and designing, we would like highlight three key aspects that we have learnt from project:

Playing with different scales: Spatial planning involves interventions on regional scale, city scale and local scale. This therefore also means a large amount of stakeholders and actors that could play a role in the project. Going back and forth through these scales helped us during the process. Focussing on super-local principles and objectives for example, helped us to build a better sense of the projects and policies which we could then develop in an upscaled matter.

Conducting concrete research: It is very easy to get lost into research when working on such a large scale. There can be large amount information from various resources found that sometimes conflict with one another as well. However, it is important to stay focussed on the spatial elements within the area which provide support. This wide research has also resulted into more evidence-based outcomes within our project, rather than utopianism approaches.

Exploring new planning tools: Since we were so unfamiliar with spatial planning, it allowed us to work with different methods to answer our research question and to form a final vision for the region. We were very open to try out different methods and ways of exploring the project which helped a lot during the process. For example, the use of scenario planning as a tool emphasized our focus point and allowed us to try out different outcomes. In addition, the instrument of weather mapping brought up and highlighted opportunities for our vision.

Group Work

Our project was highly theoretical and politically loaded, this made it difficult for us to communicate complex aspects. Not only communicating to each other begun as an obstacle due to the language barrier, but also communicating to our professors was a task on its own, because we were so deep into theories and research. However, over the course of the weeks we have become more and more effective with our communication to each other. We exploited drawing while talking and using references to show our ideas. Another aspect that comes with complex situations, was the amount of research that went into the project. We have learnt how to divide work and tasks over ourselves in individual or smaller groups, without getting 'lost into detail'. We tried to always provide each other with critical comments and whenever necessary we exchanged work and helped out with for instance language skills and graphics.

All in all, we are very proud of the work that we have done over the past weeks and the things that we have learnt from working in highly motivated and diverse group. The lectures provided by the studio helped a lot with pushing us and elaborating our research in concrete forms. In addition, we would like to thank our professors, who helped out a lot with their great patience, summarizing and concluding our work when we were lost and complimenting each other with clear structures and design ideas.

APPENDIX

A INDIVIDUAL REFLECTIONS

Cristian Rodriguez, 4747542

The power of society's dietary needs and preferences and their influence in the land use.

It's incredible to think how much our diet can change the availability of land in a country. In the Netherlands, where land is limited and every m2 is efficiently used, this becomes especially relevant.

First of all, the dietary preferences are the reason why certain types of food need to be produced. If a country cannot produce enough or they cannot do it efficiently, they would heavily depend on imports to meet the population's needs and preferences. For example, people wanting to consume spinach in winter makes it relevant for the economy. It turns out that importing the spinach from Spain has actually a smaller CO2 footprint than producing it in the Netherlands during the winter, so they would choose to import the spinach to satisfy the demand.

But instead of having to choose between these 2 not very sustainable options, a third alternative is to make people aware of the impacts of their diets and hopefully change their consumption behaviors. If people opted to consume less spinach in winter, it can do a lot of good for the world in terms of saving energy, polluting less, etc. By doing so, it is still possible to find other local food products that can grow properly in winter and can provide the same nutrients that the spinach would.

Thanks to this project, and the fact that the group chose to work with scenario planning to set rigid boundaries to the AMA, we were able to quantify and measure the impacts that certain interventions would have on the region.

An good example for this is meat consumption. Currently, raising a cow and feeding it for a couple of years before they get slaughtered and consumed requires a huge amount of land (We need 6.8 m2 to produce only 100 grams of meat). Now let's imagine that we drained half of the Markermeer surface and transform it into productive land to feed cows. We could to this in order to increase the amount of meat available in the country and be more self-sufficient. Such intervention would take decades, unimaginable amounts of money, energy, people and technology to implement it.

To reach the same percentage of self-sufficiency another strategy is to have people understand that consuming meat protein is very unsustainable and that there are other food products that can replace its nutrients such as algae, fish or legumes. Based on the calculations that we've made, if the population of the Netherlands chose to eat 250 grams less of beef every 3 weeks (1 Portion approximately), it would have the same impact than draining 50% of the Markermeer without transforming any land surface.

When we were proposing to improve the level of self-sufficiency of the AMA region, we realized the power of strategies such as raising awareness and increasing civic responsibility in the population so they would choose more sustainable food products to consume in their regular diet.

Now, imagine that we all chose to not eat beef at all! So much land would be free to serve other purposes. We could expand natural areas to keep and protect biodiversity or it could be used for city expansion where there is a high demand for housing and not enough room to build. As I mentioned before, people's dietary habits have enormous power that can even reshape the whole country.

Charlotte von Meijenfeldt, 4209990

Overall the project was a huge learning process for me on three different aspects: working together within a group, tackling complexity and the implementation of policies. I will describe these three aspects shortly and how they changed me or altered my views during the project.

Group work

Other members of the group have probably taught me the most during this project. Most of my group members handle projects in a very different way from what I was used to. In the beginning I struggled with this but after a while I decided they were actually the ones I could learn the most from. Because of them I think I have learned to communicate in a better way. I have learned to do more instead of think more. This led to shifting my focus on the process rather than the end result.

Tackling Complexity

Another reason for learning to do/draw instead of think was the complexity of the project. Already within a city it is impossible to grasp the complexity let alone within a regional scale. This forces you to choose one research direction. Since our research direction remained very broad we really had to deal with this complexity. Numerous excel sheets later I have learned that there are a lot of ways, criteria and scales that you can use to view a region. The many ways in which we tried to tackle the complexity of the project have also showed me the numerous ways of creating a regional design (with the help of our tutors).

Implementations of policies

This project was the first time I had to write policies. While writing these the difficulty of actually creating them arose. They really force you to think realistically about the implementation of a project. Of course our

policies are not all as realistic as we could have hoped but the process of creating these was very interesting. This is also where I thought the differences in cultural perspectives within the group surfaced. The creation of policies and looking for the incentives are strongly connected to governance and this is strongly connected to a culture.

To conclude I have to say that I have learned the most from my group members. Of course there were struggles but I really learned to put my own thinking aside and listen and learn from others. Apart from that I am glad we focused on the process and the creation of a vision rather than the end result because I think we learned so much more from it. I am glad we embraced the complexity even though it may have resulted in a complex end result.

Ranee Leung, 4750241

The Complexity of the Food System

As regional design and the circular economy was the core theme of the third quarter, it was important to critically think about the current ongoing and future trends within the AMA. Developing parameters for regional design is crucial so that designers and planners can create plausible development for the future that will greatly impact the social, cultural and environmental realm of a region. Long-term strategic planning is important to reflect on existing spatial conditions, policies as well as debating solutions in the current region. There were several trends that Food Island tries to address in the project and this was further analyzed through using the tool of scenario planning and weather mapping. Several critical issues that were apparent within the food system were notable throughout the food system but as mentioned in our report, only focus on three primary issues. First, there is a dominant stakeholder market in each aspect of the food chain which was also very apparent spatially as they were seen as centralized systems of control. Often at times, it appeared as if it will be difficult to distribute and create variety within the market of giving more power to other stakeholders. The second main is the increasing dependency on these stakeholders or large infrastructural nodes that provide for the region. It is important to critically change how the region is developing and who is making the decisions to move it forward.

Governance and Stakeholders

Throughout the project, we critically analyzed how stakeholders would be involved throughout key projects and milestones. The municipalities and governing bodies have a large and potential impact on our project as it would require them to impose several policies such as: implement subsidies, creating tax and regulating the food system. There are other critical stakeholders involved but the general mindset is to have the general public understand how their actions and demands really impact the food system as a whole.

The Future of the Food System

Inherently, the direct goal of the project is to educate the general public to critically think where their food comes from and who is currently managing the market. It is an important practice within the realm of education to also understand how much waste is generated from households and the impacts that has on the environment. It is critical to think about the long term sustainability and resilience of the region, not only in terms of food flows but also all the other interconnected flows such as waste, water, materials and energy. Having a holistic view of the region can not only empower stakeholders and the public, it should inform them on how to create a more liveable and healthier environment. In addition, decentralized systems and forming networks are also key to our strategy in the means of reducing risk in the system. Reducing dependency on centralized systems should always be considered. Although there is a setback in implementing this system as often it can be expensive and requires more communication with all stakeholders involved. Several of our strategies also require a lot of local implementations and as a collective whole it would impact the region. Another critical issue is that it important to reflect on the stem of the problem of the issue and that is based on wants from consumers. It can also be challenging to think of methods of how to work with stakeholders that have high power but low interest in the project. It was very challenging to see the output of linking all the subsystems together that were spatial and non-spatial. However, a key strength in the strategic spatial planning of the project was honing in on creating a very detailed analysis of the existing system and finding key vulnerabilities. The project can be seen as very critical, theoretical as well as political. As an individual, I learned a lot within the team setting on employing different tools to analyze at a regional scale. It is important to note that there are a variety of methods to employ and develop regional planning.

During the whole process of our project, the studio and lectures helped me to develop a better understanding by questioning what is spatial planning and its tools. It is also a great self-improvement by learning from my teammates and finding the ways in terms of cooperation.

Identifying trends and challenges for AMA
I referred to the Spatial Planning in Germany as a study case and founded that throughout federal, state and regional level, municipalities and their surrounding areas in Germany are identified as metropolitan areas, central areas, transition areas etc. based on their population trends as well as influential capacities. In AMA, the same preconditions are obvious that certain cities are expected to grow while others are shrinking based on their comparable high or low current density, and it will certainly contribute to enlarge the existing differences of spatial agglomerations and allocation of food resources.

We found that AMA has shown a great dependency and uniformity in terms of big stakeholders, like AEB for waste management, Schipol for import and export etc., which represent certain vulnerabilities to meet particular future challenges. In this way, we concluded the food system as a centralized, simplified and disconnected one.

A more resilient AMA
By developing theoretical framework, we found out that sustainability can only be achieved when both circular economy and resiliency are satisfied. As AMA is currently focusing only on circular economy, we believe that a more resilient food system has to be developed in the region to accomplish the basic value-sustainablility. We've also tried to respect other sub-values like equity, accessibility, biodiversity etc. at the same time.

The role of spatial planning
The concept of spatial planning in my opinion is a general idea in super-local level which will later be detailed as specific measures in local level. Coordination and consensus above local level to raise awareness of different actors, no matter private sector, public one or social society are essential and can be achieved by analyze current situation and future trend and introduce a common goal based on weighing interests. An ideal picture of future can then be developed based on which further interventions can be carried out in forms of projects or policies.

The goal and principles of spatial planning
In our project, we tried to build a more resilient food system in AMA based on the basic value: Create a more balanced whole-food-life across the region.

In this case, several principles are to be observed: Decisions shall be made by weighing different interests(public participation); Interventions need to be arranged through the timeline and revised by milestones(impact assessment); The interest of private sector can only be damaged by legal planning intervention based on public interest and refunded(legal procedure); The principles of the planning should be observed by every municipality(enforcement power).

The challenges of spatial planning
To achieve our goal, the current preconditions ought to be interpreted, such as knowledge (ie. AMA is an advanced area of high-tech agriculture), common goals (ie. circular economy is forming as a consensus in the region), stakeholders (ie. AEB and other potential stakeholders are willing to participate) and governance (which is trustful and transparent). Challenges are also apparent, for example current research is not enough to support further improvements on food resiliency, and it is not feasible enough to implement new actors or improve the connection since more support, especially financial ones, are needed from municipalities and other stakeholders.

The way to accomplish our goal- participation
The challenges as mentioned above make it crucial to raise the consensus by involving different stakeholders through formal and informal participations.

We've classified the actors according to their interest, power and attitude, and policies related to specific projects will involve different stakeholders based on the principles, leading them to share the responsibilities and benefits at the same time.

An effective and efficient participation
While participation help weighing the interests of different stakeholders, it is still hard to say how well it is weighed and if participation is a great waste of time as well as money. To avoid the negatives, participation should be guaranteed by a reasonable planning procedure as well as supported by legislation in different levels.

During planning procedure, stakeholders need to be informed in every step of spatial planning, and they will be given right to declare their opinions, and the gathered recommends are to be revised each time after public participation. The time of participation has to be well informed as well as limited so that recommends after the participation will not be considered.
In terms of legislation, binding ordinances are supposed to be carried out by municipalities, or autonomy can be designed to certain associations or local government by law to implement the principle and aim of spatial planning.

It is also necessary to evaluate the progress of participation and its outcomes every certain period of time. By acting as an advising party, institutions and universities are encouraged to work with different stakeholders to minimize the conflicts.

Franka van Marrewijk, 4343980

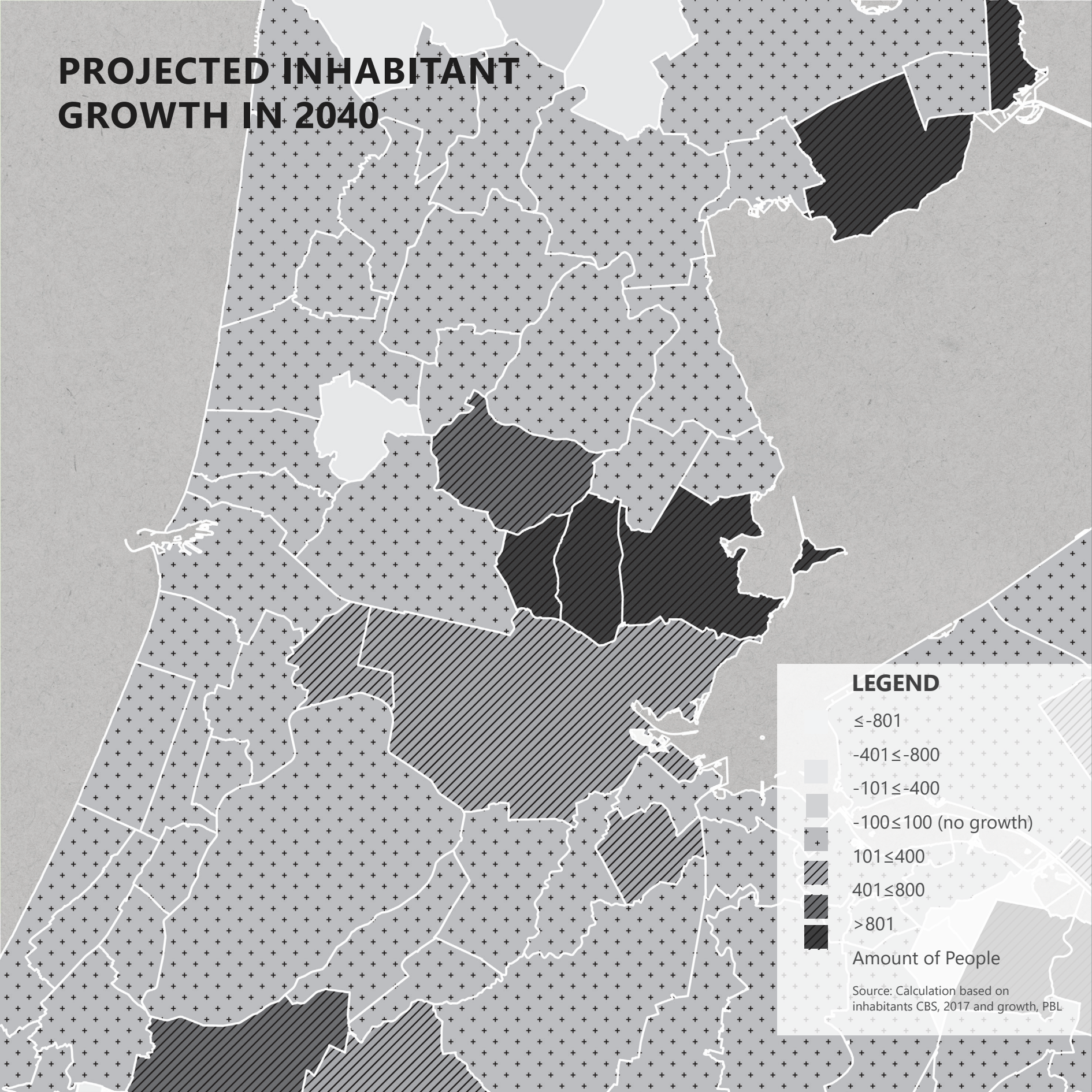
Food under control Taking the food system back into our own hands

The most important trend that we address within our spatial development is the growing domination and market control of stakeholders within the food system. This handful of large actors slowly exclude smaller and more sustainable options within the system and it also makes it economically difficult for new alternatives to set ground. In addition, the non-circular food chain is continuously elongating. While a more centralized system might be efficient, the profit oriented businesses only react to the population's needs and wants, causing an increase in steps in the process from production to consumer. At the same time, re-use and recycling all this waste along the chain isn't large scaled implemented and valuable food waste predominantly ends up along other waste streams.

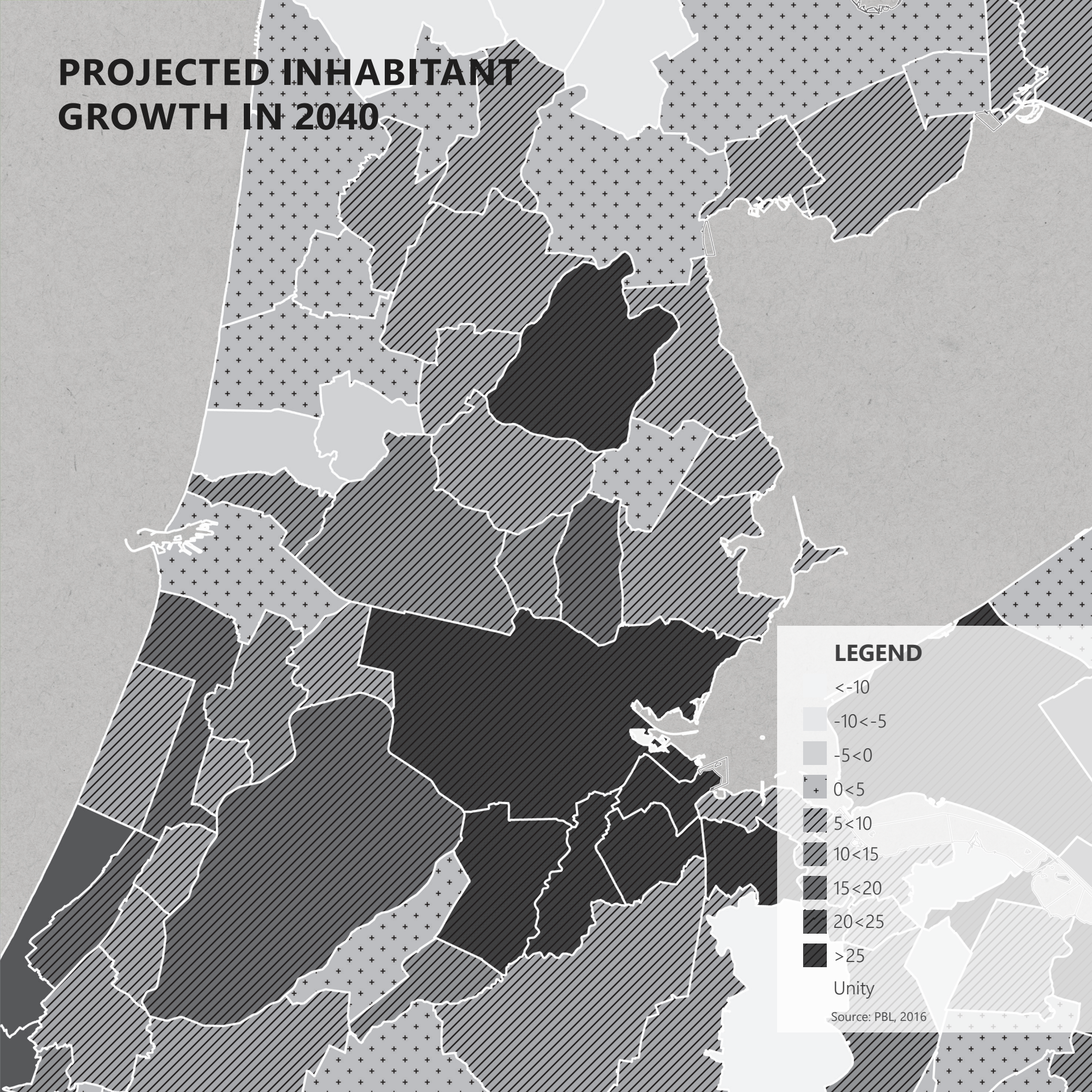
I envision a food system that is more directed by what is provided by local production, instead of us (indirectly) deciding for the unsustainable imported, chemically drenched and packaged food from China. Which is also is provided through controlling stakeholders. I would like myself and others to be more aware of where food comes from and what happens after it is thrown away so that our ecological footprint can reduce. It is a very difficult task to spatially decentralize dominating and high-powered stakeholders, which means it needs to be tackled with an integrated combination of spatial and non-spatial implementations, policies and incentives like we attempted to do within our project. Saturating the market further and placing more localized and sustainable options isn't solving the problem by itself. It is also about calling upon the population's incentives, engaging them and empowering sustainable options. Within a spatial development plan this means making it easy accessible and approachable through the means of slow traffic infrastructure and Transit Oriented Development plans. Secondly, another important aspect to raise awareness, I believe, lies within including and reacting on technological and online trends within our economy which relate to the food industry, which we only addressed slightly within our vision. People are constantly on their phones, online and on social media. Larger governmental bodies should take a bigger step in working together with education, innovation industries and technology businesses for both fun and knowledgeable applications or websites.

One of the strengths within our project is that we extensively researched, located and pin-pointed the problems and stakeholders within the area, but we also looked for opportunities. A weakness, however, is connecting all these subsystems within the larger structure on a smaller, more detailed scale. A drawback of regional planning is that it can only provide guidelines and restricting tools, but actual implementations need to happen locally. Another weakness of our project and vision is that it is rather a political strategy and change in mindset, which makes it difficult to push strong incentives and policies forward in a plan. I do think however, that projects and research like ours can open up eyes and minds and eventually help with a collaborative process of change.

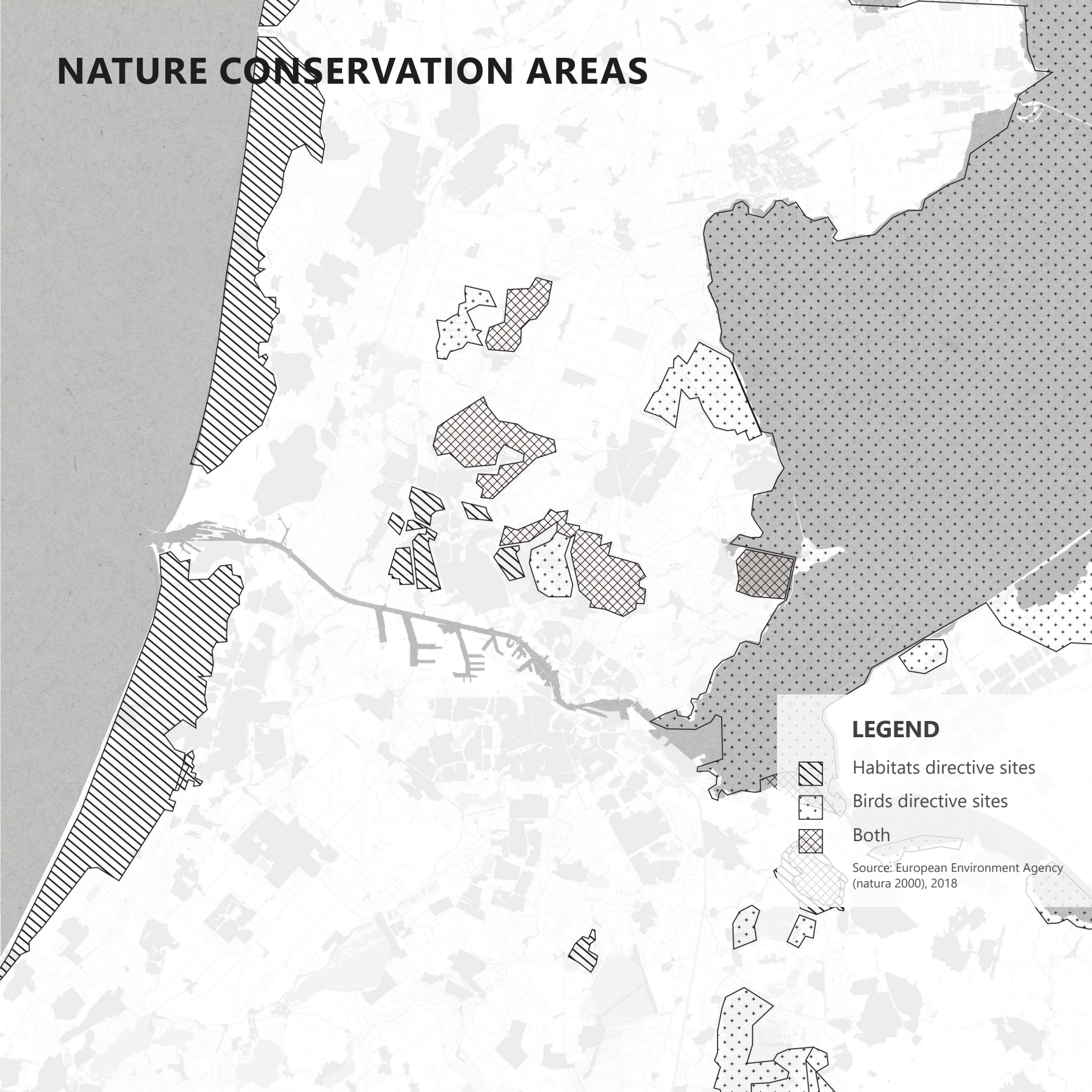
PROJECTED INHABITANT GROWTH IN 2040



PROJECTED INHABITANT GROWTH IN 2040



NATURE CONSERVATION AREAS



DATA AND CALCULATIONS

1. CURRENT DIET IN 2040			
Food group	Grams per person per day	LAND REQUIRED (KM2) Yearly	LAND AVAILABLE (KM2)
Fish	11	57,58	
SUBTOTAL WATER PRODUCTS	**11**	**57,58**	**527,33**
Beef	23	629,04	
Pork	45	524,09	
Poultry	22	210,16	
Milk	305	478,95	
Other dairy	60	800,86	
Eggs	12	54,96	
SUBTOTAL ANIMAL PRODUCTS	**467**	**2.698,07**	**903,75**
Vegetables	200	78,52	
Rice	40	68,05	
Wheat (Cereals)	196	359,08	
Fruits	248	162,27	
Potatoes	88	23,03	
Legumes	11	28,79	
SUBTOTAL CROPS	**783**	**719,73**	**336,98**
TOTAL	**1.261**	**3.475,37**	**1.768,06**

2. IDEAL DIET IN 2040			
Food group	Grams per person per day	LAND REQUIRED (KM2) Yearly	LAND AVAILABLE (KM2)
Fish	27	141,33	
SUBTOTAL WATER PRODUCTS	**27**	**141,33**	**527,33**
Beef	27	738,44	
Pork	27	314,46	
Poultry	27	257,92	
Milk	400	628,13	
Other dairy	50	667,38	
Eggs	12	54,96	
SUBTOTAL ANIMAL PRODUCTS	**543**	**2.661,29**	**903,75**
Vegetables	200	78,52	
Rice	40	68,05	
Wheat (Cereals)	200	366,41	
Fruits	200	130,86	
Potatoes	150	39,26	
Legumes	11	28,79	
SUBTOTAL CROPS	**801**	**711,88**	**336,98**
TOTAL	**1.371**	**3.514,50**	**1.768,06**

3. SUSTAINABLE DIET IN 2040			
Food group	Grams per person per day	LAND REQUIRED (KM2) Yearly	LAND AVAILABLE (KM2)
Fish	**30**	157,03	
SUBTOTAL WATER PRODUCTS	**30**	**157,03**	**527,33**
Beef	12	328,20	
Pork	12	139,76	
Poultry	17	162,40	
Milk	400	628,13	
Other dairy	50	667,38	
Eggs	12	54,96	
SUBTOTAL ANIMAL PRODUCTS	**503**	**1.980,82**	**903,75**
Vegetables	200	78,52	
Rice	40	68,05	
Wheat (Cereals)	200	366,41	
Fruits	248	162,27	
Potatoes	120	31,41	
Legumes	**30**	78,52	
SUBTOTAL CROPS	**838**	**785,16**	**336,98**
TOTAL	**1.371**	**2.923,01**	**1.768,06**

CURRENT DIET IN 2040								100% SELF SUFFIENCY	75% SELF SUFFIENCY	50% SELF SUFFIENCY
Food group	Grams per person per day	Grams per person per year	Land (m2) per g per year	M2 needed to feed a dutch for a y	Km2 to feed a dutch for a year	Population (2040)	Total Land (KM2) Daily	LAND (KM2) Yearly	LAND (KM2) Yearly	LAND (KM2) Yearly
Fish	11	4.015	0,0040	16,0600	0,0000160600	3.585.198	0,1577	57,58	43,18	28,79
SUBTOTAL WATER PRODUCTS	**11**	**4015**	**0,0040**	**16,0600**	**0,00001606000**		**0,1577**	**57,58**	**43,18**	**28,79**
Beef	23	8.395	0,0209	175,4555	0,0001754555	3.585.198	1,7234	629,04	471,78	314,52
Pork	45	16.425	0,0089	146,1825	0,0001461825	3.585.198	1,4359	524,09	393,07	262,05
Poultry	22	8.030	0,0073	58,6190	0,0000586190	3.585.198	0,5758	210,16	157,62	105,08
Milk	305	111.325	0,0012	133,5900	0,0001335900	3.585.198	1,3122	478,95	359,21	239,47
Other dairy	60	21.900	0,0102	223,3800	0,0002233800	3.585.198	2,1943	800,86	600,65	400,43
Eggs	12	4.380	0,0035	15,3300	0,0000153300	3.585.198	0,1506	54,96	41,22	27,48
SUBTOTAL ANIMAL PRODUCTS	**467**	**170.455**	**0,0520**	**752,5570**	**0,00075255700**		**7,3920**	**2.698,07**	**2.023,55**	**1.349,03**
Vegetables	200	73.000	0,0003	21,9000	0,0000219000	3.585.198	0,2151	78,52	58,89	39,26
Rice	40	14.600	0,0013	18,9800	0,0000189800	3.585.198	0,1864	68,05	51,04	34,02
Wheat (Cereals)	196	71.540	0,0014	100,1560	0,0001001560	3.585.198	0,9838	359,08	269,31	179,54
Fruits	248	90.520	0,0005	45,2600	0,0000452600	3.585.198	0,4446	162,27	121,70	81,13
Potatoes	88	32.120	0,0002	6,4240	0,0000064240	3.585.198	0,0631	23,03	17,27	11,52
Legumes	11	4.015	0,0020	8,0300	0,0000080300	3.585.198	0,0789	28,79	21,59	14,39
SUBTOTAL CROPS	**783**	**285.795**	**0,0057**	**200,7500**	**0,00020075000**		**1,9719**	**719,7284985**	**539,7963739**	**359,8642493**
TOTAL	**1.261**	**460.265**	**0,0617**	**969,3670**	**0,00096936700**	**46.607.574**	**9,5216**	**3.475,37**	**2.606,53**	**1.737,69**

IDEAL DIET IN 2040								100% SELF SUFFIENCY	75% SELF SUFFIENCY	50% SELF SUFFIENCY
Food group	Grams per person per day	Grams per person per year	Land (m2) per g per year	M2 needed to feed a dutch for a y	Km2 to feed a dutch for a year	Population (2040)	Total Land (KM2) Daily	LAND (KM2) Yearly	LAND (KM2) Yearly	LAND (KM2) Yearly
Fish	27	9.855	0,0040	39,4200	0,0000394200	3.585.198	0,3872	141,33	106,00	70,66
Beef	27	9.855	0,0209	205,9695	0,0002059695	3.585.198	2,0231	738,44	553,83	369,22
Pork	27	9.855	0,0089	87,7095	0,0000877095	3.585.198	0,8615	314,46	235,84	157,23
Poultry	27	9.855	0,0073	71,9415	0,0000719415	3.585.198	0,7066	257,92	193,44	128,96
Milk	400	146.000	0,0012	175,2000	0,0001752000	3.585.198	1,7209	628,13	471,10	314,06
Other dairy	50	18.250	0,0102	186,1500	0,0001861500	3.585.198	1,8285	667,38	500,54	333,69
Eggs	12	4.380	0,0035	15,3300	0,0000153300	3.585.198	0,1506	54,96	41,22	27,48
Vegetables	200	73.000	0,0003	21,9000	0,0000219000	3.585.198	0,2151	78,52	58,89	39,26
Rice	40	14.600	0,0013	18,9800	0,0000189800	3.585.198	0,1864	68,05	51,04	34,02
Wheat (Cereals)	200	73.000	0,0014	102,2000	0,0001022000	3.585.198	1,0039	366,41	274,81	183,20
Fruits	200	73.000	0,0005	36,5000	0,0000365000	3.585.198	0,3585	130,86	98,14	65,43
Potatoes	150	54.750	0,0002	10,9500	0,0000109500	3.585.198	0,1076	39,26	29,44	19,63
Legumes	11	4.015	0,0020	8,0300	0,0000080300	3.585.198	0,0789	28,79	21,59	14,39
TOTAL	**1.344**	**490.560**	**0,0577**	**940,8605**	**0,0009408605**	**3.585.198**		**3373,17**	**2529,88**	**1757,25**

SUSTAINABLE DIET 2040								100% SELF SUFFIENCY	75% SELF SUFFIENCY	50% SELF SUFFIENCY
Food group	Grams per person per day	Grams per person per year	Land (m2) per g per year	M2 needed to feed a dutch for a y	Km2 to feed a dutch for a year	Population (2040)	Total Land (KM2) Daily	LAND (KM2) Yearly	LAND (KM2) Yearly	LAND (KM2) Yearly
Fish	**25**	**9.125**	**0,0040**	**36,5000**	**0,0000365000**	3.585.198	0,3585	130,86	98,14	65,43
Beef	15	5.475	0,0209	114,4275	0,0001144275	3.585.198	1,1240	410,25	307,68	205,12
Pork	20	7.300	0,0089	64,9700	0,0000649700	3.585.198	0,6382	232,93	174,70	116,47
Poultry	20	7.300	0,0073	53,2900	0,0000532900	3.585.198	0,5234	191,06	143,29	95,53
Milk	400	146.000	0,0012	175,2000	0,0001752000	3.585.198	1,7209	628,13	471,10	314,06
Other dairy	50	18.250	0,0102	186,1500	0,0001861500	3.585.198	1,8285	667,38	500,54	333,69
Eggs	12	4.380	0,0035	15,3300	0,0000153300	3.585.198	0,1506	54,96	41,22	27,48
Vegetables	200	73.000	0,0003	21,9000	0,0000219000	3.585.198	0,2151	78,52	58,89	39,26
Rice	40	14.600	0,0013	18,9800	0,0000189800	3.585.198	0,1864	68,05	51,04	34,02
Wheat (Cereals)	200	73.000	0,0014	102,2000	0,0001022000	3.585.198	1,0039	366,41	274,81	183,20
Fruits	248	90.520	0,0005	45,2600	0,0000452600	3.585.198	0,4446	162,27	121,70	81,13
Potatoes	120	43.800	0,0002	8,7600	0,0000087600	3.585.198	0,0860	31,41	23,55	15,70
Legumes	**30**	**10.950**	**0,0020**	**21,9000**	**0,0000219000**	3.585.198	0,2151	78,52	58,89	39,26
TOTAL	**1.355**	**494.575**	**0,0577**	**828,3675**	**0,0008283675**	**3.585.198**		**2969,86**	**2227,40**	**1550,36**

GENERAL NUMBERS

Number of inhabitants

NUMBER OF PEOPLE							
		% within area	All inhabitants	inh. within area 2017	Population growth percentage	Inh. 2040	amount of inhabitants growth
North Holland	Aalsmeer	1	31.393	31.393	1	31.393	0
	Alkmaar	1	108.618	108.618	1,05	114.049	5.431
	Amstelveen	1	89.608	89.608	1,25	112.010	22.402
	Amsterdam	1	853.312	853.312	1,25	1.066.640	213.328
	Beemster	1	9.281	9.281	1,25	11.601	2.320
	Bergen (NH.)	1	29.793	29.793	1	29.793	0
	Beverwijk	1	40.976	40.976	1,1	45.074	4.098
	Blaricum	1	10.302	10.302	0,95	9.787	-515
	Bloemendaal	1	22.940	22.940	1,15	26.381	3.441
	Castricum	1	35.272	35.272	1	35.272	0
	Diemen	1	27.362	27.362	1,25	34.203	6.841
	Drechterland	1	19.353	19.353	1,05	20.321	968
	Edam-Volendam	1	35.859	35.859	1,05	37.652	1.793
	Enkhuizen	1	18.491	18.491	1,05	19.416	925
	Gooise Meren	1	57.171	57.171	1,05	60.030	2.859
	Haarlem	1	159.340	159.340	1,1	175.274	15.934
	Haarlemmerliede	1	5.702	5.702	1,05	5.987	285
	Haarlemmermeer	1	146.332	146.332	1,15	168.282	21.950
	Heemskerk	1	39.053	39.053	0,95	37.100	-1.953
	Heemstede	1	26.989	26.989	1,5	40.484	13.495
	Heerhugowaard	1	55.159	55.159	1,05	57.917	2.758
	Heiloo	1	22.966	22.966	1	22.966	0
	Hilversum	1	89.148	89.148	1,1	98.063	8.915
	Hollands Kroon	0,05	47.585	2.379	0,95	2.260	-119
	Hoorn	1	72.759	72.759	1,05	76.397	3.638
	Huizen	1	41.432	41.432	0,95	39.360	-2.072
	Koggenland	1	22.551	22.551	1	22.551	0
	Landsmeer	1	11.352	11.352	1,1	12.487	1.135
	Langedijk	1	27.721	27.721	1	27.721	0
	Laren	1	11.079	11.079	0,95	10.525	-554
	Medemblik	1	44.042	44.042	1	44.042	0
	Oostzaan	1	9.691	9.691	1,1	10.660	969
	Opmeer	1	11.429	11.429	0,95	10.858	-571
	Ouder-Amstel	1	13.465	13.465	1,25	16.831	3.366
	Purmerend	1	79.830	79.830	1	79.830	0
	Schagen	0,25	46.143	11.536	0,95	10.959	-577
	Stede Broec	1	21.656	21.656	1	21.656	0
	Uitgeest	1	13.462	13.462	0,95	12.789	-673
	Uithoorn	1	29.247	29.247	1,1	32.172	2.925
	Velsen	1	67.585	67.585	1	67.585	0
	Waterland	1	17.240	17.240	1,05	18.102	862
	Weesp	1	18.827	18.827	1,25	23.534	4.707
	Wijdemeren	1	23.467	23.467	0,9	21.120	-2.347
	Wormerland	1	15.949	15.949	1,05	16.746	797
	Zaanstad	1	154.037	154.037	1,1	169.441	15.404
	Zandvoort	1	16.903	16.903	1,5	25.355	8.452
South-Holland	Hillegom	1	21.486	21.486	1,05	22.560	1.074
	Kaag en Braasser	0,5	26.509	13.255	1,05	13.917	663
	Katwijk	0,5	64.589	32.295	1,1	35.524	3.229
	Lisse	1	22.740	22.740	1,05	23.877	1.137
	Nieuwkoop	0,25	28.020	7.005	1,05	7.355	350
	Noordwijk	1	25.930	25.930	1,2	31.116	5.186
	Noordwijkerhout	1	16.405	16.405	1,15	18.866	2.461
	Oegstgeest	0,5	23.698	11.849	1,1	13.034	1.185
	Teylingen	1	36.200	36.200	1,05	38.010	1.810
Utrecht	Baarn	0,8	24.574	19.659	1	19.659	0
	Eemnes	1	9.009	9.009	1,1	9.910	901
	De Ronde Venen	0,8	42.969	34.375	1,1	37.813	3.438
	Soest	0,05	45.934	2.297	1	2.297	0
	Stichtse Vecht	0,3	64.411	19.323	1,1	21.256	1.932
Flevoland	Almere	1	201.703	201.703	1,25	252.129	50.426
	Lelystad	0,05	77.095	3.855	1	3.855	0
	Zeewolde	0,05	22.452	1.123	1,2	1.347	225
Total				**3.150.567**	**1,14**	**3.585.198**	

END OF LIFE

Production of food waste within the AMA

INPUT 2017		
Production	28	%
	128755013	kg/yr
Retail	13	%
	62726801	kg/yr
Consumer	30	%
	138659244	kg/yr
Other	29	%
	136686478	kg/yr
TOTAL	466827536	kg/yr

INPUT 2040		
Production	28	%
	146517180	kg/yr
Retail	13	%
	71380165	kg/yr
Consumer	30	%
	157787732	kg/yr
Other	29	%
	155542816	kg/yr
TOTAL	531227893	kg/yr

Food waste management within the AMA

OUTPUT (2017)				
Animal Feed	77206818	kg	17	%
Fermentation	51911675	kg	11	%
Composting	130817421	kg	28	%
Incineration	195754207	kg	42	%
Landfill/discharge	11137414	kg	2	%
TOTAL	466827536	kg	100	%

OUTPUT (2040)				
Animal Feed	87857747	kg	17	%
Fermentation	59073057	kg	11	%
Composting	148864104	kg	28	%
Incineration	222759128	kg	42	%
Landfill/discharge	12673856	kg	2	%
TOTAL	531227893	kg	100	%

Food waste management different scenario's 2040

NO INCINERATION			Human Food		people		Fermentation		facilities		Composting		facilities		Incineration	
100	%	222759128	kg	31557546	kg	3585198	#	191201582	kg	13	#	191201582	kg	13	#	0	kg
80	%	178207303	kg	31557546	kg	3585198	#	146649756	kg	10	#	146649756	kg	10	#	44551826	kg
70	%	155931390	kg	31557546	kg	3585198	#	124373843	kg	9	#	124373843	kg	9	#	22275913	kg
60	%	133655477	kg	31557546	kg	3585198	#	102097931	kg	7	#	102097931	kg	7	#	89103651	kg
50	%	111379564	kg	31557546	kg	3585198	#	79822018	kg	5	#	79822018	kg	5	#	66827739	kg
40	%	89103651	kg	31557546	kg	3585198	#	57546105	kg	4	#	57546105	kg	4	#	133655477	kg
30	%	66827739	kg	31557546	kg	3585198	#	35270192	kg	2	#	35270192	kg	2	#	111379564	kg
20	%	44551826	kg	31557546	kg	3585198	#	12994279	kg	1	#	12994279	kg	1	#	178207303	kg
10	%	1267386	kg	31557546	kg	3585198	#	-30290161	kg	0	#	-30290161	kg	0	#	176939917	kg

RETAIL

Number of retail within the AMA

THE NUMBER NON-SUPERMARKET RETAIL IN 2018			
Specialist shop	Market/street trader	Other	Supermarkets in 2018
164*	79	/	763

Market share different scenario's 2040

REDUCTION OF THE MARKET SHARE OF SUPERMARKET BY(%)	remained market share of supermarkets	amount of people who need to be served by other retailers	the amount of people one non-supermarket retail can serve within 20mins walk			reduced amount of supermarket	market share in 2040			the number non-supermarket retail needed in 2040(new market share based on the propotion)		
			Specialist shop	Market/street trader	Other		Specialist shop	Market/street trader	Other	Specialist shop	Market/street trader	Other
10%	67%	358520				194	17%	11%	4%	68	102	272
20%	57%	717040				388	22%	15%	6%	136	204	544
30%	47%	1075559	5275	3517	1319	581	28%	18%	7%	204	306	816
50%	27%	1792599				969	38%	25%	10%	340	510	1359
70%	7%	2509639				1357	49%	32%	12%	476	714	1903

Diffeent scenario's 2040

Supermarkets	Specialist shops	Market/street trader	Other
MARKET SHARE IN 2018			
77%	12%	8%	3%
MARKET SHARE IN 2040			
67%	17%	11%	4%
57%	22%	15%	6%
47%	28%	18%	7%
27%	38%	25%	10%
7%	49%	32%	12%

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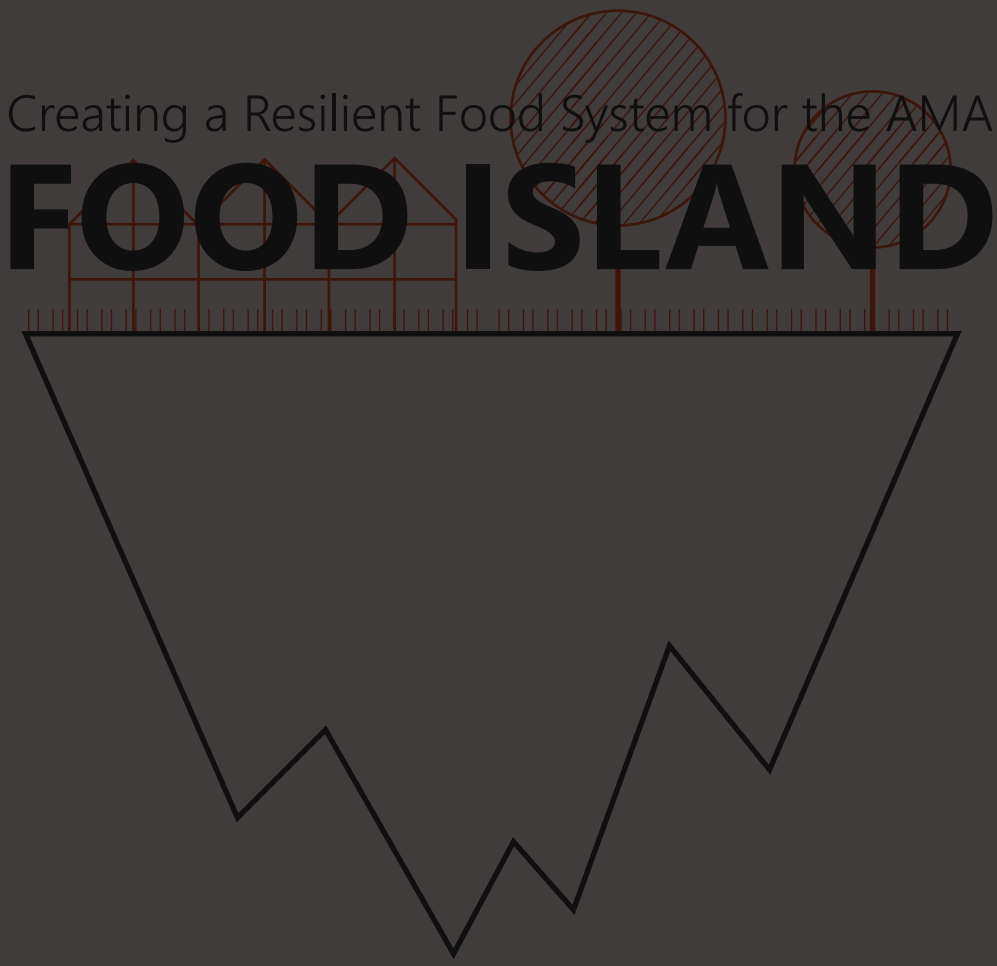
Creating a Resilient Food System for the AMA

FOOD ISLAND



MSC3 APRIL 2018
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AR2U088 RESEARCH AND DESIGN METHODOLOGY FOR URBANISM
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