2018
from Bohemian AvantGardeners
for the Bijlmer Bajes, Amsterdam

the AvantGarden

“You can solve all the world’s problems in a garden.”
Geoff Lawton

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Any questions or remarks will be welcome and can be sent to the team coordinator to email address: lucie.dudak@gmail.com

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The AvantGardeners' Manifesto

Natural systems develop in a succession. A barren field left undisturbed for long enough will become a forest, but this of course doesn't happen overnight. Ecosystems take time to mature and have several stages that are not always linear. First, pioneer plants, often called "weeds", rush to heal wounds in the earth, sending long tap roots into the ground, drawing nutrients from below and holding the topsoil in place. Organic matter accumulates, shrubby plants begin to grow, offering more niches for life, increasing the flow of nutrients. Slowly, a forest emerges from what was once naked earth; a self sustaining, stable ecosystem, built and supported by a vast network of plants, mycelium, earthworms, birds, and animals. In turn, the forest provides food, shelter, energy, water, shade, and tranquility.

Hi, we're the Bohemian AvantGardeners and we are the pioneers, the first AvantGardeners moving to Amsterdam's new Bajes Kwartier. We look at the Bajes Kwartier and see bare soil, but envision the full functioning forest ecosystem it will become.

Designing an urban greenhouse isn't enough. So we asked ourselves, **"How do we build a resilient community from the ground up around healthy food production, that is equitable for all involved, and whose members are directly invested in its survival?"** To answer this question we can't be concerned with one-way consumer transactions. What we present is a thoughtfully designed actionable plan which has the potential to create real change for a quarter, a city, and beyond.

"Changes, to be of any consequence, must come first at the basic philosophical level" (Fukuoka). We borrow our overarching philosophy from permaculture: **"Cooperation is the basis of existing life systems and future survival."** With that in mind, we have designed a multi-stakeholder cooperative B^2COOP: a cooperative of citizens living in the (former) Bijlmer Bajes (further B^2), the AvantGardeners, other local farmers and small businesses, working together to build lasting relationships based upon fair prices and fair wages, and forming community in a common effort to provide the essentials for a healthy, fulfilling life.

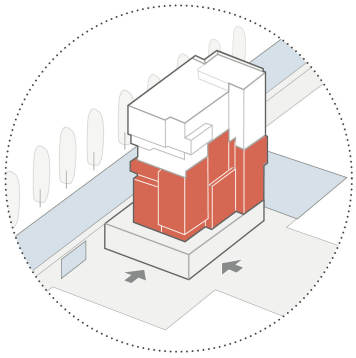
B^2COOP is the legal organization that embodies the ethical principles guiding the succession to a resilient community around the AvantGarden. The AvantGarden is where it all happens, **a place where we grow and buy healthy food, learn new skills, find meaningful employment, celebrate, meet, and develop a sense of purpose in our community.**

We don't seek to change the world. We wish to create a positive change in the lifestyle, attitude and knowledge of our community and through doing, inspire communities around the world to do the same.

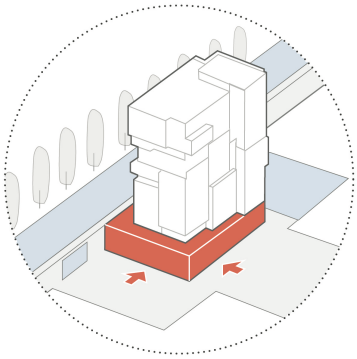
Welcome to the AvantGarden. **The new paradigm of urban farming.**

The AvantGarden can be divided into several parts which meet the needs of the different people and activities we address in our community:

At the AvantFarm we produce essential nutrition, primarily for ourselves, the community of the B^{2}COOP. We seek in every way to mimic nature. We designed a holistic food web connecting independent, but mutually beneficial cycles of aquaponics, plants, mushrooms, and insects. We wholeheartedly support aquaponics as a source of nutrients rather than any synthetic solution. Aquaponics allows a truly circular model of production through which we manage to capture, supply, and recirculate nutrients for our ecosystem while creating value in all its stages.

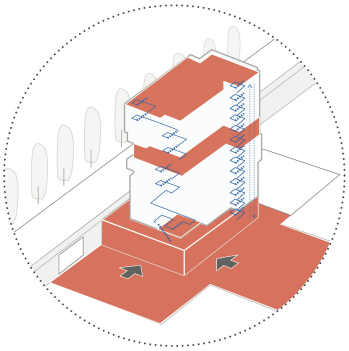


The AvantMarket is where the harvest arrives to supply essential healthy food to the citizens of the Bajes Kwartier. The harvest comes from the AvantGarden, but not exclusively. Some products, such as wheat, can be produced in our system but make much more sense to grow outdoors at a different scale. Therefore, we seek to cooperate for high-nutritional produce, sourced locally and responsibly, rather than compete and disrupt the local business environment. The AvantMarket is designed as a farmer's market held year round. Each stand in the AvantMarket tells the story of the farmer. B^{2}COOP provides the space for the stand and B^{2}COOP members-employees work as the cashiers, stock managers and cleaners of the market.

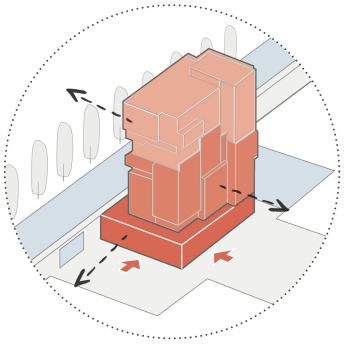


The AvantCommunity

"If niches are opportunities in space, cycles are opportunity in time" (Mollison, 1988). The AvantGarden is full of both kinds of opportunities to accommodate a wide range of activities and meet the needs and wishes of all our members. Not a single space in the common area of the AvantGarden is used for only one purpose. We have a cowork hub, which can be used as study space or library as well, kids playground which becomes a summer cinema & event space, green meeting rooms used either for classes or business meetings, a hackerspace where people can build and experiment, and a public kitchen easily transformed into a dinner party room. Apart from spaces of the AvantGarden that are accessible based on membership or rent, there are some public areas: "The Hill" and the rooftop Permagarden Café.



As the building and its community grows, it transforms its surroundings and beyond. The profits of from the AvantGarden are invested back into B^2, creating an edible quarter filled with fruit trees and berry bushes and community events. We aspire to be the model for other urban neighborhoods and through our B^{2}Apprentice program we will create a network of village communities springing up in urban areas of Amsterdam and around the world.



The AvantGarden will be run by **the AvantGardeners**, that's us, the pioneers and others who collaborate with us on setting up and managing our community from seed to forest ecosystem. As our name suggests, we aren't afraid to challenge the status quo, understanding that life is in constant flux, and adaptability brings resilience. We see the world differently and push the boundaries of urban food production, one that is modeled on natural systems, builds community and goes beyond sustainability to vitality.

When we imagine the AvantGarden in full bloom, we don't ask, "What do we have to lose by creating this?" but rather, "What do we stand to regain?" It's only since industrialization that the market economy has rapidly changed how we interact with each other. For millennia people lived and thrived in tightly knit, self-sustaining communities that relied on reciprocity, loyalty and obligation rather than cold market price exchange (Fleming, 2016). We seek to regain social capital in the community. Real value lies in functional ecosystems, healthy food and community (Lui, 2010). No society or economy (economy is a subset of society) exists in the absence of clean air, water, soil and self regulating climate. Likewise, no community exists without a common mission built around ethics [Mollison, 1988). We treat the Bajes Kwartier as a community ecosystem, where the people are not part of, but woven into the landscape and community.

The central goal of a corporation of the Wal-Mart variety is to maximize shareholder, not stakeholder, value. International corporations are, "extractive and not contributive economic mechanisms"(Rushkoff, 2016). Most of these companies' aim is to extract value from local communities and employees and pay it to investors who most likely have no interest other than their own coffers.

In contrast, by investing into B^2COOP, you invest directly into your community, lifestyle and neighborhood prosperity. In return you receive healthy food, meaning and purpose in your community and the opportunity to be apart of something bigger than yourself. All of the profits of B^2COOP are reinvested back into the AvantGarden mission, supporting community development and slowly bringing change to the way urban areas feed themselves.

Interested? In the next pages you can read more about:

B^2COOP

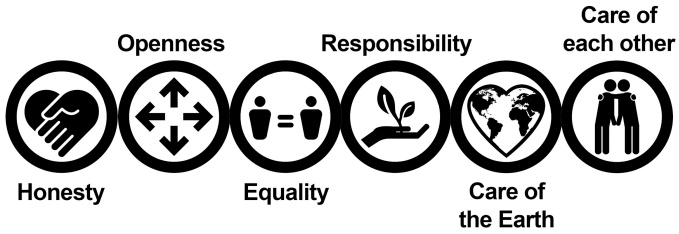
"Creating value is an inherently cooperative process, capturing value is inherently competitive" - Barry Nalebuff

B^2COOP is a movement designed from the bottom up. Top down solutions are destined to fail. Why? To quote Robert Pirsig, because they start at the end and presume the end is the beginning (Pirsig, 1974). We have devised a recipe, if you will. Sprinkle some more engagement here, or a dash of volunteering there, but in the end we're left with a meal we can feel proud of, one that was produced by a community for the community and tastes damn good.

There are a couple different cooks needed for the meal we are inviting you for:

- The citizens of the new Bijlmer Bajes - we call them B^2Neighbors
- The local farmers to produce the food we need - simply B^2Farmers
- The local businesses, because life is not just about food - B^2Business

The B^2Neighbors, B^2Farmers and B^2Business together create, operate, and own the community of B^2COOP and its AvantGarden. Communities are formed around a shared set of beliefs and principles that in turn guide actions (Mollison, 1988). Our values are:

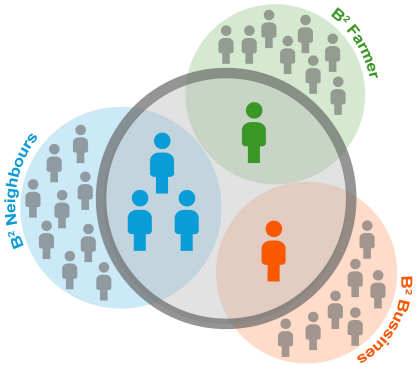


We do not need to reinvent the wheel to guide our actions. We honor the wisdom and holisticity of permaculture principles set by Bill Mollison (1988), and in our decisions we respect the principles of Rochdale pioneers (see for example COOP UK, 2018) guiding cooperatives for centuries.

Permaculture principle: Cooperative principles:

(Source: Daily Infographic; Cooperative Principles Photo)

B²COOP follows the common cooperative tradition of 1 person, 1 vote. All B²COOP members can use their voting power to choose representatives and vote for community decisions. As we have multiple different groups of people involved and each might have different perspectives, the power of these votes is weighed in the number of representatives who guide the AG on its mission, three for the B²Neighbors, 1 for B²Farmers and 1 for B²Business.



These representatives can be removed at anytime if the members feel they are not acting in the interest of the community. Elected representatives decide on major investments and directions of B²COOP listening to their neighbors through a system of constant feedback. This system of representation ensures that the citizens of the Bajes Kwartier have the final say in decision making but are actively cooperating and working with our partner farmers and businesses to find common ground and work for the good of the community.

The structure of B²COOP is lean and flexible. Representatives' job is to set people up with the resources, skills and equipment, common purpose, and freedom to apply their judgement. "This brings to life the tenacity and imagination of people; transforms the quality of decisions" (Fleming, 2016). Members of B²COOP are encouraged to form committees to solve problems and plan public events. We expect members to take turns facilitating meetings, planning agendas and working to train new people to gain skills. If one leader gets busy or moves away the organization doesn't fall apart. All members have the power to vote also on day to day operations i.e. event/workshop selection, exotic products, and investments for the Kwartier. Additionally, monthly meetings will be held in the AG that are open for members to come and present problems, give solutions, tell jokes and laugh together.

100% of profits are reinvested in our community. In what you ask? That is up to the citizens of the Bajes Kwartier to decide. Our humble recipe calls for 4 categories of investment:

1. Back into the AvantGarden
2. Paid out in dividends for members
3. Invested into Bajes Kwartier public spaces
4. Supporting the Annuals' program

These investments represent the commitment to producing healthy food, repaying the support of members, improving the community, and giving opportunities for people to transform their own communities. These areas of investment are subject to change as the needs of the coop change. Investing in the AG and repaying members might take priority at the beginning of the succession, gradually shifting to a focus on the Kwartier and beyond as the ecosystem develops and matures.

B² Neighbor?

Are you living in the Bijlmer Bajes?

What can B² COOP give to you?		*What can you give to B² COOP?*	
AvantMarket, B²FoodShare	• Local fresh food	B²COOP values	• share
events & classes & parties	• AvantCommunity	B²COOP principles	• respect
work/playground/kitchen	• Space you need	one time fee	• 100 € / 10h
money or time?	• B² Coin Wallet	B²FoodShare	• min. individual / 1x month
meaningful employment	• AvantGardeners	Get involved	• 2-3h per month (optional)
control & share on profits	• B² COOP		

B² Farmer?

Are you an organic farmer within 100km of the AvantGarden?

What can B² COOP give to you?		*What can you give to B² COOP?*	
personalized stand 6/7	• AvantMarket	B² Coop principles	• respect
guaranteed sales	• B² FoodShare	B² Coop values	• share
no time behind the counter	• B² work	AvantCommunity	• 3h /3x open door a year
worker at your farm	• B² Apprentice	AvantMarket fee	• 10 € / 1m2 / month
money or time?	• B² Coin Wallet	B² Apprentice	• host for 1 week / year
control & share on profits	• B² COOP		

B² Business?

Do you have your office within the Bajes Kwartier? Then you are as much a member of our community as any individual and we are happy to see how we can help each other. Depending on what your business is about we arrange the specifics, here are a couple examples:

- Do you make products of daily use to the neighbors?

What can B² COOP give to you?		*What can you give to B² COOP?*	
personalized stand 6/7	• AvantMarket	B² Coop principles	• respect
money or time?	• B² Coin Wallet	B² Coop values	• share
control & share on profits	• B² COOP	AvantCommunity	• 3h /3x open door a year
		AvantMarket fee	• 10 € / 1m2 / month

- Do you want to enjoy AvantGarden for your company events? (1 account a company)
  → similar to **B² Neighbor**, ask us for the details
- Do you want to support your non-BB-resident employees? (1 account a company)
  → **B² Neighbor**, pay per employee

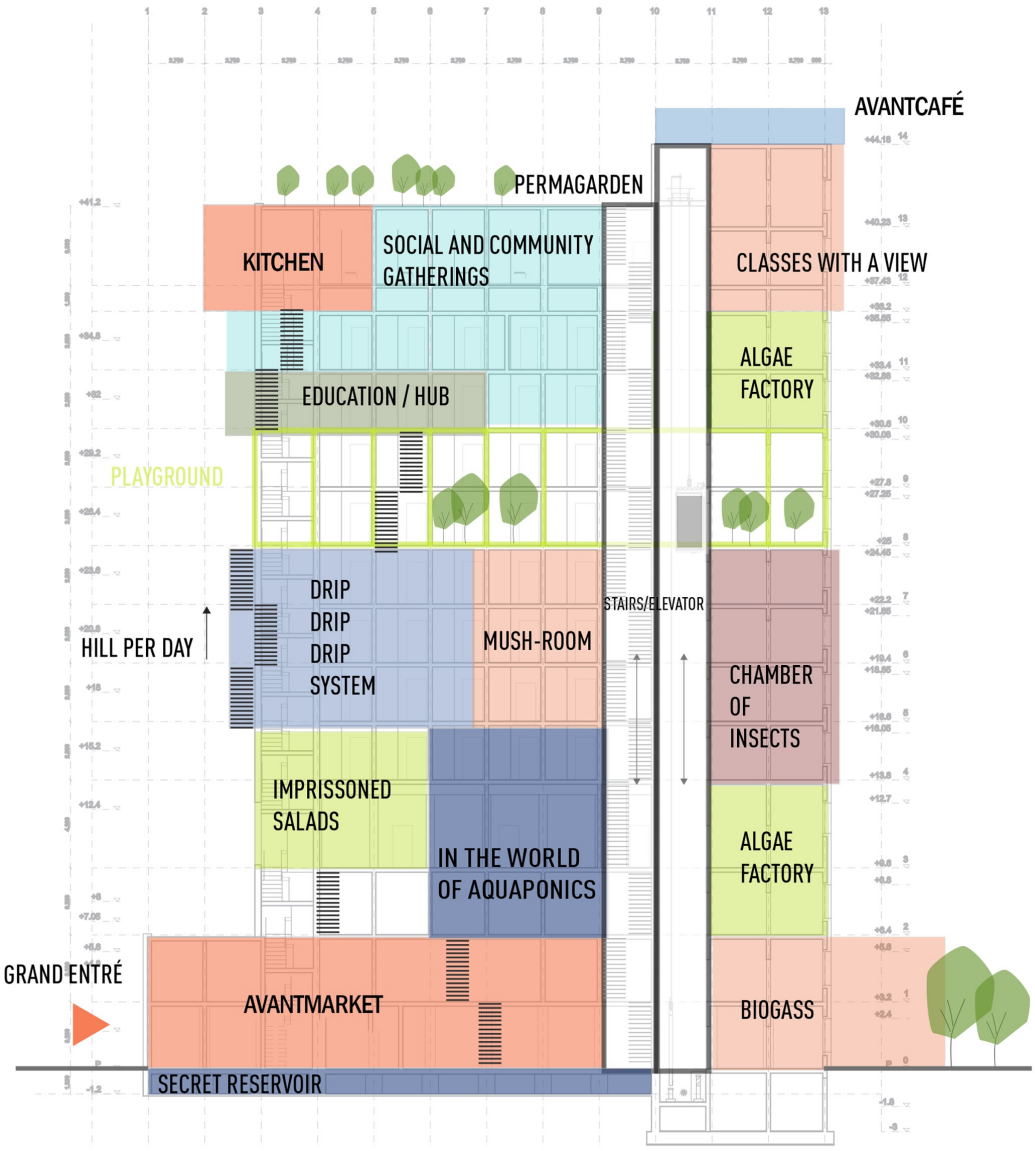
B² Other?

The three categories we designed are not in an attempt to be exclusive or deny others, but rather it ensures that the direct stakeholders maintain control over the operations of the B2 COOP. It is our hope that the Bajes Kwartier will be the first of many urban villages to spring up in Amsterdam and around the world. There is way more room for cooperation, not competition. We are happy to accept any donations from businesses outside the Bajes Kwartier. Cooperation from other cooperative groups is, by our principles, welcome!

AvantGarden

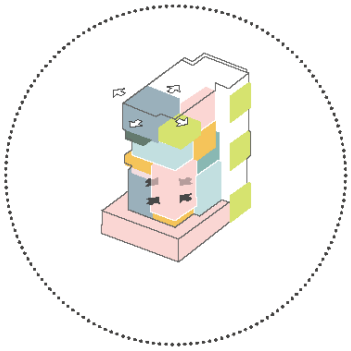
Before we jump into telling you all about what is going on inside the AvantGarden, let's give you some perspective on the layout (site plan can be found in *Annex 1.1*).

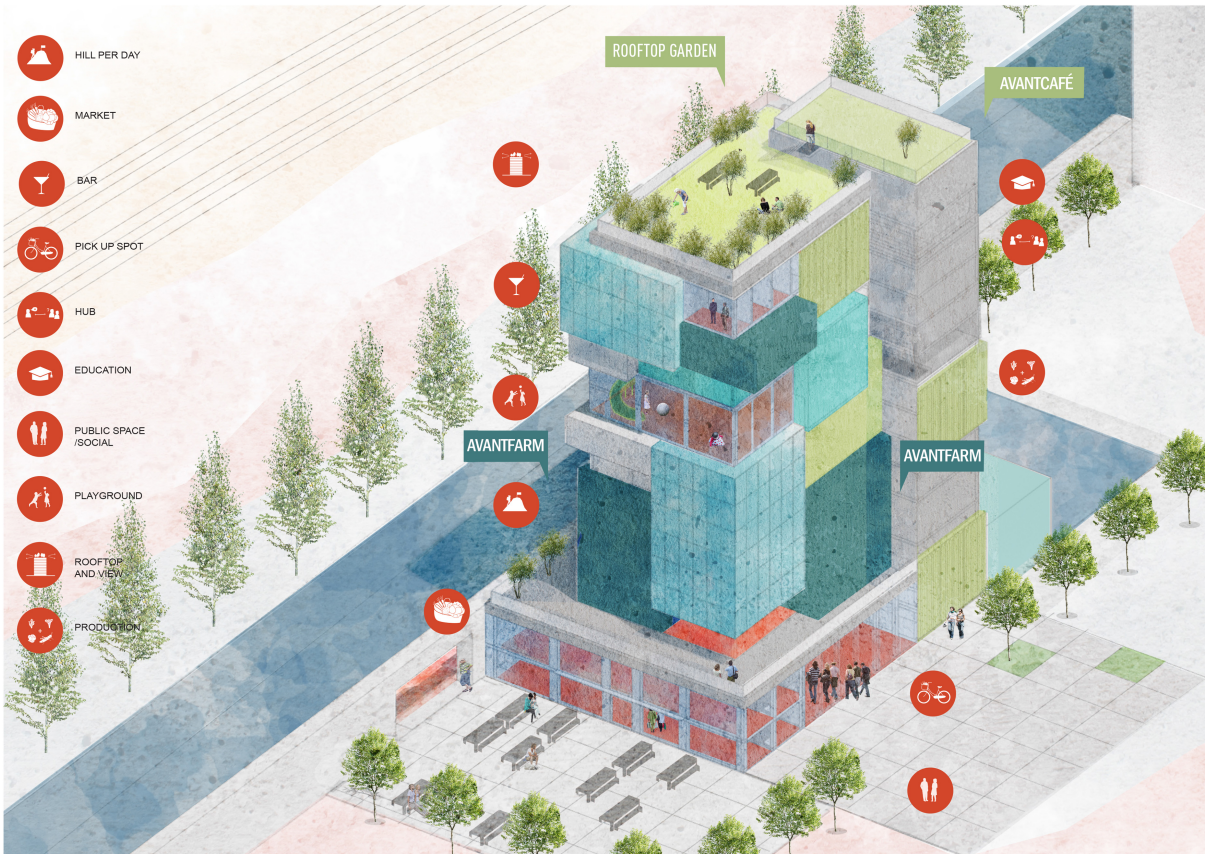
The building of the AvantGarden is a former prison tower. The prison was closed and left vacant for many years until 2015 when ~~Refugee~~ Company established several programs inside the building in the help of empowering asylum seekers through meaningful employment. We greatly admire their work and seek to build on their success with our B^2Apprentice program (see below). We envision the Bajes Kwartier as an eco-urban village, and the AvantGarden as its heart. We designed the AvantGarden to be a system of interconnected yet independent modules, each serving its specific goal, together creating a holistic system and eventually arriving at a self sufficient, stable ecosystem.



Based on the given building construction we have redesigned it to encompass our food production modules, social spaces for community needs in the form of indoor and outdoor multifunctional public spaces, and topped it off with a rooftop Permagarden & AvantCafé. We don't allow materials to be wasted, what cannot be used in the reconstruction, we will use in the redesign. Mushrooms like to breathe from the bottom, resting on the old cell bars will be a pleasure for them. The only thing imprisoned in our building from now on are our salads, which we don't like to run away. The former Bijlmer Bajes hosted, besides many others, the kidnappers of Mr. Heineken. Because we keep hops close to our heart we could not forget his misery. Hops can be found on the rooftop permagarden as well as on the facade. Other plants which will be climbing on our facade can be found in *Annex 1.2*.

After beginning this project we began noticing the number of unused building, crumbling in our own neighborhood. It inspired us to push our design a step further. All the modules in the building are individually scalable and reshuffable to fit a building in any neighbor. There are minimal scale requirements to fit to our technological and economical calculations (detailed calculation for Bijlmer Bajes in *Annex 1.3*), but we have made it possible to adjust the design as needed to revive an ecosystem rather then leave an unused space empty and destroy ecosystems elsewhere. Agriculture can go vertical, leaving natural landscapes alone.





For the feel of how the AvantGarden can look like, see our Visualization in the *Annex 1.4*.

AvantFarm

*"We only invented the word organic because we made things inorganic. We only invented the word natural because we made things unnatural. We only invented the word permaculture because we made agriculture." — **Khang Kijarro Nguyen***

Our philosophy in greenhouse design is to work with nature, rather than against it, understanding that stable ecosystems are not the sum of the parts but rather the beneficial connections between the components. We have carefully created an ecosystem with a diverse array of species and elements interacting. Although this model is designed specifically with the AvantGarden in mind, it is adaptable and easily replicated in just about any urban area where waste streams are abundant. We have taken great care to use as few inputs as possible by nutrient and water recycling while creating value in healthy, organic food from waste that would otherwise go to a landfill.
For millennia people were sharing resources and knowledge, natural processes were indispensible for the survival of species and populations and kept our descendants alive. We understood how deeply we were tied to our relationship with land and with each other. With overpopulation, globalization, and urbanization these values and knowledge have been lost in many parts of the world. Most people have very little understanding of how food is grown and where their food comes from, other than the supermarket.
Sustainability is a fundamental aspect of how we have designed our production systems. If it's not sustainable in the long term, it's not worth doing. We are not using herbicides, pesticides or synthetic nutrients. Hydroponics is dependant on mined elements and energy intensive processes. Instead, we mimic natural systems by means of aquaponics.
There are two major objectives for our production in The AvantGarden. The first one is to feed the Bajes Kwartier. The second one is to pass our knowledge of growing food on to our Annual Apprentices and the public in the hope that the AvantFarm is but one of many viable urban food systems springing up throughout the world.

The AvantGardeners

Perennials: The master gardeners of the AG. They are specialized in their respective cycles - aquaponics, plants, mushrooms, insects and cooperative business. However, each perennial understands the whole web of interactions and how each aspect links together, as well as the broader values and mission of the AvantGarden. We expect our Perennials to be gardener philosophers. The perennials will be citizens of BB and therefore neighbors to each other with direct interest in the community. As an example, we, the pioneers, will move in BB to start our proposed movement.
Annuals: The apprentices of the AG. They are trained by Perennials for 2 years with the goal to spread the knowledge to other quarters, cities, and the world, so that each quarter has its own basic production and therefore is self-reliant at least to the extent of meeting basic needs. They will spend time with each Perennial, learning the respective food cycles and how they fit into the larger food web . Their education is not purely technical. Annuals are taught the financial and managerial roles involved in running B^2COOP. They are also expected to hold classes on food systems and give tours to visitors. Additionally, they will spend time with other local coop farmers in the field to have a well rounded understanding of how food is grown organically outdoors in a variety of conditions. **The Annuals welcomed to the AG are primarily, but not exclusively, socially disadvantaged people, such as**

asylum seekers and formerly imprisoned people. We agree with ~~Refugee~~ Company, that meaningful work is the best method of integration into society. Our program pays Annuals a living wage and provides the skills and tools needed to succeed in starting or joining other food cooperatives in Amsterdam and around the world.

The AvantFarm will employ at least 6 full time Perennials to manage the systems and a minimum of 6 Annuals who will spend at least several weeks with each Perennial, learning how the production systems work and how they fit into the whole ecosystem. We feel that a full education requires learning the ropes of "in soil" farmers is vital for all food producers. That is why we ask partner local farmers who join B^2COOP to agree in taking each Annual for a week introduction on their farm and we pay the Annuals for this time. The Annual gains valuable "know how" and the farmer receives a helping hand on the farm for a week. Both benefit and share in this cooperation. This well rounded education for Annuals is necessary for ensuring they are able to enter a neighborhood or community and no matter what resources are available, can regenerate this community around growing food.

Interior Design of Food Systems

The AvantFarm is a part of The AvantGarden building, and since it must fit in space defined by the tower construction, our production is modular. Due to this modularity, our farm can be built in phases and is easily replicable. Each modular block is different according to the type of production. Apart from modular production we also have operational space which needs to be separated (eg mushroom spawning room). Connections between blocks are carefully designed to save labor and efficiently use energies (eg having connected technologies on the same floor, or in two floor beneath as it goes for gas exchange in between plants and mushrooms).
Specific production spaces are divided into "blocks", which respect the original jail layout, but more importantly enable complete scalability. The blocks have minimal requirements to be functional and feasible. There are set ratios among blocks, which allows indefinite scalability. Aquaculture is placed on a steel construction built on the side of the tower, designed to carry the heavy weight of the aquaculture tanks. Algae production is visible in the building design creating prison bar impression. It is more than an architectural element, greening the facade of the AvantGarden. Our production reaches outside the building as we speak of extensive aquaculture, bee, and duck keeping.

Technologies, Logistics, and Mass Balance in the AG

*"Permaculture principles focus on thoughtful designs for small-scale intensive systems which are labor efficient and which use biological resources instead of fossil fuels. Designs stress ecological connections and closed energy and material loops. The core of permaculture is design and the working relationships and connections between all things. Stupidity is an attempt to iron out all differences, and not to use them or value them creatively." -**Bill Mollison***

Aquaponics

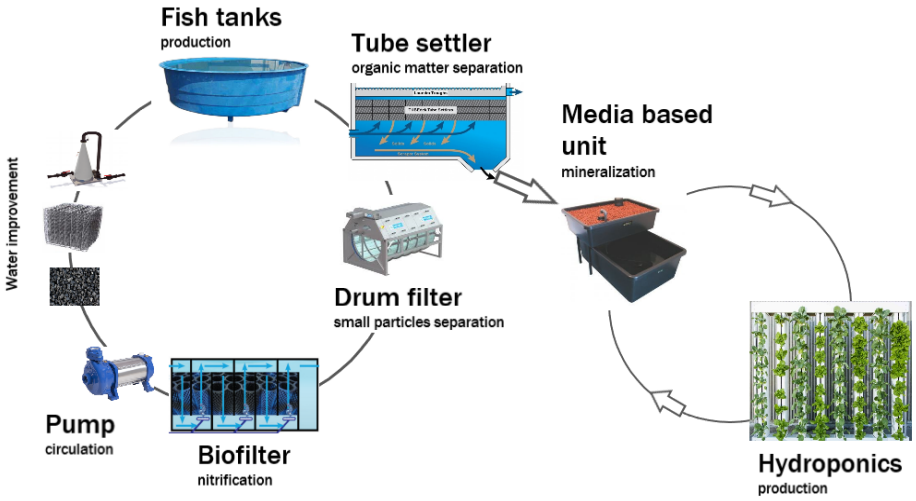
Aquaponics mimics natural systems, integrating hydroponics and recirculating aquaculture (RAS). Aquaponics has been used for centuries and can be seen in integrated farming in Asia where rice farmers add fish to their paddies as additional source of food for themselves

and nutrients for the plants. Recently, aquaponics has become an indoor farming possibility. The primary question was why we shouldn't use only hydroponics? If we consider the environmental footprint and reasonable use of natural resources, aquaponics is a more sustainable way of producing quality animal protein without damaging natural ecosystems. Animal agriculture has become industrialized and is now ridden with animal welfare and health issues. Additionally, we are facing overpopulation with a growing appetite for meat worldwide. Fish have the best feed conversion ratio from all bred livestock, ranging from 1 to 1.5, most efficiently utilizing provided feed. Providing a safe source of animal protein also allows diversification of our production while achieving yield in both plant and fish production, all without the use of fossil fuels or mined minerals.

Technological Solution

Plant and fish have their own environmental demands. In order for them to thrive, our technology must secure a breeding system which optimal parameters for both. One looped aquaponics doesn't allow keeping water quality parameters at optimum levels for both. This is why we chose to separate recirculating aquaculture system (RAS) and hydro/bioponics; only using aquaculture effluent processed by mineralization as a nutritional solution for our bioponics. To see how have we connected aquaculture with bioponics see *Annex 2.1*.

We have two RAS for fish. Organic matter filtration is managed by a tube settler filter, filtering out bigger organic particles, and a drum filter with 30 micron screen filtering micro organic waste, improving quality of water for fish. Effluent from the tube settler and drum filter containing organic matter produced by fish from aquaculture is transferred to a media based unit and then used in our bioponics. Check *Annex 2.2*.

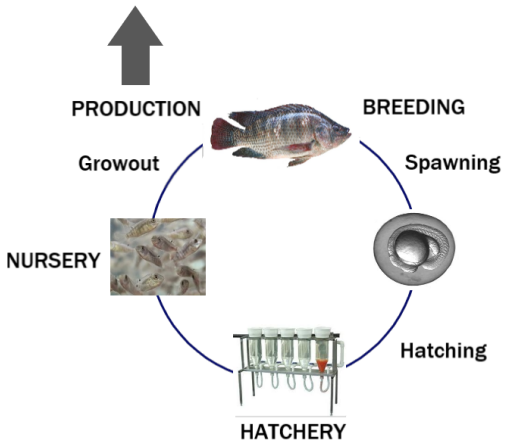


That Fish Cray

Crayfish aquaponics supplies our drip bioponic systems with fruiting crops, which requires higher stocking density then our fish RAS feeding leafy bioponics. We chose eurykee Red Swamp Crayfish (*Procambarus clarkii*) which tolerates a wide variety of conditions and are also not very aggressive, so they can be bred with success in high densities. In order to reduce aggressivity, piping is used to provide shelters. Key to successful crayfish breeding is size separation in all life stages to prevent inflighting.

Logistics of Aquaponics Production, Not So Sofishticated

Apart from our main production loops there are breeding rooms for each species, allowing us to obtain new generations of fish and crayfish for production. Breeding tanks are technically setup as small one - looped aquaponic systems, saving water and showing another technical solution for small farmers. The planting area is dedicated for planting duckweed as a feed for our fish and for supporting productions: snails, insects and duck breeding. Altogether breeding loops provide 69,6 m^2 of planting area.



After spawning, eggs are hatched or separated from parents tanks and then moved to the nursery room. Because fish growth is the fastest with the highest mortality rate in this period, frequent feeding and close control in this phase is necessary. From the nursery, fish and crayfish are moved to the main production systems. When they reach marketable size, they are harvested and prepared for our customers.

Our products

We have Nile tilapia, African catfish and Red swamp crayfish. We chose not to breed carnivorous species, because they require high levels of protein in their feed, which can´t be supported by the AG production. In an artificial environment it is difficult to satisfy carnivore species need for space and we believe that in order to have a high quality product, sufficient level of welfare must be kept. Choosing omnivorous fish for aquaculture plays an important role in achieving sustainable production by reproducing our fish and crayfish inhouse and by formulating fish feed fully supplied from our resources using waste streams from B^2.

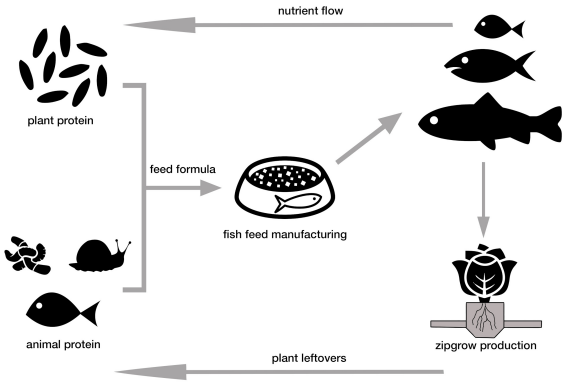
Tilapias, if prepared properly, are a tasty part of a healthy diet; catfish are more fatty but with very few bones. They are considered to be a culinary speciality with higher marketable price then tilapias. Both species are fast growing, easily bred, and tolerable to water quality, making them very well suitable for indoor fish farming. We start with a small production of 480 - 960 fillets per month and max 810 pieces of crayfish, expecting to grow in time. To see more details on our production check *Annex 2.3*.

Fish and crayfish are fresh, organic and safe products produced in a ecological and sustainable way, while the whole process is transparent and explained to customers with possibility to taste our products in the AvantMarket.

How do we feed the fish?

"Permaculture creates a cultivated ecology, which is designed to produce more human and animal food than is generally found in nature." ***-Bill Mollison***

The feed formula of the AvantFeed is based on duckweed, brewers spent grains, fish, insects, snails and Chlorella algae. Most important to us is getting fish meal and fish oil from our own production, without supporting overfishing of the oceans. Protein is formulated using the square method. For use in RAS, feed is manufactured into pellets, to reduce risk of contamination. For details on fish formula see *Annex 2.4*.



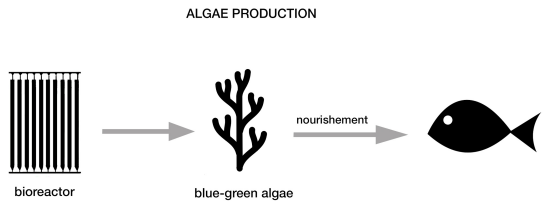
We have designed the following production systems to provide a sustainable source of food for our aquaculture breeds, we call it **supporting production**:

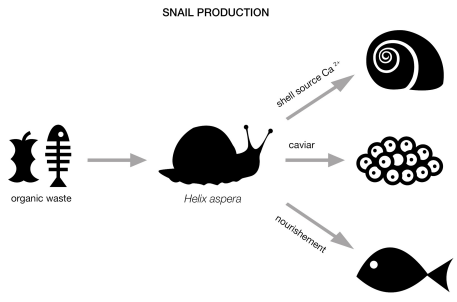
Outdoor Aquaculture… They're Not off the Hook.

We need to achieve about 297 kg of low value fish per year. We do that by building a series of small ponds in connection with beneficial integrating of duck breeding. Because of our ducks enjoying the ponds, ponds are connected to channel surrounding B^2 to secure necessary mild, but constant flow of water. In these ponds fish density is low, about 15 kg/m^3. Ponds are harvested 4 times per year and fish are processed into fish meal and fish oil, and stored maximum for three months. The ponds provide a source of engagement and interaction as well for Bajes Kwartier citizens as we will have feed dispensers near the ponds where people can feed the fish and ducks.

I used to hate ALGAE, but it's growing on me

A freshwater microalgae *Chlorella* is used in our production due to its high content of chlorophyll, vitamins and high iodide content which is essential for crayfish diet. Growing Chlorella algae only requires filtered water, plant nutrients, sunlight and aeration with carbon dioxide. See more in *Annex 2.5*.





Snailed It!

The species *Helix aspersa* is commonly found in European conditions, it has simple requirements for food, is highly adaptive and it has short reproductive cycle. The production cycle is splitted into 4 sections according to the life stages: reproduction, incubation, nursery and grow out + hibernation. The system includes movable boxes placed on shelves using space more efficiently. Food for snails is supplied

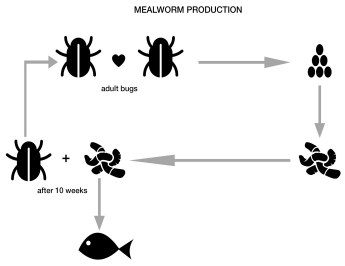
from AG waste streams. A source of calcium is provided from recollected duck and chicken eggs. More can be found in *Annex 2.6*.

Insect Production, Don't Let it Bug You

Our Mealworm and Black soldier fly production is divided into breeding, growing and harvesting. The environment conditions are maintained by software. For breeding and growing we use high racks placed next to each other. For feeding we also use waste from AG including mushroom or fish.

Oh Mealworms, Where on Earth have You Been?

Adult bugs lay eggs on the floor of the container. The eggs fall through a filter and continue growing. Adult worms are harvested and fed to the fish.



What do you call a fly with no wings? A Walk.

Black soldier fly is a valuable component in a fish diet having favourable protein content. After getting eggs from adults, they are raised in a grow - out and simply used for feeding purposes. Check *Annex 2.7* to see more!

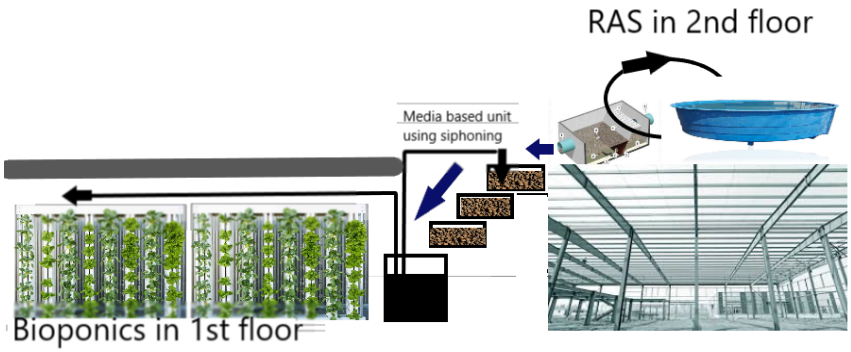
Vermicomposting is pretty hot right now!

Vermicomposting is a supporting production for our bioponics and Chlorella algae production. We will use barrels of 200 Litre volume. After organic matter is decomposed, which takes 6 - 9 months according to the input matter composition, it is mineralized in strongly aerated buckets for 4 - 6 weeks in order to make a vermicompost tea, which is then used as a manure for our bioponics.

Connecting aquaculture with plant production?

*"Mineralization is a process of conversion of organic matter into simple inorganic compounds, mainly by microbial degradation" -**Mackey and Paytan, Phosphorus Cycle 2009***

Transformation of nutrients from aquaculture via mineralization is necessary before reaching bioponics. For this purpose, a multi-leveled media based unit is an intermediate period in between technologies. For more efficient processing of nutrients, earthworms will help with mineralization. The media based unit is operated by siphons. Part of the unit is a sump which serves as a checkpoint for water quality parameters which can be changed in order to satisfy plant needs. pH is decreasing with constant nitrification, changing pH favourably for plants. Missing nutrients can be easily supplied in the sump.



Plant production

Crops grown in the AvantFarm are chosen to be complementary, not substitutive. We carefully researched local farms in the Amsterdam region, what they produce and when (for our list of possible B^{2}Farmers see *Annex 3.1*). We then evaluated what produce are missing on the local market from the nutrient and citizens' preference perspective. We strive to produce off season, and different species varieties than local farmers. This ensures we are not competing for produce demand and also that we are not importing produce from afar. Our production differs by season, "summer'' and ''winter''. Summer season starts in March and winter, October. In summer there is a plentiful diversity of local produce, therefore indoors we can focus on satisfying more exotic and non traditional tastes. In winter, on the contrary, we switch to produce what would be imported. We have selected complementary crops to support the community with a balanced source of essential produce.

In general, our veggie production can be divided in six categories. Leafy greens (30 %), fruit vegetables (20 %), fruits and herbs (20 %), roots (15 %), bulbs (10 %), tubers (5 %). Check

our plant species offer in *Annex 3.2*.

Technologies used

The plant production of The AvantFarm is based on two types of systems, a **drip irrigation system** (we call it DripSys) and **VerticalTower** towers (modeled after Bright AgroTech's ZipGrow™ technologies). By making this choice, we are able to fit into the limitations of the AvantGarden, as well as meet our own objectives for food production to feed the Bajes Kwartier. More details on technology can be found in *Annex 3.3*.

Microclimatic condition are very important within the production unit. Carbon dioxide (CO_2) from the mushroom production is recycled. Oxygen produced by plants is used in mushroom production through ventilation. Units with VerticalTower systems are equipped with VerticalTower racks which hold them in vertical position, whereas drip irrigation systems use horizontal growing beds in which transplanted blocks from germination are placed. Specific light spectrum is provided via LED lights and sunlight.

Bioponics

We design our system from seed to harvest. The germination unit is where plant seeds are inserted into growing medium, either rockwool or oasis blocks, depending on crop type. Seeded blocks are watered and transferred into moisturizing microclimatic boxes, where temperature, light exposure, air conditions and humidity are automatically kept at set levels for optimal germination. Once the germination process finishes, the blocks are transplanted

from production trays to VerticalTowers, or growing beds for the drip irrigation system. Organic waste from harvesting unit is collected and used for our vermicomposting or transported to biogas station. Processed products then continue directly in the market or to storage. All reusable materials are delivered to a cleaning unit.

Leafy greens are planted in a VerticalTower only. There are eight units of 15 m² running whole year. Species of leafy greens are chosen to create a nutritious and visually attractive salad plate. Drip irrigation system offers a variety of vegetables, fruit, and herbs.

The Mush-Room

Mushrooms are extraordinary at turning “waste streams” into food. For the purposes of the AG, we’ve chosen coffee grounds as a substrate, and what better place to do it than Amsterdam with her many coffee shops and bistros. The Mush-Room production cycle is creating value through low tech, low energy means. The coffee grounds could be turned into compost, but we turn them into food, use the substrate to feed the insects which feed the plants (which supply the mushrooms oxygen) to feed the Bajes Kwartier.
The essential element needed for production is creating partnerships with these businesses in and around the immediate surroundings (4 km or 15 minute by bike) of the Bajes Kwartier.
The cycle goes as follows:

1. We will provide reusable containers to the cafes where they will fill with used coffee grounds each day. Several young lads or ladies will be sent out each day to collect the coffee grounds with special bikes fitted with a cart.
2. The riders will deliver the coffee grounds to a small room on the first floor of the AG
3. Grounds enter the inoculation room. No need for pasteurization or sterilization as they are effectively pasteurized by the brewing process.
4. The grounds are inoculated with the spawn in reusable plastic containers. The grow tubs are then moved to an incubation/grow cell. Mushrooms require different conditions for incubation and fruiting. These conditions will be controlled by cell so we can induce fruiting when the mycelium has fully colonized the tubs.
5. Bi-weekly harvest brought directly to the market

See more logistics here: *Annex 4.1*. Check more details on production in *Annex 4.2*.

The inputs are free, but require several good workers. Our design calls for 1 experienced mushroom growers (perennial) and 2 - 3 apprentice (annuals). We selected the following species based on their ability to grow on coffee grounds, speediness, nutritional and medicinal properties. More details description in *Annex 4.3*.

Duck Deficiency

We have more than sufficient snail production so we were inspired by Bill Mollison, “You don’t have a snail problem, you have a duck deficiency”. We will have duck breeding to offer eggs on the AvantMarket. We chose Khaki Campbell duck which are able to produce 340 eggs per year. We have 120 ducks laying almost 500 eggs weekly. We feed our ducks with chopped greens, mealworms, snails, earthworms and seeds.

The AvantMarket

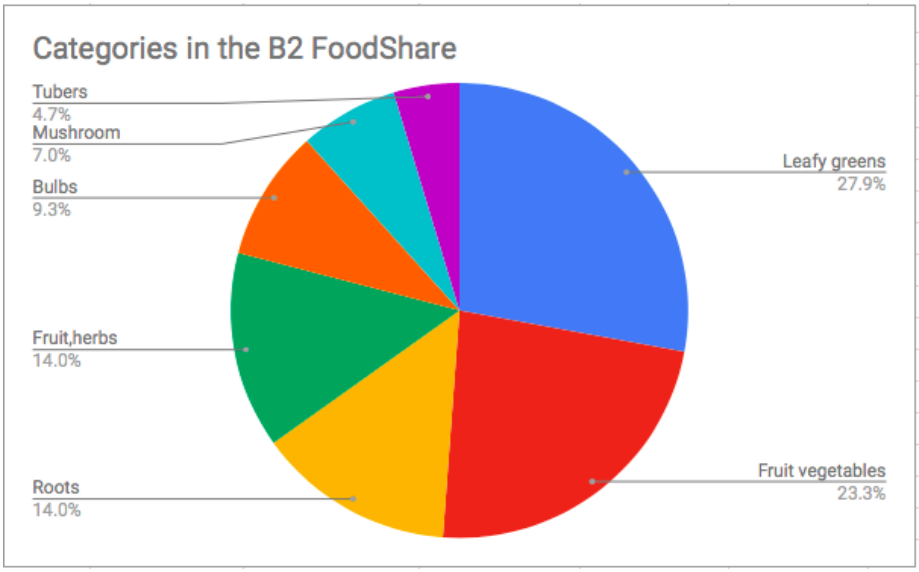
Our main goal is to make sure that all our community has essential food all year round from local sustainable sources. The AvantMarket is where the harvest from the AvantFarm goes to your hands. The production of the AvantFarm is designed to complement the already existing local farmers' environment. Some products can be produced in our system but make much more sense to grow outdoors at a different scale. We are inviting other local farmers to join us. In this way, we fill gaps in our own production for items such as potatoes, wheat, organic dairy, artisan bread, free range chicken and eggs, and grass-fed beef.

The AvantMarket is essentially a farmer's market open six days a week year round. Each farmer have a personal stand with his story, a box where you can leave a note as well as a calendar showing when they will be at the AvantGarden for events, when their own classes for the public will be held, and times that they give tours around their farm or garden. It is the farmer's decision how their stand will be organized and presented. The AvantGardeners for example, brings down the vertical grow tower with leafy greens ready to harvest and allow the customer to harvest it themselves. The operation and support of the market is done by employees of B^2COOP, which enables farmers to save time. They can also hire workers directly for their stands easily through the money and time exchange system using their B^2Wallet. The market setup propagates our ideology of cooperation over competition and deepens the connection between citizens and farmers even more. We close on Sundays because even the creator needed a rest.

There is space for about 34 farmer stands, about 9m^2 on average. ⅓ of the market area is for the AvantFarm. We carefully selected categories (see *Annex 5*) that we would like to be present and besides the majority of food stands, there are a couple day-to-day essentials and also a space left for irregular specialties.

B²FoodShare

B²Neighbors have the first pick of our production, a guaranteed supply of fresh produce year round. Our food share is designed and carefully calculated to not be symbolic or an add on. It is meant to be the main source of fresh produce for an individual, couple, or family. It is a mix of fruits, vegetables and mushrooms, carefully selected with the same logic as the AvantMarket. Accordingly to what is in season by local farmers we adjust the AvantFarm's choice. 70% of the food in the food share comes from the AvantFarm, 30% are supplied from the B²Farmers. On the graph below you can check out what to expect in the basic B²FoodShare - for an individual for a week. The box will always weigh approximately 4kg.



What specific produce you can expect? See in the *Annex 6* as an example.

As a B²Neighbor, you can pick your best B²FoodShare to fit your eating habits. Here are your options:

Type of B²FoodShare	# People eating	Per month (EUR)
Individual	**1**	**108**
Couple	**2**	**195**
Family (serves 3 to 4)	**4**	**324**

Through your B²Coin Wallet you can select the frequency (we don't want to see any food wasted). However, the minimum is set to one individual food share per month. In that way you ensure that, at the very least once a month, the AvantFarm and other B²Farmers will be able to financially support the productions of your Share.

AvantCommunity

"Ritual is a regular meeting place, and taking part in it affirms that the participants are members of the community. Communities need to have some reason for getting together. If that reason is a myth with no practical function, nothing is lost. What matters is getting together." -David Fleming

Bajes Kwartier Carnival: Carnival represents a break from the normality of working life; the opportunity to be enchanted, to listen to music, dance and feast. "Ecstasy", from Greek: *ec* out + *histanai* place. Routines are broken several times a year, to refresh and remind that we all must take time to celebrate the beauty of life and community. Celebrating together defines the character and identity of our community (Fleming, 2016). We see Carnival filled with live music, people dancing and laughing and tables of delicious food spread out around the AvantGarden through the Kwartier.

Social Spaces:
Whether it's a town square, church, or field, all communities are built around gathering places. The AvantGarden houses a variety of social spaces, such as small and large meeting rooms, a kitchen studio, hackerspace (where people can build and experiment), cowork hub (which can be used as study space or library as well), and a children's playground can transform into a summer cinema and event space. These places are made to be multi-functional and inclusive for all ages.
We see there is so much opportunity to take advantage of unused building space and time. That is why all social spaces are accessible to coop members 24 hours a day; the building is accessible through our application or ID card which ensures accountability. While B^2COOP members do have priority and largely reduced prices, these spaces are available for everyone. Individuals or companies from outside the Kwartier can visit or rent a B^2Community space and attend events. For prices see *Annex 7.1*.

Education through Engagement: Numerous and diverse array of classes, lectures, discussions will be organized by coop members. Topics ranging from cooking with food scraps, art history, online security, to reducing energy consumption. We encourage members to self organize and rent rooms for a nominal price. Through **B^2 COOP**'s application, members can reserve rooms, group pay, and make events public to find others interested in the same activities. This allows small and large groups of members to gather, share knowledge, and build friendships.

The Hill: The Hill is an important part of the AvantGarden. We noticed that the Netherlands is noticeably lacking in hills, elevationally challenged if you will. So we created a walking path that wraps around the AG ending at the rooftop Permagarden Cafe with a beautiful view over Amsterdam. This pathway is open to anyone, 24/7 365 days a year. This feature can provide a nice after dinner walk for residents who want to watch the sunset over Amsterdam. The Hill also provides a path for a walking tour but these will be scheduled at certain times to avoid crowding.

Tours: The Annuals working at the AvantFarm will lead organized tours several times per week. This enables people to see the inner workings of the AvantGarden and meet one of the gardeners. This also provides the Annuals with immensely valuable public speaking and social skills and a way to connect with people from all around the world. Just as no space

has only one function, we know that people are so much more than a teacher, farmer, cashier. The Annuals will be trained on how to give tours and encouraged to add their own style. Guests will visit the various production ecosystems, learn about the history of the building as a prison facility, ending at the rooftop permaculture garden and cafe.

Edible Forest at Our Permagarden Rooftop:
After the tour through the greenhouse, the visitor can absorb their thoughts and new knowledge in the peaceful environment of our permagarden at the rooftop. The rooftop has two floors. The first floor will be indoor/ outdoor café and permagarden; the second floor will have an open outdoor café, with a solar power roof. An educational trail leads through the permagarden explaining the principles of permaculture. From spring till autumn there will be an open air cinema in the evenings. The produce will be used to make homemade cakes, salads, juices etc. and sold in the café. For details on Permagarden design, see *Annex 7.2*.

Employment vs Automation: We have consciously chosen to limit automation at the AvantGarden because we believe that engaging employment in a healthy environment can bring meaning and purpose to life and strengthen community. Certain systems are automated to the extent that the AvantGardeners are alerted if a system is out of balance. However, you will never see a robot rushing to fix the situation. We see an over reliance on technology as an Achilles heal in any production process; if the technology fails, the crop fails and we fail as a farm to continually supply our neighborhood with healthy food. We believe that the benefits of providing employment to our community greatly outweighs the small financial gains that could be made by automating. The rapid decline of rural communities around the world is due mostly to large corporations seeking to lower costs by moving jobs to places where they can pollute freely and hire workers for low pay in unhealthy conditions, or automate production; all this for the sake of maximizing profit. We measure value beyond monetary terms in what is best for the welfare of our community. A community's economy is strong when the members are employed within it, building social capital, and recirculating money in the community.

Investing into Our Community: We imagine the entire Bajes Kwartier filled with edible species of fruit and nut trees. The walkways and hedges will be filled with delicious herbs, tea leaves, and medicinal plants. Bees will find an oasis of nectar to feast on in the middle of Amsterdam from the spectacular variety of flowers and apple, pear, and walnut trees will replace energy consumer lawns. The Bajes Kwartier will be a full forest ecosystem and the AvantGarden profits will fund this transformation. People, especially children, should not be cut out of nature completely in urban areas. It's also very important that they know where their food comes from and the manner in which it is raised so they could appreciate the value of food. What better reminder than to be sent out to gather herbs for dinner or stroll along the canal, browsing lazily on raspberries.

AvantEconomy

"A sacred way of life connects us to the people and places around us. That means that a sacred economy must be in large part a local economy, in which we have multidimensional, personal relationships with the land and people who meet our needs, and whose needs are met in turn." ***— Juliana Birnbaum Fox***

More than Meets the Eye: After all costs of materials, energy, and fair wages, the prices for food produced at the AvantGarden are slightly higher, but comparable to nearby supermarket prices. This is quite a feat when we stop to consider how supermarket prices can be so low. How can an apple from New Zealand compete in price (or nutrition) with one grown in the Netherlands? Supermarket prices are reliant on cheap and abundant fossil fuel energy, do not account for pollution costs from production, packaging & transporting, subsequent increased health costs, and infrastructure costs from trucks on roads. These unaccounted costs are external to the price system, thus termed "externalities". The field of environmental economics attempts to assign prices to these costs, but how can you put a price on a functional ecosystem? "There is very little that can usefully be done with a serious underestimate of infinity" (Toman, 1997). Externalities can be positive as well. Like a smiling cashier leaving the counter to help an elderly lady carry her shopping to her bicycle, or keeping the Market open 5 minutes after close because you're running late. The B^2COOP community will understand that there is much more to the price of produce at the AvantMarket. The money you pay stays in the community, employs your neighbor who then buys your crafts, and so on. All this keeps the local economy solvent while stopping external costs to the planet and society.

B^2Coin: Because Value Doesn't Lie in Paper

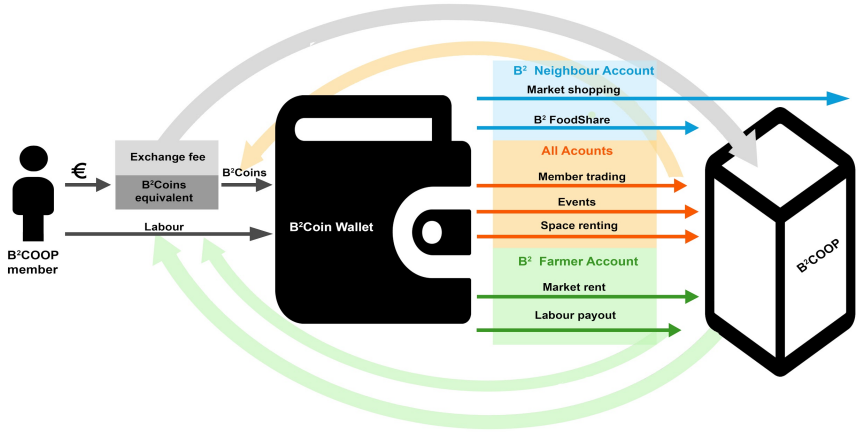
Money is a social contract, nothing more than the trust we put into the governments and financial institutions that issue it. National currency flows through a country and tends to accumulate in multinational companies and investment banks. Local currency on the other hand is not useful or wanted outside of the community it is issued, so it circulates indefinitely, providing a constantly available resource (Mollison, 1988). What we propose for the Bajes Kwartier is not just a virtual wallet, but a form of local employment trading (L.E.T). This system allows Bajes Kwartier citizens to invest their time in exchange for B^2Coin which they can then use to pay for their B^2FoodShare, AvantMarket produce, and renting social spaces.

In our mission to be inclusive, we have devised an innovative payment system. Each person seeking membership in B^2COOP can either invest their money or their time (labor), depending on their resources and disposition. This system creates an opportunity for everyone to participate and have ownership in B^2COOP. People with full-time jobs probably have more money than time and, students, artists, freelancers, and seniors can likely offer their time instead. There are multiple opportunities to obtain ownership through labor, all creating social value, increasing employment and lowering the total operational costs. Labour can be measured in time or fixed value, and after finishing a job and confirming it through our application, he or she will receive a monetary credit (and therefore will be set into the same position as someone who invested actual money). These tasks cover a large spectrum of activities and skills, from manual labour such as is cleaning or storekeeping, through product or service sales, to operation directing.

By investing, the member is buying a virtual currency, B^{2}Coin, at set exchange rate equal to Euros. If a member invests money, their investments are immediately transformed into B^{2}Coins saved in a personal account and a nominal transaction fee of the amount transferred goes to B^{2}COOP. If a person invests labour, they need to finish a task for specific amount of B^{2}Coins, which after completion is awarded to a personal account.
This ecosystem functions online, which will be connected to the physical world by either an application or contactless card. Regardless of choice, it is also accessible through a website platform. This offers an organized and clean overview of the personal account (i.e. list of previous purchases, reservations for events or workshops, active memberships etc.) and the whole B^{2}COOP (available work tasks listings, voting, electing representatives, transparent investments lists etc.). To top up your personal B^{2}Coin balance (apart from investing through labor), you can again use the website platform or visit client centrum of The AvantGarden. The same applies for withdrawals. We illustrated couple examples - see *Annex 8.1*. Visitors to the AG will receive a public contactless card, which collects their purchases. When leaving the AvantGarden the customer pays their balance at a cashier desk and returns the card. These non-members however have none of previously mentioned benefits, and prices for all products are taxed by B^{2}COOP.

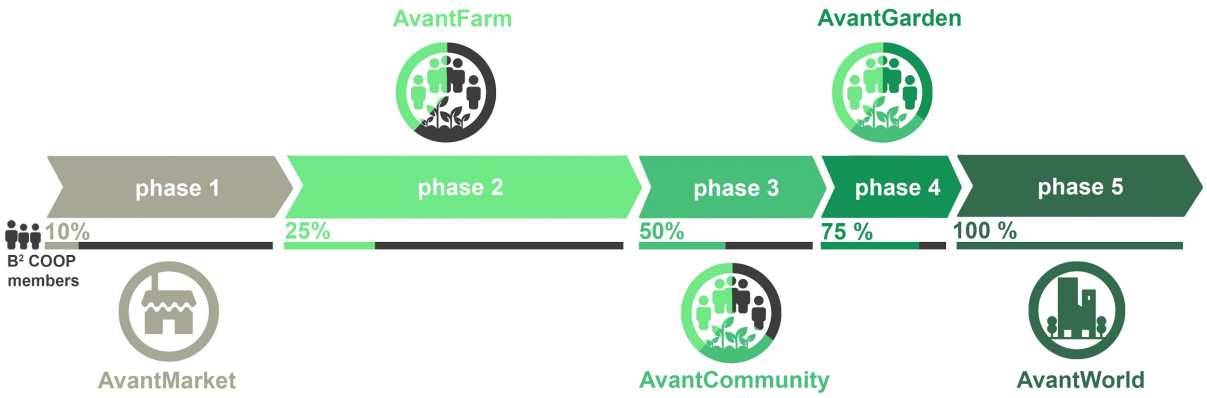
It's important to note here that we have not factored any of these additional sources of revenue into our economic analysis. This is to give a worst case scenario and most pessimistic outlook of our finances. Yet, from our calculations, we remain profitable.

Our hope is that people put their trust in B^{2}Coin. For now, 1 B^{2}Coin is equal to 1 Euro. However, in the case of sudden devaluing of Euros, B^{2}Coin can hold its value because it can be backed by a tangible asset, food. This differs from other electronic currencies such as bitcoin, whose only store of "value" is energy consumption (daily Bitcoin transactions surpass the daily energy consumption of the Czech Republic), or Euros, which are backed by the stock market (itself largely controlled by algorithms) which is subject to fluctuating oil prices, and relies on forever increasing consumptive growth on a finite planet. Regardless of the national economy, B^{2}Coin builds social bonds created in the community which is the true backbone of any local economy. Anyone who wants to work can offer services through B^{2}Coin. Since only members can trade with each other, the money circulates in the Bajes Kwartier and the account is always balanced.



Multi year business plan

Building a new community as we are proposing here, will be slow, which is especially difficult in an era of multi-tasking, quick tech fixes, and quarterly stock earnings. Like forests, communities do not form over night, they take time. If we want to truly act sustainably we must take the long-term approach, growing organically and accepting the limits of growth within the BB. To build a sustainable ecosystem we must follow the rules of natural succession, taking small steps towards cooperatively satisfying our needs while retaining our independence and autonomy in running B^{2}COOP. The realization of such a project is very ambitious. Therefore, the AvantGarden succession to economic self-sufficiency and stability follows 5 phases, each with a goal of increasing our B^{2}COOP membership at a rate of sustainable growth while adding and improving on the different systems and places that make up the AG.



The phases have different construction goals overlapping with social goals:

Phase 1: Construction of the AvantMarket, rooftop permagarden with café, The Hill, spaces for staff and operations, open social spaces and energy systems

- Begin with a party. The first of a long tradition of Bajes Carnivals
- Partnerships with local farmers and craftspeople are formed
- B^{2}FoodShare boxes begin with goods from farmers - if the interest is high enough then...

Phases 2-4: The AvantFarm and expanding on social spaces

- We have the support of 10% of the **B^2** and growing. The AvantGardeners get to work setting up the food ecosystem and supplying to the AvantMarket and B^{2}FoodShare.
- Social spaces are slowly created, gaining momentum and engagement as more people get involved
- B^{2}Apprenticeship program begins
- In each of these 3 phases we plan on expanding by approximately ⅓

Phase 5: 100% of BB citizens (utopia)

- We may never get there, but it's okay to dream, to strive for this goal and maybe one day, every person in the Bajes will be a happy member of B^{2}COOP.

At each stage we must step back and ask ourselves if our goals are being met. This is a process of constant feedback and response, kind of like riding a bike. For detailed description of phases check *Annex 8.2.1*.

Initial investments and their returns:

The whole process of building starts with outside funding, which will be used to build the AvantMarket, its supportive rooms, and first social spaces. The operation of this phase is not designed to bring profit, but rather test out interest and engagement of Bijlmerbajes community in such project. All following phases (2-5) are projected to be independent of other non-community fundings and will make enough profit to pay for themselves. The duration between starting a new phase and finishing it is solely dependent on a performance of the given building process. The return of investments for investors of phase 1 can be done from profits of phase 2 and later. Once investments of all phases are paid off, profits can be invested into the Bijlmer Kwartier or other programs, based on preference of B^2COOP members. Exact calculations can be found in *Annex 8.2.2*.

In the event that we need additional funding that cannot be sourced from our community our plan is to reach out to the various cooperative banks and credit unions in Amsterdam.

Cashflows:

There are multiple costs and revenue streams in the project of the AvantGarden, based on all parts described before, whether they come from food production, social spaces and engagement, B^2COOP operations, or energy flows. Essentially, their volume closely reflects the succession of all phases:

- Phase 1: The main costs of the AvantGarden are payments to staff, which cover running the whole operation. The revenues of AG come from the rooftop café and capturing of energy. The AvantMarket cash flow oscillates around B^2FoodShares - costs of labour and products of local farmers, and prices of food shares as revenues.
- Phase 2-4: The AvantFarm becomes the primary source of costs and revenues. The majority of costs again come from staff payments, a much smaller part consists of costs for energy and utilities, closely followed by materials needed in production processes. This is reflected in revenues, where value of production is more than twice bigger than value of rents of social spaces. The AvantMarket largely increases its costs and revenues from B^2FoodShares, becoming a primary source of income in the whole AvantGarden.
- Phase 5: While The AvantFarm is complete at this point, the potential of The AvantMarket is able to serve to 100% citizens of Bijlmerbajes and therefore increasing its profits accordingly.

Detailed analysis can be found in *Annex 8.2.3, 8.2.4 and 8.2.5*.

Innovative Sources of Funding:

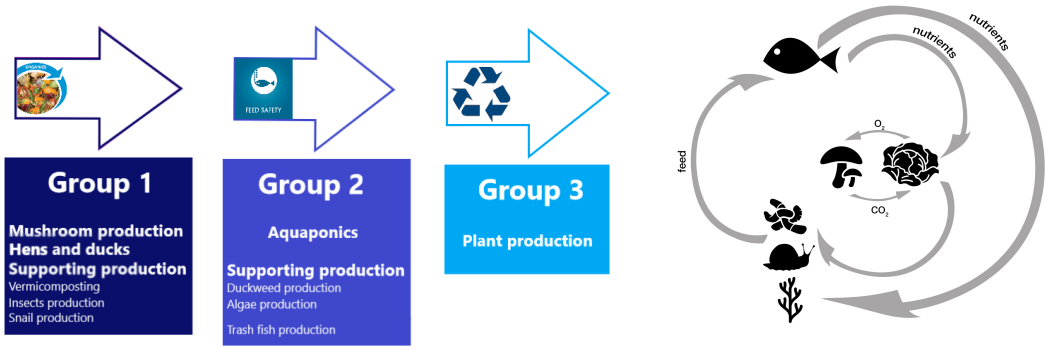
We plan on renting services for lighting, water pumps, refrigeration, renewable energies. This saves us large upfront costs of investment and planning. We specify what we need, for example, lux of light for so many hours, and the manufacturer of the light bulb must use the least amount of bulbs, that last the longest and use the least energy. It is also their responsibility for the light bulb at the end of its life cycle so we don't produce any waste and the manufacturer must design the product to be easily recycled. (For me info, see Circularity)

AvantCircularity

There is no such thing as waste in natural systems, all energy is recycled and reused in a continuous circle. Until very recently in human history, humans made things to last, Roman Colosseum compared to modern sports arena. The concept of “waste” is invented which means that we can change our idea about waste. We need to urgently design our cities to deal with their own waste streams. We can capture this energy and create value in multiple forms: meaningful jobs, growing food, reduce water and energy use.. Waste, otherwise headed to the landfill, powers and feeds the Bajes Kwartier. We have created complex, schematic diagram showing all the flows in th AvantGarden. To see the diagram go to *Annex 9.3*.

Our Food Web:

To simplify our concept we have created three groups demonstrating nutrients flow. The first group are waste feeders, using organic waste to create higher value end products, mushrooms, and eggs. The supporting production provides nutrients for Group 2: aquaponics and supporting production for aquaponics. This system is capable of extensive plant production, capable of feeding the entire Bajes Kwartier via recycling nutrients from aquaponics and vermicomposting using vermicompost tea.



Supporting production is a net of six systems allowing us to feed our fish and plants. These systems are fed with organic waste from the main production and nutrient rich water nourished with vermicompost tea and fish feces. All unused organic waste is recycled via vermicomposting and by the biogas station. The final products are mushrooms, plants, eggs and fish delivered to our market.

Capturing Energy

Energy from Biogas:

The Waste Transformers are a partner business that will operate a biogas reactor in the AG. Bajes Kwartier residents are responsible for bringing food scraps and any organic waste to the biogas station. If the AvantGarden and Waste Transformers are unable to meet the energy demands and food waste needs of the supporting production, we will recruit restaurants and cafes in the area to bring us their food waste. See *Annex 9.1.1.*

Solar Energy:

Panels will be placed on roof of the AvantCafe, an area of approx. 110 m^2 from which it will possible to get approx. 1,3 MWh monthly. PV panels used in our design are panels from company called Sunpower, contain microcrystalline cells and have one of the highest efficiency of 21,5%. These panels are able to achieve 95% efficiency in first 5 years, after

this period the panels slowly lose their efficiency, which is only 0,4% per year to year 25. They are designed to deliver the most energy in demanding real-world conditions, in partial shade and hot rooftop temperatures. *See Annex 9.1.2.*

Wind Energy

Because the main source of water is the rainwater from roof harvesting system and stored in the underground reservoir, we had to find some way to efficiently get the water up to the production units. With the help of a wind pump we can transport water up the building and avoid use of electricity for pumping. See *Annex 9.1.3*.

Rainwater: Will be collected from the roof, where the water will be mechanically filtered with use of different grain layers. After mechanical filtration the water will be sent and stored in the underground reservoir A, which will be connected to the reservoir B containing already clean and potable water that will be pumped and used within the building. The capacity of stored water is approx. 270,000 litres. To obtain potable water we will use a special nanofiber filtration sieve (BMTO company) and UV radiation.

Grey & Black Water: Why do we flush our waste with drinkable water? We have no idea. There is enormous energy saving potential for using gray water, not just in the AvantGarden, but worldwide. Gray water is water that goes down a drain, not a toilet. All gray water from kitchens and bathrooms will be cleaned using biofiltration; water plant roots and microorganisms living in the water environment will effectively filter the water. A biofiltration pond will be placed next to the building and the clean water will be possible to use as water for flushing the toilets. At this moment the gray water is turned to the black water. At this point the blackwater will be sent to the municipal sewer system. We aren't satisfied with this solution because it means that there is a hole in our circular design. At the last moment before publishing this manifesto we found a project at a Adarsh College in Badlapur India that offers a solution. See *Annex 9.2*.

Supporting a Paradigm Shift in Manufacturing: We recognize that solar panels, wind turbines, and batteries have high up front energy costs. Through careful design, use, and repair, we expect these technologies to provide much more energy over their lifespan than was used to produce them. We searched for ways to find products that were circular in design and built to last. We were inspired by Dutch Architect, Thomas Rau in thinking about the technology used in our systems e.g. lighting, pumps, refrigeration, and energy storage. Mr. Rau partnered with Phillips in a "pay per lux" lighting scheme. By switching the responsibility to the manufacturer we can change the paradigm of "designed obsolescence". To paraphrase Mr. Rau in addressing Phillips, "We want light, not light bulbs, and we don't want to pay an electric bill". Suddenly, the manufacturer must think about the product through its entire life cycle, knowing that it is their responsibility, and in their best business interest, to design the lights to be long lasting, energy efficient, repairable, and easily recycled. This model is in stark contrast to the current, which incentivise producers to design products to break and intentionally makes them difficult to repair, e.g. smartphones.

AvantWorld

"The place to improve the world is first in one's own heart and head and hands, and then work outward from there." -Robert Pirsig

As it's become clear, this project is much more than building a greenhouse in Amsterdam and is nothing less than fundamentally changing the way cities feed themselves and form community around common values and goals. The Bajes Kwartier has the potential to be an urban village on a hill (metaphorically speaking, there are no hills in the Netherlands), a model for fundamentally changing the way city quarters and communities cooperate locally to meet basic needs. This is not the start of the Transition movement which gained momentum in the aftermath of 2008, but it could be the tipping point. Relocalization can be seen in the brewing industry, and the growing small scale organic gardening movement where people in suburbs and abandoned city lots are breaking from industrial agriculture, taking back control of their food. We are excited and encouraged by the growing empowerment of the peasant movement worldwide in rural areas. Peasant farmers feed 70 % of the world on 30 % of the land with almost all food consumed within 100km of where it is produced (Hilmi, 1988). There is no reason we cannot model village cooperation and community in modern metropolises; in fact, it's becoming increasingly clear that there is no alternative to relocalization. Villages are places where individuals respect each other because they live, work, play and celebrate together and identity is not lost in a sea of anonymity. They are places of true democratic power, where people are engaged because their voice is heard.

We picture a network of urban village communities in Amsterdam and around the world. We are invested in localization through our B^2Apprentice Program. The skills and knowledge gained from the ecosystems they will build at the AvantGarden can drive transition to resilient communities throughout Amsterdam and around the world, able to respond and adapt to difficulties brought on by a changing climate and the unavoidable end to cheap energy. This transition will not be easy; It will take courage, innovation, and most of all, cooperation. Gandhi wouldn't have gotten far sitting at his spinning wheel; we can all take responsibility for our actions and bring the change we wish to see in the world in ourselves first, then our families, and finally, our communities. By doing this, we can change the world.

"Our place was made by long cooperation
With nature, rock, the rain, the ancient dead,
The living, by their day-by-day inventions
A local ecosystem slowly bred-
All grievous error to the Enlightened head.
But we'll outlive the onward march of reason;
Our science rings true with system, time and season."

-The Peasant's Defiance against the Advance of Rationalism, by David Fleming

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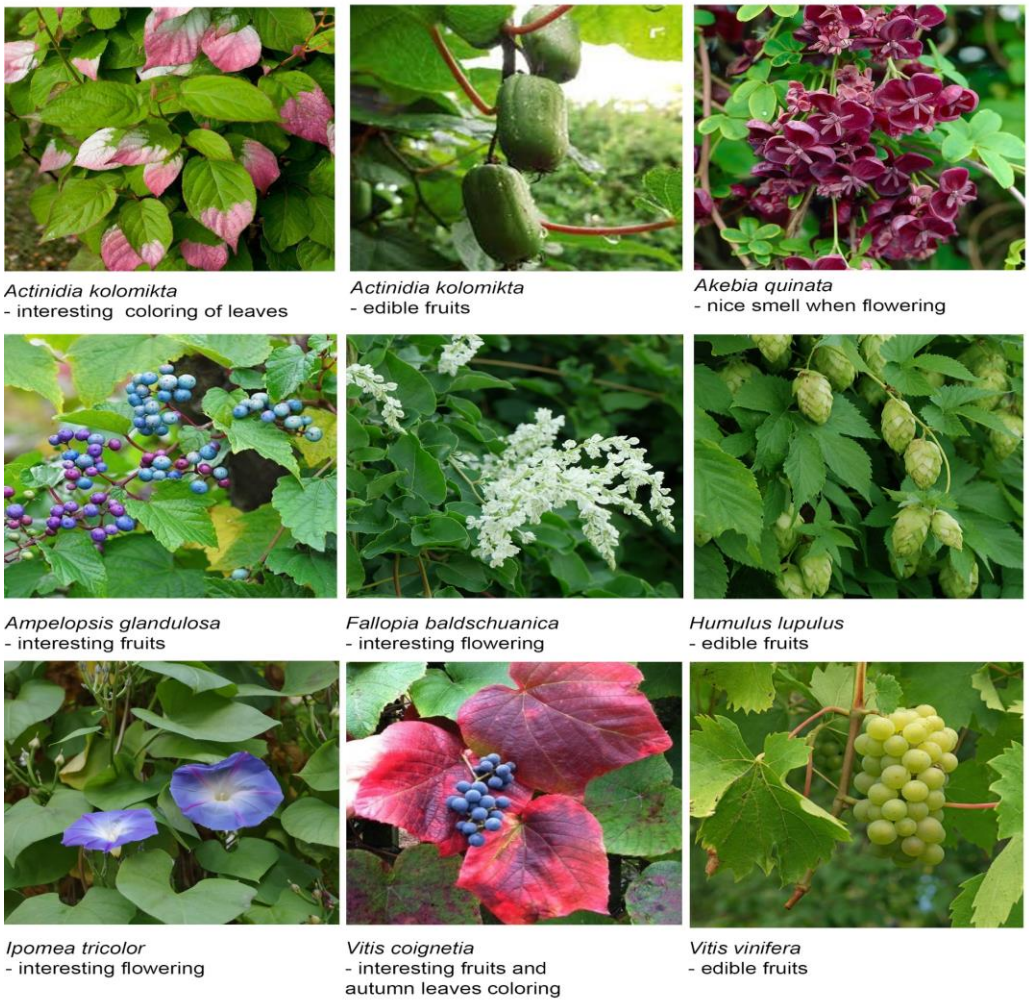
Annexis

1. AvantGarden

1.1. Site plan

Picture 1 Neighborhood site plan

1.2. Facade detail



Picture 2: Selection of climber plants for the facade

1.3. Use of space

	m^2	% of usable area	% of total floor area
Building setup			
Total production area	919.9	28.48	18.78
Total utility area	630.6	19.53	12.87
Total social area	1679	51.99	34.28
Hallways, stairs, elevators	1668.5	-	34.06
Total area	4898.0	100	100.00

Table 1: Building space utilization

			m^2		m^2
Block type	**Block system**	**Block name**	**Single block dimensions**	**Total number of blocks**	**Total dimensions**
Food production	Plants	ZipGrow germination	15	2	30
Food production	Plants	ZipGrow production	15	10	150
Food production	Plants	ZipGrow harvesting	15	2	30
Food production	Plants	ZipGrow cleaning	15	2	30
Food production	Plants	Drip sys. germination	8	2	16
Food production	Plants	Drip sys. production	15	14.2	213
Food production	Plants	Drip sys. harvesting	15	2	30
Food production	Plants	Drip sys. cleaning	8	2	16
Food production	Mushrooms	Coffee room & press	8	1	8
Food production	Mushrooms	Spawn lab	15	1	15
Food production	Mushrooms	Mixing room	15	1	15
Food production	Mushrooms	Growing room	15	5.46	81.9
Food production	Mushrooms	Sterilization room	15	1	15
Food production	Fish	Aquaponic breeding	6	5	30
Food production	Fish	Aquaponic nursery	0.33	130.7	21.6
Food production	Fish	Aquaponic production	1	238	118.8
Food production	Fish	Aquaponic harvesting	6	5	30
Food production	Insects	Production room	15	1	15
Food production	Insects	Storage&processing room	15	1	15
Food production	Bees	Honey processing	15	1	15
Food production	Snails	Production room	15	1	15
Food production	Ducks	Production room	15	1	15
Storage	Plants	Plants storage	15	3	45
Storage	Mushrooms	Mushroom storage	25	1	25
Storage	Fish	Fish storage	6	4	24
Storage	Other	Other products storage	15	1	15
Storage	Maintenance	Utility storage	10	4	40
Maintenance	Maintenance	System monitoring	12	3	36
Maintenance	Maintenance	Cleaning supplies	12	2	24
Maintenance	Other	Bathrooms & toilets	20	12	240
Maintenance	Staff	Changing room	10	3	30
Social	Staff	Office	12	10	120
Social	Social	Culinary class	100	1	100
Social	Social	Education classroom	45	1	45
Social	Social	Event space	200	1	200
Social	Social	Big meeting room	40	1	40
Social	Social	Small meeting room	26	1	26
Social	Social	Workshop/hub/hackerspace	200	1	200
Social	Social	Rooftop	298	1	298
Social	Social	Market	650	1	650
Energy	Algaes	Photobioreactor	32	1	9.6
Energy	Algaes	Service room	15	1	15
Energy	Algaes	Biomass + waste water	8	1	8
Energy	Nutrients	Bio-filter	15	2	30
Energy	Biogas	Brain container	13.9	1	13.9
Energy	Biogas	Diggestor tank	13.9	3	41.7
Energy	Biogas	Gas Chamber/Collector	20	1	20
Energy	Biogas	Storage for waste	5	1	5
Energy	Digestate	Digestate treatment	10	1	10
Energy	Biochar	Biochar treatment	15	1	15
Energy	Vermicompost	Nutrients	4	2	8
Energy	Wind	Windmill	0	1	0
Energy	Solar	Solarpanels	0	1	0

Tables 2 and 3: Building space division

1.4. Visualizations

Picture 3: Front view visualization of the AvantGarden

Picture 4: Visualization of the AvantGarden from west

Picture 5: Visualization of the AvanGarden from southeast

2. Aquaponics

2.1. Matching aquaculture with bioponics and production calculations

Designing the ratio between aquaculture and bioponics, ratio ranging from 1:1 to 1:4 is commonly used. Many parameters such as stocking density, technology used, and protein content in feed influence this ratio. To be precise with our calculations we chose a way to size aquaponics according to Dr. James Rakocy[1], the “father of aquaponics”. The closest to VerticalTower production is NFT technology, which requires 25 % raft ratio being 60 - 100 g of feed/m^2/day, which makes it 15 - 25 g of feed/m^2/day. Square footage of VerticalTower is 0,15 m^2 (0,1*1,5) for one tower. Considering we have 2 560 towers for VerticalTower, with Drip systems having similar requirements, it gives us a total of 24 systems 921,6 m^2. According to Dr. James Rakocy ratio, our bioponics requires 14 - 23 kg of feed per day.

2.2. Technology parameters

Fish tanks are circular in order to achieve a water flow pattern. Water from tanks is drained by dual drains. Filtered water from drum filter and tube settler goes to a moving bed biofilter, where nitrification occurs and helps remove toxic ammonia. Carbon filters are inserted in recirculation. CO_2 removal and O_2 supplementation is necessary. Before water goes back to fish tanks it goes through UV sterilizer which is only in function while high densities are applied. Two pumps are at work, changing everyday. The system is fully automated and water quality is monitored by probes monitoring temperature, pH, dissolved oxygen, total dissolved solids, conductivity, constantly giving feedback. Water level sensors are at work, refilling the wasted water when water level drops. Water is heated to needed temperature by using biogas waste heat. System design dimensions for production systems, hatchery, breeding, and nursery are shown in tables below.
System design dimensions for production systems, hatchery, breeding, and nursery are shown in tables below.

Production systems	Number of Tanks pc	Tank volume m^3	Biofiltration dimensions m^3	Total volume = Pump flow through
Tilapia	12	1	2,4	16,4
Catfish	6	1	1,2	8,2
Crayfish	48	1,5	14,4	56,4

Table 4: Production systems dimensions

	Number of tanks pc	Tank Volume Liter	Total volume m^3	Biofiltration dimensions m^3	Hydroponic part m^2
Hatchery	6	McDonald hatching jars	-	-	-
Breeding	3	1000	3	0,6	12

[1] Dr. James Rakocy, Ten guidelines for Aquaponic systems (2007); Recirculation Aquaculture Tank Production Systems - Integrating Fish and Plant Culture (2006)

Nursery Tilapia Catfish Crayfish	 6 6 16	 1000 300 750	 6 1,8 12	 1,2 0,36 2,4	 24 7 48

Table 5: Hatchery, breeding and nursery systems dimensions

2.3. Production parameters

Fish and crayfish are fed with 2% of their weight, which gives us total stock ranging between 690 - 1152 kg. Having a range allows some flexibility with nutrient management in the system. Densities used for tilapias are ranging from 30 to 60 kg/m^3 and for catfish they are kept at maximum densities 120 kg/m^3. Adult crayfish are bred in maximum densities of 75 pc/m^2.

Species	Number of sq/cbm meters required for min/max stocking density	Marketable size (g)	Number of individuals (Noi)	Noi In kg	Harvest per month	One harvest yield (pc)	Harvest per month (pc)
Tilapia	7,6 - **12,8 m^3**	500	768	384	2*	60 - 120	120 - 240
Catfish	3.8 - **6,4 m^3**	500	768	384	1*	120 - 240	120 - 240
Crayfish	72 m^2/ **36 m^3**	50	5400	270	8*	112	900
Total cbm	**72 m^3**	Total harvest per month In number of fish fillets Total harvest per number in pc of crayfish					**480 - 960** **900**

Table 6: Production parameters for bred species

In both fish species we are aiming to reach maximum possible stock of 384 kg. Because we want to harvest fish regularly, so our customers would know when is their “CrayFish day”, tilapias are divided into 12 tanks, catfish 6 and crayfish 48.
“Plate size” of tilapia and catfish is around 500 grams. Crayfish are sold at marketable size of 50 grams and more. All species are fast growing, able to achieve marketable size in 6 months of age.
Expected losses are low in fish (1%) and variable in crayfish. They can vary up to 50 % or in case of disease high mortality occurs. Strict zoo hygiene plan is kept and all the tools for lowering mortality in crayfish are used such as using piping shelters and sorting out crayfish according to size.

Table below shows environmental requirements for bred species (CrayFish):

Environmental requirements	t°C	pH	O_2
Tilapia, Catfish Crayfish	26 - 32 21 - 30	5 - 10 5,8 - 10	4 mg/l + 3 mgl/l +
Optimum	**27**	**6,5 - 7,5**	**6 mg/l+**

Table 7: Environmental requirements for bred species

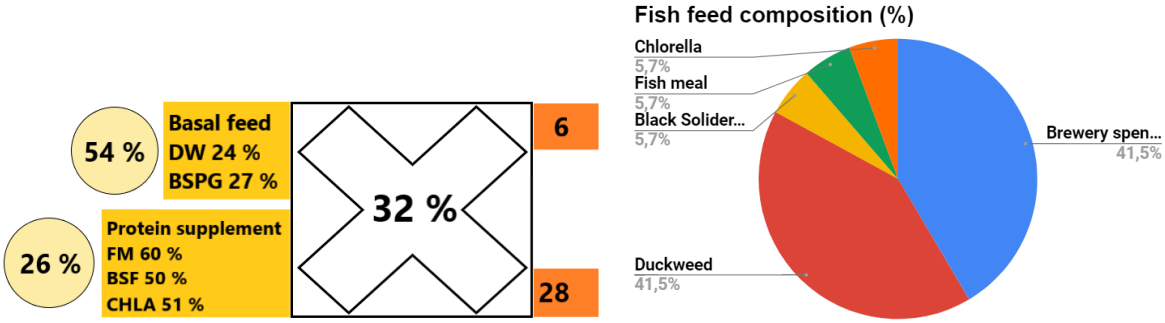
2.4. AvantFeed

For fish stockings we need 14 - 23 kg of feed daily. The most important parameter for feed formulation is protein content. Both tilapia and catfish need 32 % protein content in their diet. With using our own resources for feed formulation, content will slightly differ according to

changing quality in input feed compounds. Regardless, protein content (in kg) should range from 4,16 - 7,36. Individual inputs were calculated according to square method.

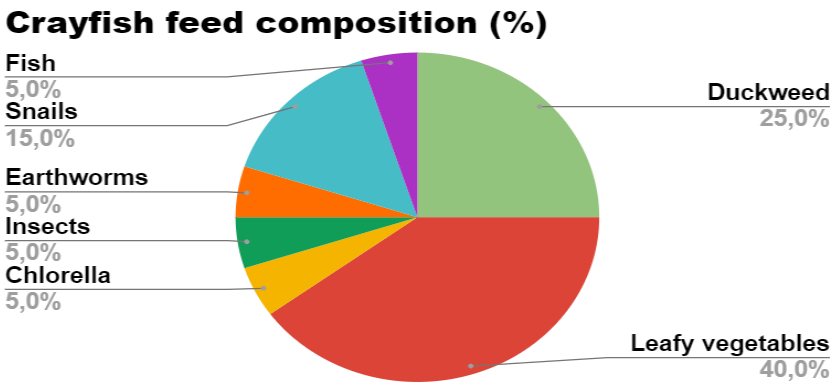
Nutritional Value Of Used Inputs	Crude protein (%)	Fat (%)	Carbohydrates (%)	Crude fiber (%)	Level used (%)	Level of protein used (kg)
Basal feed						
Duckweed	24	1,8 - 9,2	14 - 43	5 - 15	41	**3**
Brewer's spent grain	27	9,5	28	16	41	**3**
Protein supplementation						
Fishmeal	60	6	-	-	5,6	**0,412**
Black soldier fly	50	7 - 39	-	-	5,6	**0,412**
Chlorella	51	8 - 30	10 - 23	6 - 25	5,6	**0,412**

Table 8: AvantFeed compound content



Pictures 6 and 7: Square method formula and fish feed composition

Crayfish need mainly calcium rich plant-based feed and also animal protein. They will be fed with duckweed, leafy vegetables, vitamin and iodide rich chlorella and insects (BSF, mealworms, earthworms), snails and small pieces of fish. Percentage amount is seen in a graph below:



Picture 8: Crayfish feed composition

Duckweed is planted in our nursery systems which has a capacity of 79 m^2. We have calculated with yield 32 tons/acre/year. Brewer's spent grain is bought in cooperation with local breweries in a small amount of 90 kg/month.

2.5. Algae

To be able to produce 1 metric ton of dry biomass we need a tubular glass photobioreactor with a photoactive volume of $8m^3$. Floor space for the algae system will require a floor space of approximately 160 m^2. Algae production is completely automated and is maintained by software.

2.6. Snails

Breeding box measurements are 50X100 cm. Temperatures in range of 4.5 - 21.5 °C are good for most stages, for incubation stage stable temperature of 20 °C is beneficial. At the last stage, before processing, it's necessary to put snails into hibernation by using low temperature. Each m^2 of the boxes allows to produce 150 - 200 snails (200 snails = one kilogram), which gives 43 - 85 Euro profit per m^2. Considering the shelved structure, expected profit from 100 m^2 is 18 000 - 34 000 Euro per year.

2.7. Insects: mealworms and black soldier fly

In the growing section we maintain a perfect environment for growing mealworms - dark, humidity around 60% and temperature around 20 ℃. Harvest is every 10 weeks. After 10 weeks there is an approximate ratio between bugs (95%), and pupas (5%). Mealworms and pupas are harvested by an automatic separator, but pupas are returned back into the breeding container. Feeding rate for mealworms is 2 kg of spent grains and vegetable/1kg mealworm/day.

Breeding of black soldier flies starts in the breeding cage where adult flies mate. After one week most of the flies die and eggs are transferred into the nursery. After hatching, they start to eat immediately and stay in nursery for 5 days. Then we split them in to the growing containers and they are transferred in to the growing stage, where they stay until harvest. We return 5% of larvaes into the pupas stage, where they transform into the adult flies and the cycles begins again. The feeding rate for black soldier flies is 10 kg organic waste/1 kg black soldier flies/day. Efficiency use is 27 %.

3. Plant production

3.1. List of local farmers

CSA, organic farms			
Farmer	**Crops**	**Address**	**Link**
Het Groene Buitenland	Apple, pear, plum, berries, beet, salad, potatoes, spring onions, strawberries (black and red), celery, leaker.	Zeedijk, Assendelft	http://www.hetgroenebuitenland.nl/
Pluk! Groenten van west	Vegetables: broad beans, lettuce, arugula, summer purslane, carrots, radishes, turnips, parsnip, broccoli/bimi, Chinese cabbage, Savoy cabbage, spring onions, pea shoots, bok choy, fennel, sugar snap peas, pea shoots, fenugreek, tomatoes, chili peppers, koolrabi, potatoes, spinach, swiss chard, beans, zucchini, onions, shallots, cucumbers/pickling cucumbers, pumpkins, lamb's lettuce, spinach, Asian salad mix, turnip greens, celery, celeriac, Jerusalem artichoke and ramenas. Herbs: basil, chives, chervil, tarragon, dill, basil, oregano, thyme, sage, pineapple sage, rosemary, southernwood, stevia, leaf fennel, mint, lemon balm, lemon verbena, parsley, coriander, lovage, shiso, bay leaf and anise hyssop. Edible flowers: calendula, nasturtium, cornflower, borage, pumpkin/squash and many herb flowers.	Tom Schreursweg 48, Amsterdam	www.plukcsa.nl/
De Stadsgroente boer	Spring: chard, spinach, arugula, radish, turnip tops, turnip, kale, red russian kale, kohlrabi, beets, snow peas, sugar snaps, marrowfat peas, endive, broccoli, fava beans, courgette. Summer: potatoes, garlic, shallot, onion, leek, chard, endive, spinach, kale, beans, beets, fennel, aubergine, pepper, spanish pepper,tomatoes, courgette, cucumber, pickle, cabbage Autumn: leek, onion, shallot, carrot, chard, beets, parsnip, brussels sprouts, sweet corn, kale, beans (several), fennel, aubergine, pepper, spanish pepper, tomatoes, potatoes, courgette, pickle, pumpkin, cucumber, topinambour, yacon, sweet potatoes.	Nico Broekhuysenweg 22, 1067 HT Amsterdam	www.stadsgroenteboer.nl
Wij Telen Groente	Aubergine, salad, zucchini, green beans, cucumber, snow pie, basil, spices, head salad, carrot, green leaves, white currant.	Witte van Haemstedelaan 72, Haarlem	www.wijtelengroente.nl/
Tuinderij De Ark	Vegetable.	Dennenweg, 2061 Bloemendaal	http://stichtinglinkingpeople.nl/tuinderij-de-ark
Moestuin Leyduin	Red currant, strawberry, jerusalem artichoke, endive, asian mesclun, chives, beet, celery, kale, zucchini, garlic, celeriac bulb, fenchel, cucumber, kohlrabi, corn, meiraap, new zealand spinach, paksoi, palm cabbage, parsnip, patisson, snow pie, pumpkin, leaker, rebarb, radish, red chicory, salsify, shallot, chard, beans,	2e Leijweg 11, Vogelenzang	www.moestuinleyduin.nl
	brussels sprouts, tomatoes, onions, winter purslane, carrot, summer purslane, sorrel.		
Tuinen van Hartstocht	Beef, vegetable.	Gein Zuid 26, Abcoude	www.tuinenvanhartstocht.nl

Other farms			
Farmer	**Crops**	**Address**	**Link**
Goat farm Ridammerhoeve	Goat milk (cheese, yogurt, ice cream,butter,...), Organic eggs, Goat meat, eco vegetable.	Nieuwe Meerlaan 4, 1182 DB Amstelveen	Nieuwe Meerlaan 4, Amstelveen, http://www.geitenboerderij.nl/
Farm Klarenbeek	Vegetable, Herbs,Fruit, Honey.	Ouderkerkerdijk 225 1096 CR Amsterdam	https://www.boerderijklarenbeek.nl/
Boerderij de Stadshoeve	Lamb, beef, milk.	Zundertorpergouw 29 1027 V Zunderdorp - Amsterdam	https://www.beleefdestadshoeve.nl/
Breedijk Hoeve	Milk, dairy products, Sheep,, Rabbits, pork, milk/beef,Chicken,Goats, vegetable, herbs.	Bloemendalergouw 37, Amsterdam 1028 BH	https://www.zorgboeren.nl/de_breedijk_hoeve/
Plantagelab & The Farming society	Vegetable.	Wiltzanglaan 60, Amsterdam	https://www.facebook.com/PlantageLab-1427884267484023/
De Boterbloem	Vegetable.	Lutkemeerweg 262 1067 TH Amsterdam	http://www.deboterbloemamsterdam.nl/
Fruittuin van West	Fruit,berries, apples,chickens, eggs, chickory.	Tom Schreursweg 48 1067 MC Amsterdam	http://fruittuinvanwest.nl/
Kwekerij Osdorp	Vegetable.	Osdorperweg 937, 1067 SW Amsterdam	https://www.kwekerijosdorp.nl/
Winkel - Wim Bijma	Vegetable, herbs, flowers.	Osdorperweg 943, 1067 SW Amsterdam	http://www.wimbijma.com/
BioRomeo	Vegetable.	Zwijnsweg 5	http://www.biorom

Bakery Paul Année	Bakery.	Bellamystraat 8, 1053 BL Amsterdam	http://bakkerijpaulannee.nl/
Brandt and Levie	Pork products.	Archangelkade 9, 1013 BE Amsterdam	https://www.brandtenlevie.nl/
LINDENHOFF	Everything.	Rijksstraatweg 21, 1396 JC Baumbrugge	https://lindenhoff.nl/
Mama/Concept of Life	Bakery.	Domineeslaan 31 (702,40 km) Zwanenburg	https://www.facebook.com/MAMAConceptOfLife/
Zonder Bakt	Gluten free, lactose free, sugar free etc. bakery, cakes.	Baron GA Tindalstraat, Amsterdam	http://www.metzonder.com/
Eriks delicatessen	Cheese and eggs.	Beukenplein 16 1091KH Amsterdam	http://eriksdelicatessen.nl/
KOBUNDER	Cheese.	de Buorren 101, 8408 HL Lippenhuizen	http://www.kobunder.nl/
Appels and peren	Cider.	Singel 1 6624 AV Heerewaarden	http://www.firma-appel-en-peer.nl/
Flowerfusion	Flowers.	Rubensstraat 45 Amsterdam	http://mail1001.wixsite.com/website
Rapsberry maxx	Raspberry.	Steenoven 28 5768 PK Meijel	http://www.raspberry-maxx.nl/?ln=nl
Piet van Zanten	Kapucijners beans.	Groningen, Garmerwolde	https://www.nieuweband.nl/producenten/
Het Blauwe Huis	Herbs.	Drenthe Ruinerwold	https://www.nieuweband.nl/producenten/portret/7/aromatische-kruiden-van-het-blauwe-huis/
Buffalo farm twente	Cheese: Buffalo mozzarella, riccotta,...	Ahuisweg 1 7591PL Denekamp	http://www.buffalofarmtwente.nl/
iambe	Bakery.	Van der Helstplein 6 1072 PH Amsterdam	https://www.iambe.nl/
Brouwerij de prael	Beer.	Nieuwe Hemweg 2, 1013 BG Amsterdam	https://www.deprael.nl/
GrowX	Greens.	Keienbergweg 26, 1101 GB Amsterdam	https://www.growx.co/our-farm
Containing Mushrooms	Mushrooms.	Nico Broekhuysenweg, Amsterdam	https://www.containingmushrooms.nl/
GRO	Mushrooms.	Nieuwe Hemweg 2, 1013 BG Amsterdam	http://www.gro-holland.com
Cheese Farm Catharina Hoeve	Cheese.	Zeilenmakerspad 5, 1509 BZ Zaandam	https://www.dezaanseschans.nl/ontdek/ambachten/

Table 9: List of local farmers

3.2. List of plant species

An example of local farmers winter season production (October-March):

Tubers: Potatoes, Jerusalem artichokes
Roots: Salsify, Carrot, Parsnip, Celery, Beetroot, Radish, Turnip
Bulb: Onion, Garlic, Leek, Spring onion
Leafy: Butterhead, Lamb's lettuce, Romaine, Green Cabbage, Red Cabbage, Kale, Witloof, Brussels sprout, Rhubarb
Flower: Broccoli, Cauliflower
Fruit vegetables: Pumpkin
Fruit: Apple, Pear

An example of local farmers summer season production (April-September):

Tubers: Potatoes, Jerusalem artichokes, Sweet potatoes,
Roots: Salsify, Carrot, Parsnip, Celery, Beetroot, Radish, Turnip, Daikon, Burdock root
Bulb: Onion, Garlic, Leek, Spring onion
Leafy: Butterhead, Lamb's lettuce, Watercress, Romain, Indian lettuce, Spinach, Paksoi, Sea Lavender, Green Cabbage, Red Cabbage, Kale, Witloof, Brussels sprout, Rhubarb
Steam: Celery, Asparagus, Kohlrabi, Rhubarb
Flower: Broccoli, Cauliflower
Fruit vegetable: Pumpkin, Eggplant, Courgettes, Scallopini, Telegraph cucumber, Short cucumber, Gherkin, Chinese beans, Green beans, Butter beans, French beans, Peppers, Tomatoes
Fruit: Apple, Pear, Peach, Berries, Plum, Currant..ect

Based on the information above an example of production in the AvantFarm is:

In the VerticalTower (VT) production system - count with 10 VT units:

VT 1-3: ''Cosberg'' lettuce- F1 cross between Cos and Iceberg, covers lack of Iceberg on dutch winter market
VT 4-5: ''Red Oak'' lettuce- offers colour variability in lettuce dish
VT 6: Sorrel ''Bloody''- 100 grams of fresh sorrel has 48 mg of vitamin-C (80% of daily recommended levels of vitamin C). Vitamin C is a powerful antioxidant which helps the human body develop resistance against infectious agents and scavenge harmful oxygen-free radicals which is very important in winter season. Adding sorrel in ''green dish'' in combination with Cosberg and Read Oak makes good healthy meal.
VT 7-8: Swiss chard ''Five Color Silverbeet''- suits for heat treated dishes, rich in nutrients, not available on local market in winter
VT 9: Orach ''Aurora''- replace spinach in meal, same use.100-gram serving has 800 mg of potassium,100-gram serving of orach yields 200% of calcium requirements for the day, stimulates digestion.
VT 10: Basil ''Genovese''- one of the most used herbs, fresh pesto in winter

In the Fruit Irrigation system units (IS):

IS1: Green beans ''Maxibel'' - In Nederland available from May, used as side dish or single meal, used in indonesian, asian, europe recipes, 4 varieties increases customers choice
IS2: Green beans ''Soleil''
IS3: Green beans ''Contender''
IS4: Green beans ''Dragon Tongue''
IS5-6: Eggplant Mix (''Applegreen, Aswald, Pink Tung, Turkish orange'')- covers deficit of local eggplant production in winter
IS7-8: Zucchini Mix (''Caserta, Golden Egg, Magda, Summer Green Tiger'')
IS9-10: Okra ''Clemson Spineless''- Used for exotic food, very tasty vegetables as side dish
IS11: Chayote ''Green n White fruited'' - exotic food
IS12: Strawberries ''Albion''
IS13: Raspberries ''Jewel''
IS14: Pineberries

Season	Product	Supplier	Production	Category
All year	*Lettuce"Cosberg"*	AF	ZipGrow	Leafy green
All year	*Lettuce"Red Oak"*	AF	ZipGrow	Leafy green
All year	*Sorrel "Bloody"*	AF	ZipGrow	Leafy green
All year	*Swiss chard "Five Color Silver*	AF	ZipGrow	Leafy green
All year	*Orach "Aurora"*	AF	ZipGrow	Leafy green
All year	*Green beans "Soleil'*	AF	Irrigation system	Fruit vegetables
All year	*Green beans "Contender'*	AF	Irrigation system	Fruit vegetables
All year	*Green beans "Dragon tongue'*	AF	Irrigation system	Fruit vegetables
All year	*Zuchinni Mix*	AF	Irrigation system	Fruit vegetables
All year	*Eggplant Mix*	AF	Irrigation system	Fruit vegetables
Winter	*Okra*	AF	Irrigation system	Fruit vegetables
Winter	*Chayote*	AF	Irrigation system	Fruit vegetables
All year	*Strawberries "Albion"*	AF	Irrigation system	Fruit
All year	*Pineberries*	AF	Irrigation system	Fruit
All year	*Raspberries "Jewel"*	AF	Irrigation system	Fruit
All year	*Horned melon*	AF	Irrigation system	Fruit
All year	*Basil "Genovese"*	AF	ZipGrow	Herbs

Table 10: Preview of plant species list

3.3. Scaling the bioponics

The ratio in scaling plant production system is for 5 production units: 1 growing unit, 1 harvesting unit and 1 cleaning unit. One production unit is 15m^2 and contains 256 VerticalTowers, divided in 4 rows with a walking paths in the centers. One unit of production is designated for drip irrigation system (DripSys), also 15m^2 and can accommodate a variety of plant stations, depending on a crop choice. These production units can be merged and divided as pleased.

Our plant production is designed to reach all 3033 citizens of the Bijlmerbajes quarter. We modified the average leafy greens consumption of 0.245 kg/person/week by adding 20% on top, with a healthier lifestyle proposition. In the end, a single Production unit of VerticalTower system is producing 204.8kg/week of goods. To meet our goal, a minimum of 5 units must be built. However, the AvantGarden accommodates double this, for various reasons (contamination prevention, B^{2}Apprentice program, AvantGarden tours and other). Scaling of the DripSys is done in a similar manner.

4. Mushroom

4.1. Mushroom logistics

The entire Mush-Room production process can be divided into 6 units:

1. Bicycle pickup
2. Press Room, located on the ground floor. This is where the coffee grounds are brought to the AvantGarden and the excess liquid is removed using a steel cider press. The

liquid drains to the biogas reactor and the moist grounds are taken by cart to the elevator and brought to the mixing room.

Part Requirements:

a. Bikes fitted with cart
b. 3 - 4 people
c. Cider Press with a capacity of >100 Liters
d. Relationship with coffee shops and bistros

3. Mixing Room: this is where the fresh coffee grounds are brought and immediately inoculated with spawn. This mixture is then filled into reusable 22L buckets and brought directly to the grow cell.
4. Incubation/Fruiting room: The mycelium colonizes the grounds in this room. We can change the condition (humidity, CO^2, temperature) to induce fruiting.
5. Spawning Laboratory: The spawning lab must be on a separate floor from the Mush-Room to avoid contamination of spores. It will not be accessible to the public, only through glass. Employees that work with the mushrooms will do lab work first thing during the day before going to the Mush-Room to avoid spore contamination.

Supply of coffee grounds		
coffee shops (within 4 km)	20	shops
average coffe grounds per day per shop	4	kg
collected coffee per day	80	kg
per month	2400	kg
# of cells supplied per month	2.18	cells
Yield per growing cell per year		
Shelves per room	10	shelves
buckets per shelf	11	buckets
buckets per room	110	buckets
Kg substrate per bucket	10	kg
kilos wet substrate per room	1100	kg
Biological efficiency of 25% wet substrate	275	kg produced per cell per grow cycle (1 month)
Production 1 year per cell	3300	kg Oyster mushroom (averaged amounts for various species)
Revenue Per Year		
Estimated price per kilo (€)	11	
Estimated Revenue per year per cell	36300	
# of cells producing	5	
Total Revenue per year	181,500.00	

Table 11: Economics of mushroom production

Because of the susceptibility to contamination, the Mush-Room must be mostly closed off to the public. However, we can install windows on the grow rooms that would allow the visitors to see the mushrooms fruiting. Although laboratory conditions are needed, the Mush-Room should not look like a lab, full of straight lines, stainless steel, white walls, etc. Artists from the quarter will be invited to paint the walls, giving the floor a psychedelic - Alice in Wonderland - type of feeling. However, the mushrooms that are painted should be representative of actual mushrooms that are grown in the AvantGarden and around the world and they should be labeled, adding an educative aspect.

4.2. Mushroom production requirements

Mushroom type	Incubation temperature °C	Humidity %	Duration days	CO_2 ppm	Fresh air exchange per hour	Light requirements (lux)
King Oyster	24	90 - 95	26	5,000	1	n/a
Golden Oyster	24 - 29	90 - 100	24	5,000	1-2	500 - 1000
Pink Oyster	24 - 30	95 - 100	22	>5,000	5-8	750 - 1500
Reishi	21 - 27	95 - 100	90-110	2000 - 5000	1	500 -1000

Table 12: Mushroom production requirements

The primary challenge of the mushrooms production is in eliminating contamination. This will require each grow room being equipped with at least 2 filters, one for the course material and the second, a HEPA filter that captures 99.99% of air particulates under 3 microns. The air in each grow room must be cycled 4-6 times per hour. This cycling will pull the O^2 saturated air from the VerticalTowers and pump the CO^2 from the mushrooms. If this is insufficient, additional air can be pulled from outside.

Each room will be fitted with an ultrasonic humidifier These humidifiers work using spinning discs that vaporize water droplets – which are then pumped out of the unit and into the room. These humidifiers can raise the relative humidity of the chamber to 100%. Additionally, ventilation for heating/ cooling will be present with a monitor attached to the outside of each room informing the growers of the temperature, humidity, CO2/O2 levels with alerts if one is falling below set levels. The advantage of having each of the grow rooms equipped in this way is that we will be able to guide the mycelium to fully colonizing the containers and then induce fruiting by changing the conditions stated above. In this way we can avoid moving tubs of colonized mushrooms into different cells that would have stable conditions. Each of the grow rooms and the mixing room would be equipped with a floor drain for easy cleaning. The drained water/coffee grounds mixture can be sent to the vermicompost or waste transformer.

The Mush-Room production is the most labor intensive area in the AvantGarden. This is offset by the fact that the substrate is free, and after some time, mushroom spawn will be cultured in house, not sourced from a separate facility. The AvantGarden philosophy seeks to find a balance between providing meaningful work in a healthy environment and the use of technology in the automating certain functions. We see an over reliance on technology as an Achilles heal in any production process; if the technology fails, the crop fails and we fail as a farm to continually supply our neighborhood with healthy food. We believe that the benefits of providing employment to our community greatly outweighs the small financial gains that could be made by automating. The Mush-Room will be run by 2 perennial gardeners with 2-3 annuals assisting and learning every step of the production process, including how to manage financials.

4.3. Species selection

Our initial mushroom selection is limited to only certain mushrooms that can grow well on coffee grounds. If we are able to find wood-based waste streams then we can expand our

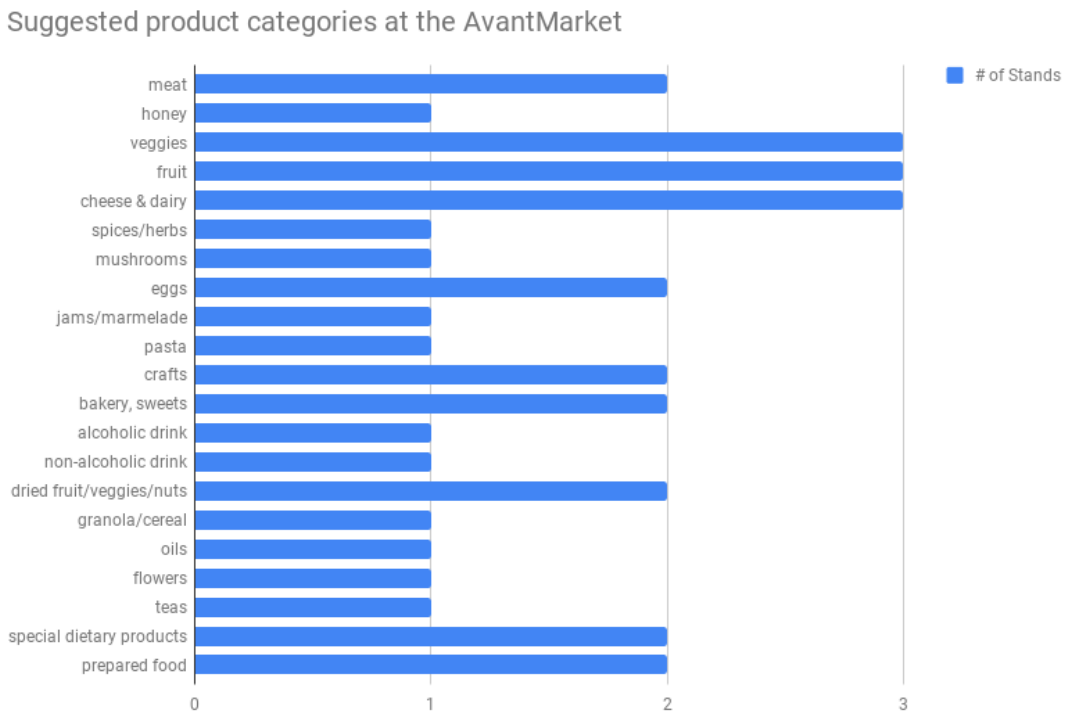
varieties in the future. The genus pleurotus (Oysters) is highly adaptable, very aggressive and grows on nearly any waste stream, even clothing. Oyster mushrooms have a very high yield efficiency, frequently converting 25% of wet mass substrate into fresh mushrooms. They contain a high amount of protein and are a significant source of vitamin C, B and niacin (El Kattan, 1991) (Rai et al. 1998). The disadvantage of growing this species is also an advantage for the Avant-Garden. Pleurotus are quick to spoil which is not a problem if fruiting containers are brought to the market floor and people pick them fresh from the tubs, most likely consuming them within several days. A real disadvantage is that these mushrooms produce billions of spores during fruiting. Precautions must be taken for worker safety. There are, however, sporeless strains that can be cultivated, eliminating this problem.

Several valuable by-products are produced from growing oysters. The remaining substrate after harvest can be fed to fish, worms, chicken or even cattle (in our case, the first 3).

a. King Oyster Mushroom (Pleurotus eryngii): By far the best tasting oyster mushroom and one of the largest of the species. It is easy to grow and grows on nearly any substrate, including coffee grounds. They have small short gills which means they release much fewer spores than the other varieties.
b. The Golden Oyster (pleurotus citrinopileatus): This mushroom has brilliant yellow color that forms in large bouquets of individual mushrooms connecting at a base, ideal for selling clusters rather than individuals. This mushroom has a spicy and nutty flavor, making it great for stir fry.
c. The Pink Oyster Mushroom (pleurotus djamor): This variety is very quick fruiting and is known for its ability to adapt and flourish in a wide variety of substrates. It is a very aggressive strain, which means that there is less risk of competitive bacteria beating the mycelium in colonization of the substrate. This mushroom spoils rapidly with only 4 or 5 days of shelf life.
d. Reishi (Ganoderma lucidum): This mushroom is renowned for its health properties by the Japanese, Chinese and Koreans since ancient times. Scientific studies have found this mushroom to be anti-carcinogenic, cholesterol lowering, anti-viral, anti-inflammatory and immune boosting. Anecdotally, reishi is said to have sexual stimulating properties in older men. This mushroom can be made into teas, tinctures or simply cooked and eaten. This mushroom is much slower growing, but can be sold as a higher value medicinal product

Picture 9: King Oyster Mushroom, The Golden Oyster, The Pink Oyster Mushroom, Reishi

5. AvantMarket



Picture 10: Number of stands for individual product categories at the AvantMarket

6. B^2 FoodShare

Product	Supplier	Production	Category	Cost EUR/kg	Composition box (cca 4kg)	Production price (4kg) EUR
Lettuce"Cosberg"	AF	ZipGrow	Leafy green	5.32	0.5	2.66
Green beans "Soleil'	AF	Irrigation system	Fruit vegetables	7	0.1	0.7
Potatoes	Local farmer	In stock	Tubers	1.8	0.2	0.36
Salsify	Local farmer	In stock	Roots	5		
Onion	Local farmer	In stock	Bulb	1.2	0.2	0.24
Strawberries "Albion"	AF	Irrigation system	Fruit	7	0.2	1.4
Basil "Genovese"	AF	ZipGrow	Herbs	5.32		0
King Oyster	AF	Mush-Room	Mushrooms	6.8	0.3	1.25
					4.3	19.566

Table 13: Example of a winter B2 FoodShare - individual

7. AvantCommunity

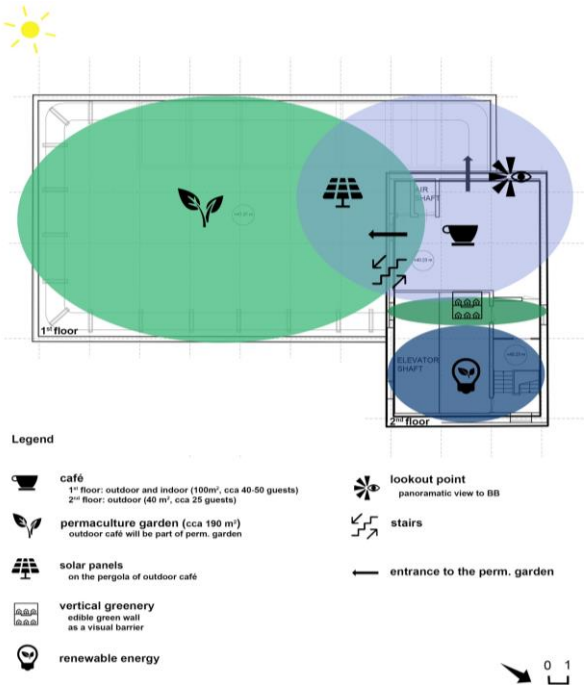
7.1. Social spaces calculations

	Cost per hour				
Type of spcae	Coop-Citizen	Coop Farmer/Business	Non-Member		
Small Meeting Room (1-10)	10	20	30		
Large Meeting Room (1-50)	20	30	50		
Kitchen for Cooking	Free	20	40		
Experimental Space	10	50	80		
	Total Revenue of Space Use				
Type of spcae	Coop-Citizen	Coop Farmer/Business	Non-Member	Total per month	per year
Small Meeting Room (1-10)	900	1800	1800	€4,500.00	€54,000.00
Large Meeting Room (1-50)	1800	2700	3000	€7,500.00	€90,000.00
Kitchen for Cooking	0	1800	2400	€4,200.00	€50,400.00
Experimental Space	900	4500	4800	€10,200.00	€122,400.00
	3600	10800	12000	€26,400.00	€316,800.00
**Estimate based on 60% member reservation 40% non-member/ Rooms are filled 20% of total time in a month					
hours in a month	744				
hours in use per month	150				
hours member reserve (60%)	90				
hours Non-member (40%)	60				
COOP Members can book 2 months in advance					
Non-Members can book 1 month in advance					

Table 14: Social spaces calculations

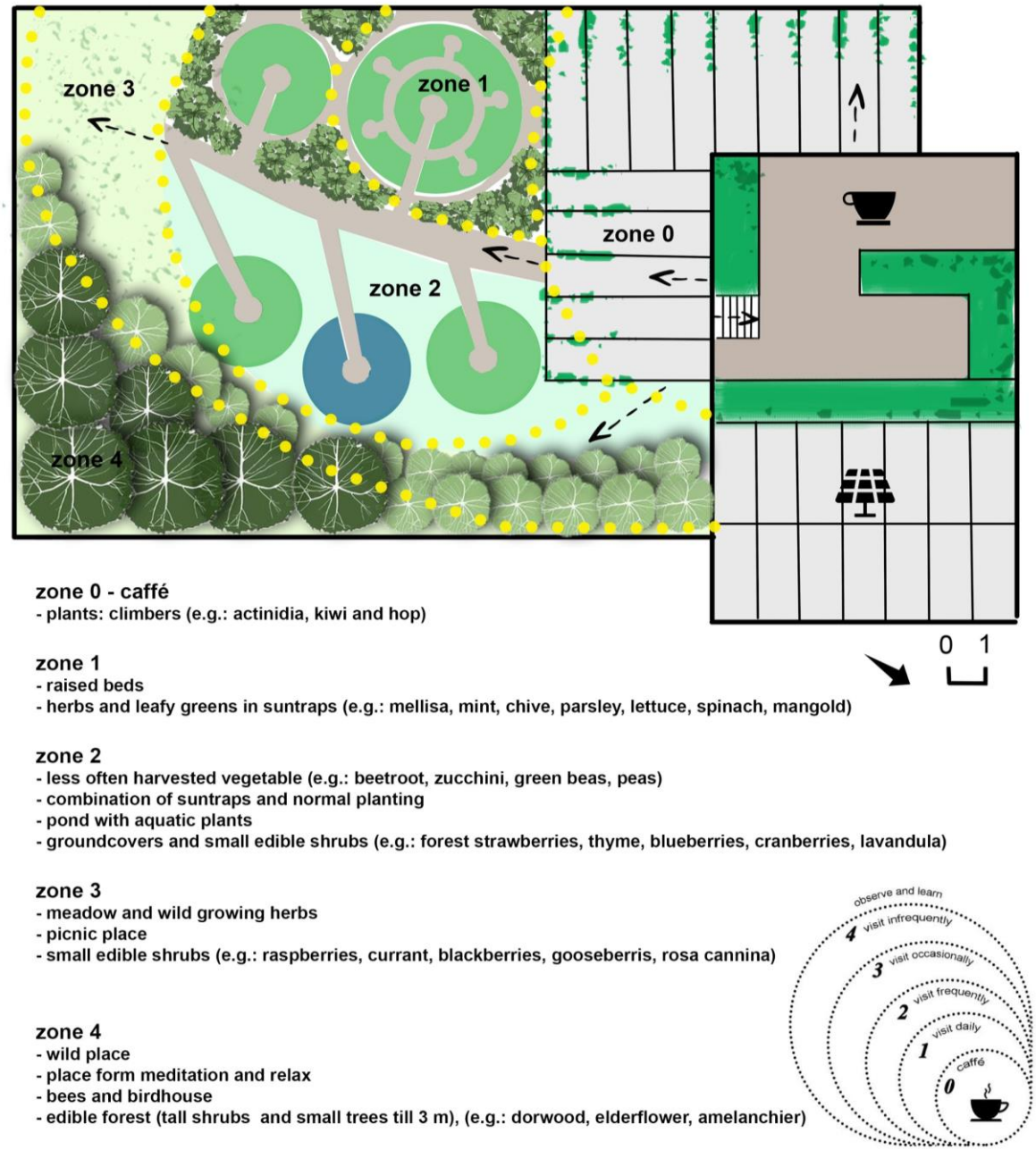
7.2. Permagarden

According to permaculture design principles, the garden is divided in 5 zones: **Zone 0** is two-story **AvantCafé**. The 1st floor is designed as indoor caffé with outdoor space– pergola. The second floor is open space with edible green walls. In the 2nd floor visitors can observe the panoramic viewing point. The cafe space is 140 m2 in total (both floors) and it could serve approximately 70 guests in summer time and 30 guests during winter. **Zone 1** is the closest part to the café and it will be the most visited part filled with the most used herbs and annual vegetables. **Zone 2** is the largest zone where we designed a suntrap to capture heat in the spring and autumn; Here are vegetables and small pond with aquatic plants. **Zone 3 is a meadow** with perennial herbs and with small fruit bushes. The meadow part could serve as a picnic spot with people borrowing blankets or

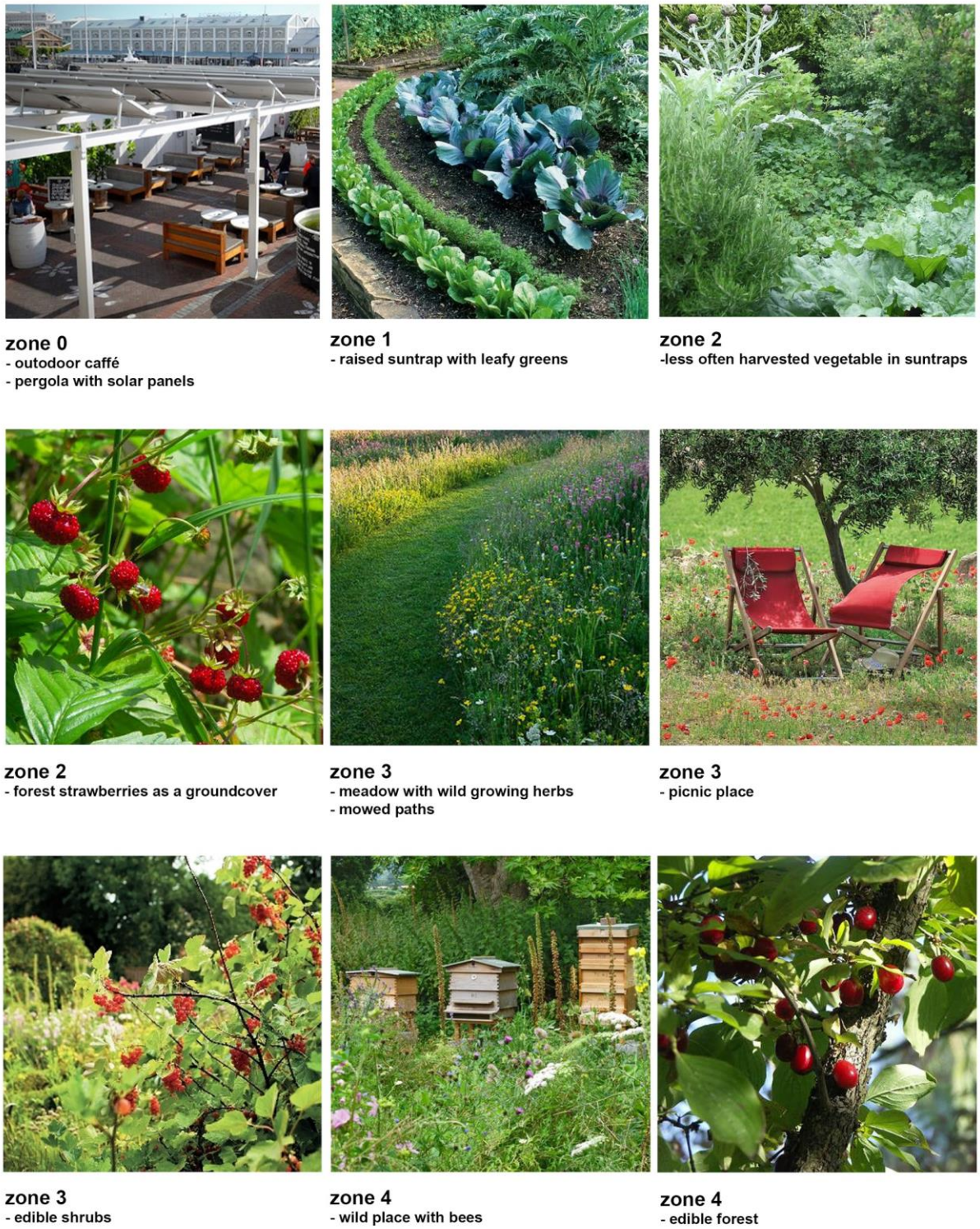


Picture 11: Rooftop garden – first idea

deckchairs in the café. **Zone 4 is an edible forest** with tall shrubs and small trees. Here is a home for bees and birds This part will be the wildest part and it could serve as a place for meditation and relaxation.



Picture 12: Rooftop garden – concept



Picture 13: Rooftop garden – inspiration

8. Economics

8.1. Examples of B^{2}Coin usage

Adult citizen of the Biljmer Bajes quarter: A citizen decided to subscribe to CSA. He or she will come to The AvantGarden to create an account and also invest their first money, which

transform immediately into B²Coins. Then he installs the phone application, logs in into the personal account and subscribes to CSA in only few clicks. A few days later receives a notification his B²FoodShare is ready for a pick up. He stops by the AvantMarket to pick up the package, but also would like to buy a honey from local farmer stand. The farmer's stand has a QR code; He scans it and price of the honey is deducted from the B²Coins wallet. While enjoying fresh products from the CSA package at home, the citizen scrolls through B²COOP votings and decides to join a poll on what subject the next event should be.

Student living in the BB quarter: Not able to afford a smartphone, the student opted in for a contactless card when joining the B²COOP. After class she accesses her personal account on a computer at the university and browses work tasks listing. There is a task for afternoon harvesting in The AvantMarket for a specified time period and B²Coin reward. She selects this task and walks over to The AvantGarden, where she meets with a Perennial Gardener who needs some help harvesting mushrooms. This is her first time working at the AG and she is surprised at how fun and interesting it is. After this afternoon she has a new appreciation for the mushrooms in the market. She collects her B²Coin after a couple hours of work and uses it to pay for dinner from a local farmer.

Local farmer: The farmer likes the benefits, vision and idea of B²COOP and The AvantGarden in general. He has decided to join this system and wants to have a farmer stand at The AvantMarket. Through his farmer-type account he rents a farmer stand. However, he can't spend a whole morning by unloading his products to the stand, so he lists a specified work task in the application, with details about objectives of the work, time requirements and B²Coin reward, a few days prior. Once this listing is picked up by a B²COOP member, he is ready to delivers his products to The AvantGarden. The worker confirms the quantity and type of products and then the farmer is free to do what he does best. The worker unloads farmer's products into the rented farm stand and inputs all products into the system. At the end of day the farmer confirms that the worker completed the work task and his reward is deducted from farmer's B²Coin wallet. Since all his products have been successfully sold, he receives B²Coins from all his sales to his wallet automatically. After months of using this system, the farmer sees an opportunity for improvement of The AvantMarket. He knows another B²COOP member, who shares his idea and who is actually running for a post of representative of farmers, and so through the application he votes for him with his voting power.

8.2. Business calculations

8.2.1. Overview

The overall project of The AvantGarden is divided into 5 phase:

- Phase 1: *The AvantMarket, rooftop permagarden with café, The Hill, spaces for staff and operations, open social space, energy systems*
- Phase 2: *⅓ of The AvantFarm (4* VerticalTower *units, 5 DripSys units, 1 aquaculture unit, 3 mushroom units, all supportive production systems), storage and operation room, spaces for staff, event space/forest kindergarden, big meeting room, culinary room, energy systems*
- Phase 3: *⅓ of The AvantFarm (3* VerticalTower *units, 5 DripSys units, 1 aquaculture unit, 2 mushroom units), storage rooms, spaces for staff, meeting room, experimental space*

- Phase 4: *⅓ of The AvantFarm (3* VerticalTower *units, 4 DripSys units, 1 aquaculture unit), storage and operation rooms*
- Phase 5: -

The business calculations of the project are compiled from over 600 items, including initial setup cost, running costs, and revenues. All of these have set specified variables, including:

- Block type (i.e. food production, maintenance, social, energy)
- Block system (i.e. plants, fish, mushrooms, supportive system, staff, social)
- Block name (i.e. VerticalTower germination, spawn room, fish nursery, office, meeting room)
- Construction phase
- Assignment (AvantGarden or AvantMarket)
- Type (production, social, utility, labour)
- Item name
- Item price
- Item quantity
- Total price

8.2.2. Return of investments & Cashflows

The financing of phase 1 is dependent on outside sourcing, with a set objective of building The AvantMarket, its supportive rooms, and first social spaces. The operation of this phase is not designed to bring profit, but rather test out interest and engagement of Bijlmerbajes community in such project. All other upcoming phases are projected to be profitable and to return the investments and later invest in activities and programs. It is expected that phases 2-5 will be realized from the profits of previous phases over time, meaning that any profits will be invested into parts of given stage. This way there is no additional funding required after phase 1 and phases 2-5 naturally pay themselves off. Return of investments for the investors of phase 1 can be done during phase 2 or anytime later.

The AvantGarden				
Total running costs	**12,167.87**	EUR/month	**146,014.40**	EUR/year
↳ Production	0.00	EUR/month	0.00	EUR/year
↳ Social	1,000.00	EUR/month	12,000.00	EUR/year
↳ Utility	517.87	EUR/month	6,214.40	EUR/year
↳ Labour	10,650.00	EUR/month	127,800.00	EUR/year
Total revenues	**13,718.84**	EUR/month	**164,626.09**	EUR/year
↳ Production	0.00	EUR/month	0.00	EUR/year
↳ Social	9,000.00	EUR/month	108,000.00	EUR/year
↳ Utility	4,718.84	EUR/month	56,626.09	EUR/year
Total profit	**1,550.97**	EUR/month	**18,611.69**	EUR/year
	(does not include incomes gained from B2Coin fees)			

The Market				
Total running costs	**69,626.82**	EUR/month	**835,521.80**	EUR/year
↳ Production	0.00	EUR/month	0.00	EUR/year
↳ Social	53,523.31	EUR/month	642,279.72	EUR/year
↳ Utility	721.84	EUR/month	8,662.08	EUR/year
↳ Labour	15,381.67	EUR/month	184,580.00	EUR/year
Total revenues	**67,758.00**	EUR/month	**813,096.00**	EUR/year
↳ Production	0.00	EUR/month	0.00	EUR/year
↳ Social	67,758.00	EUR/month	813,096.00	EUR/year
↳ Utility	0.00	EUR/month	0.00	EUR/year
Total profit	**-1,868.82**	EUR/month	**-22,425.80**	EUR/year

Tables 15 and 16: Economics of phase 1 in full effect

The AvantGarden				
Total running costs	**111,241.80**	EUR/month	**1,334,901.58**	EUR/year
↳ Production	8,601.15	EUR/month	103,213.75	EUR/year
↳ Social	5,000.00	EUR/month	60,000.00	EUR/year
↳ Utility	12,696.65	EUR/month	152,359.83	EUR/year
↳ Labour	84,944.00	EUR/month	1,019,328.00	EUR/year
Total revenues	**161,526.30**	EUR/month	**1,938,315.62**	EUR/year
↳ Production	103,099.58	EUR/month	1,237,195.00	EUR/year
↳ Social	53,400.00	EUR/month	640,800.00	EUR/year
↳ Utility	5,026.72	EUR/month	60,320.63	EUR/year
Total profit	**50,284.50**	EUR/month	**603,414.05**	EUR/year
	(does not include incomes gained from B2Coin fees)			

The Market				
Total running costs	**278,753.39**	EUR/month	**3,345,040.68**	EUR/year
↳ Production	0.00	EUR/month	0.00	EUR/year
↳ Social	262,116.55	EUR/month	3,145,398.60	EUR/year
↳ Utility	721.84	EUR/month	8,662.08	EUR/year
↳ Labour	15,915.00	EUR/month	190,980.00	EUR/year
Total revenues	**326,630.00**	EUR/month	**3,919,560.00**	EUR/year
↳ Production	0.00	EUR/month	0.00	EUR/year
↳ Social	326,630.00	EUR/month	3,919,560.00	EUR/year
↳ Utility	0.00	EUR/month	0.00	EUR/year
Total profit	**47,876.61**	EUR/month	**574,519.32**	EUR/year

Tables 17 and 18: Economics of phase 2 in full effect

The AvantGarden				
Total running costs	**72,097.33**	EUR/month	**865,167.95**	EUR/year
↳ Production	5,065.50	EUR/month	60,785.99	EUR/year
↳ Social	3,000.00	EUR/month	36,000.00	EUR/year
↳ Utility	7,287.83	EUR/month	87,453.96	EUR/year
↳ Labour	56,744.00	EUR/month	680,928.00	EUR/year
Total revenues	**96,019.81**	EUR/month	**1,152,237.77**	EUR/year
↳ Production	61,447.03	EUR/month	737,364.41	EUR/year
↳ Social	29,700.00	EUR/month	356,400.00	EUR/year
↳ Utility	4,872.78	EUR/month	58,473.36	EUR/year
Total profit	**23,922.49**	EUR/month	**287,069.83**	EUR/year
	(does not include incomes gained from B2Coin fees)			

The Market				
Total running costs	**149,320.12**	EUR/month	**1,791,841.38**	EUR/year
↳ Production	0.00	EUR/month	0.00	EUR/year
↳ Social	132,683.28	EUR/month	1,592,199.30	EUR/year
↳ Utility	721.84	EUR/month	8,662.08	EUR/year
↳ Labour	15,915.00	EUR/month	190,980.00	EUR/year
Total revenues	**164,835.00**	EUR/month	**1,978,020.00**	EUR/year
↳ Production	0.00	EUR/month	0.00	EUR/year
↳ Social	164,835.00	EUR/month	1,978,020.00	EUR/year
↳ Utility	0.00	EUR/month	0.00	EUR/year
Total profit	**15,514.89**	EUR/month	**186,178.62**	EUR/year

Tables 19 and 20: Economics of phase 3 in full effect

The AvantGarden				
Total running costs	**131,004.19**	EUR/month	**1,572,050.26**	EUR/year
↳ Production	11,948.09	EUR/month	143,377.06	EUR/year
↳ Social	5,000.00	EUR/month	60,000.00	EUR/year
↳ Utility	16,912.10	EUR/month	202,945.20	EUR/year
↳ Labour	97,144.00	EUR/month	1,165,728.00	EUR/year
Total revenues	**189,020.91**	EUR/month	**2,268,250.91**	EUR/year
↳ Production	130,440.25	EUR/month	1,565,283.02	EUR/year
↳ Social	53,400.00	EUR/month	640,800.00	EUR/year
↳ Utility	5,180.66	EUR/month	62,167.90	EUR/year
Total profit	**58,016.72**	EUR/month	**696,200.65**	EUR/year
	(does not include incomes gained from B2Coin fees)			

The Market				
Total running costs	**408,186.67**	EUR/month	**4,898,239.98**	EUR/year
↳ Production	0.00	EUR/month	0.00	EUR/year
↳ Social	391,549.83	EUR/month	4,698,597.90	EUR/year
↳ Utility	721.84	EUR/month	8,662.08	EUR/year
↳ Labour	15,915.00	EUR/month	190,980.00	EUR/year
Total revenues	**488,425.00**	EUR/month	**5,861,100.00**	EUR/year
↳ Production	0.00	EUR/month	0.00	EUR/year
↳ Social	488,425.00	EUR/month	5,861,100.00	EUR/year
↳ Utility	0.00	EUR/month	0.00	EUR/year
Total profit	**80,238.34**	EUR/month	**962,860.02**	EUR/year

Tables 21 and 22: Economics of phase 4 in full effect

The AvantGarden				
Total running costs	**131,004.19**	EUR/month	**1,572,050.26**	EUR/year
↳ Production	11,948.09	EUR/month	143,377.06	EUR/year
↳ Social	5,000.00	EUR/month	60,000.00	EUR/year
↳ Utility	16,912.10	EUR/month	202,945.20	EUR/year
↳ Labour	97,144.00	EUR/month	1,165,728.00	EUR/year
Total revenues	**189,020.91**	EUR/month	**2,268,250.91**	EUR/year
↳ Production	130,440.25	EUR/month	1,565,283.02	EUR/year
↳ Social	53,400.00	EUR/month	640,800.00	EUR/year
↳ Utility	5,180.66	EUR/month	62,167.90	EUR/year
Total profit	**58,016.72**	EUR/month	**696,200.65**	EUR/year
	(does not include incomes gained from B2Coin fees)			

The Market				
Total running costs	**537,619.94**	EUR/month	**6,451,439.28**	EUR/year
↳ Production	0.00	EUR/month	0.00	EUR/year
↳ Social	520,983.10	EUR/month	6,251,797.20	EUR/year
↳ Utility	721.84	EUR/month	8,662.08	EUR/year
↳ Labour	15,915.00	EUR/month	190,980.00	EUR/year
Total revenues	**650,220.00**	EUR/month	**7,802,640.00**	EUR/year
↳ Production	0.00	EUR/month	0.00	EUR/year
↳ Social	650,220.00	EUR/month	7,802,640.00	EUR/year
↳ Utility	0.00	EUR/month	0.00	EUR/year
Total profit	**112,600.06**	EUR/month	**1,351,200.72**	EUR/year

Tables 23 and 24: Economics of phase 5 in full effect

8.2.3. Setup costs

Apart from construction costs, there are prices of equipment and installations required for all of The AvantGarden and its parts. This list starts with buyout of the building from the municipality and ends with the cost of a B²COOP member card for the very last citizen of Bijlmerbajes.

Total setup costs			**3,120,828.00**	EUR
↳ Setup construction phase 1			803,381.00	EUR
↳ Setup construction phase 2			1,382,488.50	EUR
↳ Setup construction phase 3			934,958.50	EUR
↳ Setup construction phase 4			510,947.00	EUR
↳ Setup construction phase 5			1,250.00	EUR

Table 25: Setup costs

8.2.4. Running costs

Running costs include recurring items of various characters, mainly labour, materials and maintenance, but also costs of B²FoodShare and other B²COOP services. The major sums are labour in The AvantGarden and products going into B²FoodShare.

Running costs									
							EUR/month	#	EUR/month
Block type	Block system	Block name	Cons. phase	AG/M	Data type	Item name	Item price	Item quantity	Total
Food production	Fish	Breeding	2	AG	Utility	Pump (3,6 m3; 50Wh) + Aeration (25Wh)	0.16	54	8.64
Food production	Fish	Breeding	3	AG	Utility	Pump (3,6 m3; 50Wh) + Aeration (25Wh)	0.16	54	8.64
Food production	Fish	Breeding	4	AG	Utility	Pump (3,6 m3; 50Wh) + Aeration (25Wh)	0.16	54	8.64
Food production	Fish	Nursery	2	AG	Utility	Pump (12 m3; 80Wh) + Aeration (25Wh)	0.16	216.0	34.56
Food production	Fish	Nursery	3	AG	Utility	Pump (1,8 m3; 80Wh) + Aeration (25Wh)	0.16	27.0	4.32
Food production	Fish	Nursery	4	AG	Utility	Pump (6 m3; 80Wh) + Aeration (25Wh)	0.16	102.0	16.32
Food production	Fish	Production	3	AG	Utility	Pump 8 m3	0.16	120.0	19.20
Food production	Fish	Production	4	AG	Utility	Pump 16 m3	0.16	240.0	38.40
Food production	Fish	Production	2	AG	Utility	Pump 60 m3 (620 Wh)	0.16	900.0	144.00
Food production	Fish	Production	2	AG	Utility	Drum filter (50Wh)	0.16	12.9	2.06
Food production	Fish	Production	3	AG	Utility	Drum filter (50Wh)	0.16	12.9	2.06
Food production	Fish	Production	4	AG	Utility	Drum filter (50Wh)	0.16	12.9	2.06
Food production	Fish	Production	2	AG	Utility	Biofilter aeration (80Wh)	0.16	57.9	9.26
Food production	Fish	Production	3	AG	Utility	Biofilter aeration (80Wh)	0.16	57.9	9.26
Food production	Fish	Production	4	AG	Utility	Biofilter aeration (80Wh)	0.16	57.9	9.26
Food production	Fish	Production	2	AG	Utility	Automation (50Wh)	0.16	36	5.76
Food production	Fish	Production	3	AG	Utility	Automation (50Wh)	0.16	36	5.76

Table 26: Preview of running costs items

8.2.5. Revenues

Revenue streams are based of the production and services of The AvantGarden. Primary incomes are from production of The AvantFarm and again B^{2}Food share. However, the calculations do not include incomes from B^{2}Coin exchange fees, which can largely contribute to creation of additional profit.

Revenues									
							EUR/month	#	EUR/month
Block type	Block system	Block name	Cons. phase	AG/M	Data type	Item name	Item price	Item quantity	Total
Food production	Plants	ZipGrow production	3	AG	Production	Herbs products (→ CSA)	1.13	696	784.39
Food production	Plants	ZipGrow production	3	AG	Production	Herbs products (→ AvantMarket)	2.66	504	1,340.64
Food production	Plants	ZipGrow production	4	AG	Production	Herbs products (→ B2FoodShare)	1.13	696	784.39
Food production	Plants	ZipGrow production	4	AG	Production	Herbs products (→ AvantMarket)	2.66	504	1,340.64
Food production	Plants	Drip sys. production	2	AG	Production	Fruit vegetables products (→ B2FoodShare)	4.10	336	1,378.51
Food production	Plants	Drip sys. production	2	AG	Production	Fruit vegetables products (→ AvantMarket)	7.00	3024	21,168.00
Food production	Plants	Drip sys. production	3	AG	Production	Fruit vegetables products (→ B2FoodShare)	4.10	252	1,033.88
Food production	Plants	Drip sys. production	3	AG	Production	Fruit vegetables products (→ AvantMarket)	7.00	2268	15,876.00
Food production	Plants	Drip sys. production	4	AG	Production	Fruit vegetables products (→ B2FoodShare)	4.10	252	1,033.88
Food production	Plants	Drip sys. production	4	AG	Production	Fruit vegetables products (→ AvantMarket)	7.00	2268	15,876.00
Food production	Mushrooms	-	2	AG	Production	Mushroom products (→ B2FoodShare)	7.70	149.325	1,149.80
Food production	Mushrooms	-	2	AG	Production	Mushroom products (→ AvantMarket)	7.70	675.675	5,202.70
Food production	Mushrooms	-	3	AG	Production	Mushroom products (→ B2FoodShare)	7.70	99.55	766.54
Food production	Mushrooms	-	3	AG	Production	Mushroom products (→ AvantMarket)	7.70	450.45	3,468.47
Food production	Fish	-	4	AG	Production	Tilapia	2.50	256	640.00
Food production	Fish	-	3	AG	Production	African catfish	3.20	256	819.20

Table 27: Preview of revenues items

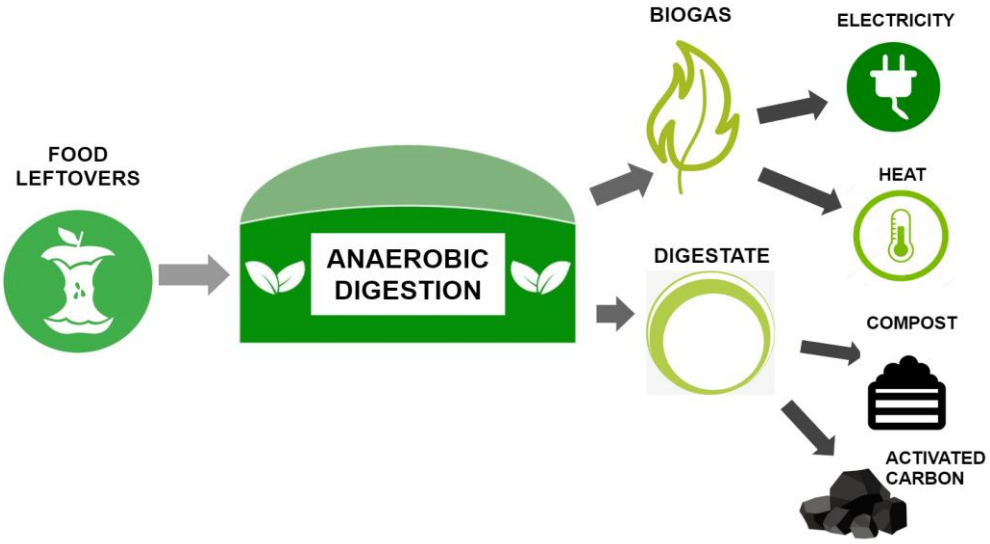
9. AvantCircularity

9.1. Energy production

9.1.1. Energy from biomass

We want to ensure that no “waste” will leave our building and will be processed on site. The biogas reactor produces a digestate that will be further utilized into material called biochar that can be used as the activated carbon in biofilters in aquaponic system. Additionally, there will be also production of heat in the cogeneration unit that will be possible to use for heating the fish tanks and rest of the building. During biogas combustion a small amount of CO2 is produced which can be sent to the plant growing areas. It is common practice for greenhouses to artificially create CO2 to maximize yields. We can turn this waste into a resource.
For production of biogas the food leftovers will be needed in amount of 1 800 kg per day and will be collected from the nearest neighborhood. The biogas station will be able to produce such amount of biogas, to be able to gain energy of approx. 193 MWh/year and heat approx.

225 MWh/year. Except of biogas there will be also another output called digestate (approx. 500 tonnes/year). It is organic material that will be added to vermicomposter or pyrolyser in order to produce biochar, material containing high amount of carbon and possibility in usage as an activated carbon for filtration in aquaculture.



Picture 14: Process of biogas production and outputs utilization

9.1.2. Solar energy

The first part of the roof occupies 67 m2 and is dedicated only to solar panels, SunPower X-Series Residential Solar Panels X21-345 specifically. Efficiency of these panels is 21,5% and nominal Power is 345 W. According to the approx. calculation there should be solar panels in amount of 32 that will be able to produce energy of 26,9 kWh per day or 819,2 kWh per month (calculated from year average).

In the second part there will be except of the same type of solar panels as above and also a water pump. The area of this part is smaller and covers 45 m2 and will be covered by 18 solar panels that will be able to produce 15,1 kWh per day and 460,8 kWh per month.

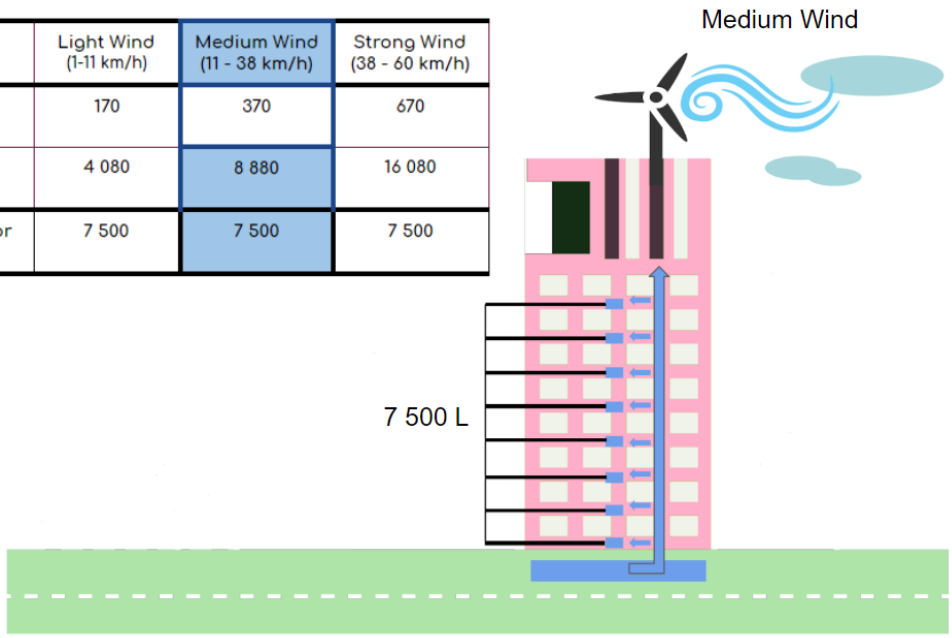
9.1.3. Wind energy

To state that it is windy in the Netherlands would be an understatement. The Dutch are advanced and comfortable with harvesting wind as they have been at it for centuries. The wind pump will be placed on the roof and we expect will be able to supply water to the whole building. In the case of very weak/no wind and high amount of water needed, the pump will use stored energy in batteries. There will be a backup system connecting to the biogas generator in case the system fails.

The wind pump will be able to transport approx. 170 litres of water per hour with light wind (0-11 km/h). In the case of medium wind (11-38 km/h) it can be 370 litres of water per hour and with strong winds (38 - 60 km/h) even 670 litres of water per hour.

Elevation of pumping is estimated to 50 m and the wind pump diameter is designed to be 50 mm.

	Light Wind (1-11 km/h)	Medium Wind (11 - 38 km/h)	Strong Wind (38 - 60 km/h)
Amount of Water (l) - hour	170	370	670
Amount of Water (l) - day	4 080	8 880	16 080
Daily Water Demand for production	7 500	7 500	7 500

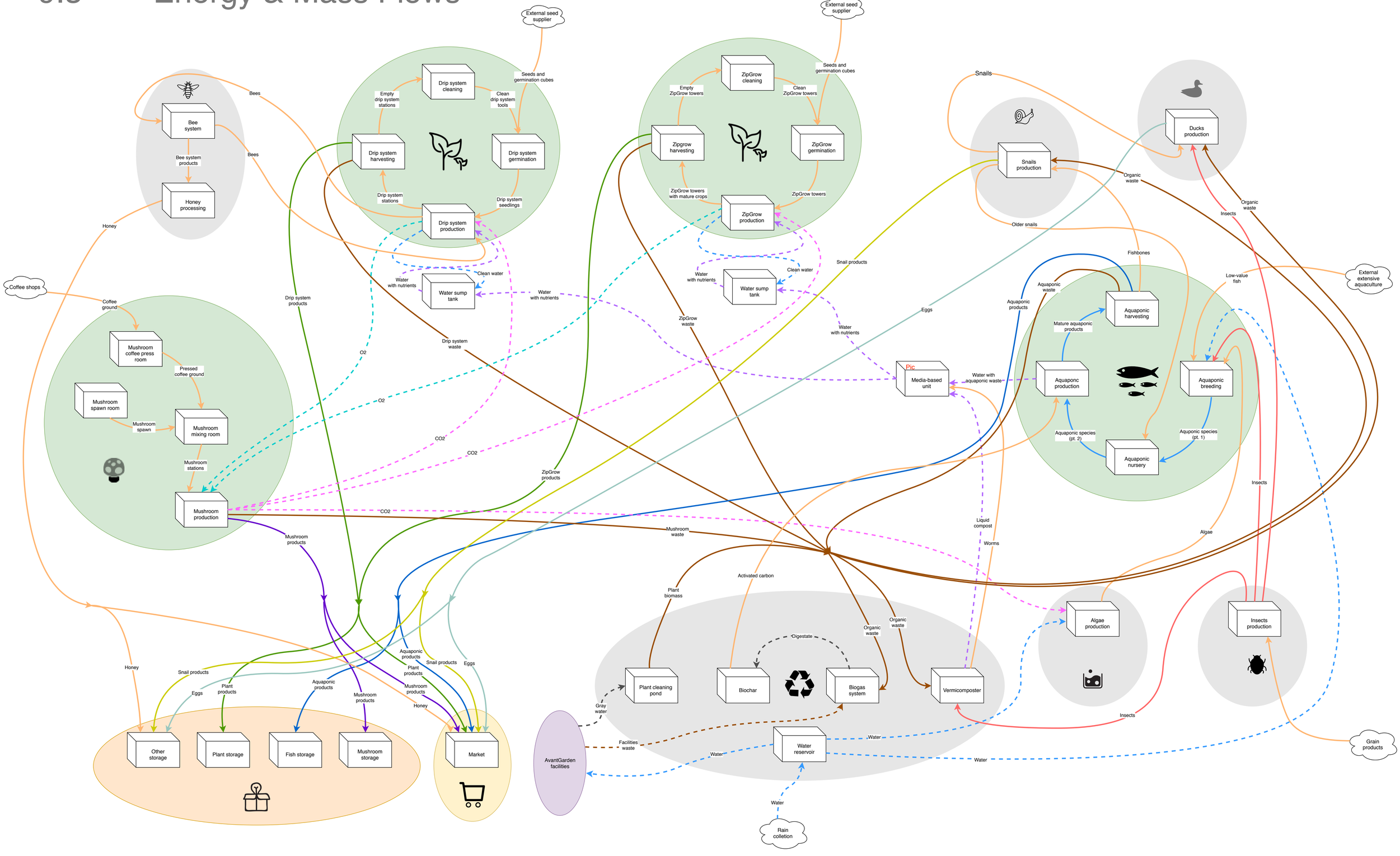


Picture 14: Wind energy calculation

9.2. Grey & Black Water

Adarsh College in Badlapur India has 2,800 students. The students designed and constructed a wastewater treatment facility on campus. This facility consists of a anaerobic digester that collects can use 97% of the methane for producing energy in the school. The digestor itself uses no energy. With the solids digested, the black water is sent through a wetland filtration system and the nutrients are used for a student garden nearby. They have had no problems with smell or contamination. The sludge is collected from the anaerobic reactor every 2 years and co-composted. This project demonstrates that there are indeed cost effective, eco-friendly, sanitary ways to deal with human waste in urban areas. This stands as a model for future stages of the AvantGarden waste recycling system. All that is needed is the courage, knowledge and resources to implement such projects. For more info see: *http://www.susana.org/_resources/documents/default/2-38-en-susana-cs-india-badlapur-adarshschoolfinal.pdf*

9.3 Energy & Mass Flows



Picture 15: AvantGaren Energy & Mass Flows