Re-Organise - The Game - English- V2.0

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Re-Organise – The Game

Preparation reader

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For educational purposes only

Introduction

Thank you for joining Re-Organise – The Game! A board game in which you learn to connect waste, people and technologies, to create valuable circular businesses.

By joining in this game experiment, we aim to inform you about
- (important aspects in) Circular Business Modelling,
- tools to communicate circular business models to practitioners, and
- facilitating the ideation of new circular business networks through game play.

In this preparation reader you will find all information that you need to prepare for the game. The document consists at least of: the game steps, a case description, technology cards and role cards, and a map of the case area.

Attached to the document is the preparation assignment form (excel document) containing:
1a. Business model canvas + building block sheets
1b. Reflection form

On behalf of TU Delft and HvA, I wish you a fruitful, and joyful journey into Agro-Industrial Symbiosis!

Kasper Lange
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HvA Urban Technology
TU Delft

Contents

Game experiment steps

Phase 1: preparation (1 hour)

1. Before playing the game, read this game preparation document carefully
2. You are given a specific role that is described in the preparation document, see list on dropbox or e-mail.

   Note: If you didn't receive a role yet, please contact the game instructor: k.p.h.lange@tudelft.nl or send a message to +31 6 21156153.

3. Enter your name and student number in sheet '1a. Canvas'
4. Answer the questions in '1a. Canvas', by filling out the yellow boxes in the canvas building block sheets (Value Proposition, Key Partnerships, Key Activities, etc.), of course from the perspective of the given role.

   Notes:
   - *Look at your role card. Try to use as many waste streams as possible, and try to meet your needs (necessities). Also think about the assets that you have.*
   - *If you, for some reason, are unable to answer a canvas question, no worries! Please fill out in short why this is impossible for you.*

5. Use sheet '1a. Canvas' to check whether you have filled out every question.
6. After completing 1a, fill out sheet '1b. Reflection'. Write a reflection about what you have learned after filling out the canvas.
7. Send the complete excel-document to your instructor (e-mail k.p.h.lange@tudelft.nl) and upload it to the dropbox.

Phase 2: Game play (2 hours)

In this phase, you will play the game with your fellow students. More instructions will be given during that day (2 hours)

Phase 3: Evaluation (1 hour)

After playing the game you will receive the evaluation assignment. More instructions will be given after playing the game.

Case Description Agro-Industrial Symbiosis

To investigate the possibilities for symbiosis regarding organic waste streams within an urban agricultural area, we use the urban agricultural area of Tuin van Geluk as a case study.

The most important characteristics of the area is mentioned in this case description. Please pay attention to the obstacles found and the motivations of the entrepreneurs for using organic waste streams. An overview is given of the available organic waste streams and the needs for organic products.

Overview of waste streams, product needs and motivation

The area Tuin van Geluk consists of a number of polders on the edge of Amsterdam, totalling 700 hectares. Of these, 400 hectares have been designated as a recreational area with special attention to urban agriculture; RE-ORGANISE, however, focuses on all 700 hectares. This is traditionally an agricultural area. A few very small-scale (hobby) livestock farms still remain, with an average of 15-30 cows or sheep, and there is still a piece of arable land with, amongst other things, a care farm. In addition, new activities such as a pick-yourself fruit garden, a care nursery, a brewery and a restaurant/party venue were added. In addition to food producing companies, the area also houses other companies with organic waste streams, such as gardeners, stable, a sports park, a cemetery, a sawmill and various allotment gardens. Finally, there are public and private green areas in which organic waste streams are also released during pruning and mowing.

The aim and mission of the entrepreneurs - united in an Entrepreneur's Association - is not in all respects the same as the aim of the City of Amsterdam. The city mainly wants to preserve the traditional landscape image (the agricultural appearance) and thus make recreation attractive (City of Amsterdam, 2006). The entrepreneurs want to do business, and for their new plans sometimes need an extension of, for example, a shed, where they encounter strict permits. The high lease price is also a problem for many entrepreneurs. The city and entrepreneurs agree on the desire to make the area a "circular testing ground": an area in which as many materials as possible are reused locally.

Organic waste streams in the area of Tuin van Geluk

Figure 1 shows the size of the available waste streams in the Tuin van Geluk. The "grass clippings" stream does not include the grass that farmers harvest for hay/silage grass production; it only concerns grass from roadsides, dikes and other public green areas/nature areas. Included in the graph are the waste streams that currently already have a local destination. A few examples:

- The brewer’s grain goes to cattle farmers in the area as animal feed;
- Entrepreneurs with vegetable gardens or arable farming put their crop residues underground as a soil enricher;
- Pruning wood is used as wood chips for paths;
- Wood chips from the sawmill are used as soft floor material for livestock keeping;
- The fruit garden has a bio-fermenter and a biomeiler (heat-producing compost heap) in which people convert their own residual products into energy and soil improvers.

The following organic waste streams in particular are not yet, or not yet fully included in local symbiosis: roadside cuttings, garden waste, pruning waste, organic waste, coconut substrate from greenhouse horticulture and fats from the hospitality industry. These streams leave the area in order to be processed elsewhere in the Netherlands (often at the expense of entrepreneurs).

It is striking that the waste streams from the maintenance of public green areas are relatively large compared to those of the entrepreneurs. The stream of crop residues is quite large; half of this comes from the care nursery and almost the other half from the care farm. However, the latter must, according to the city's plans, give way to a business park which would make this stream much smaller. With regard to organic waste, the organic households in the area are not included. This stream has the potential to grow.

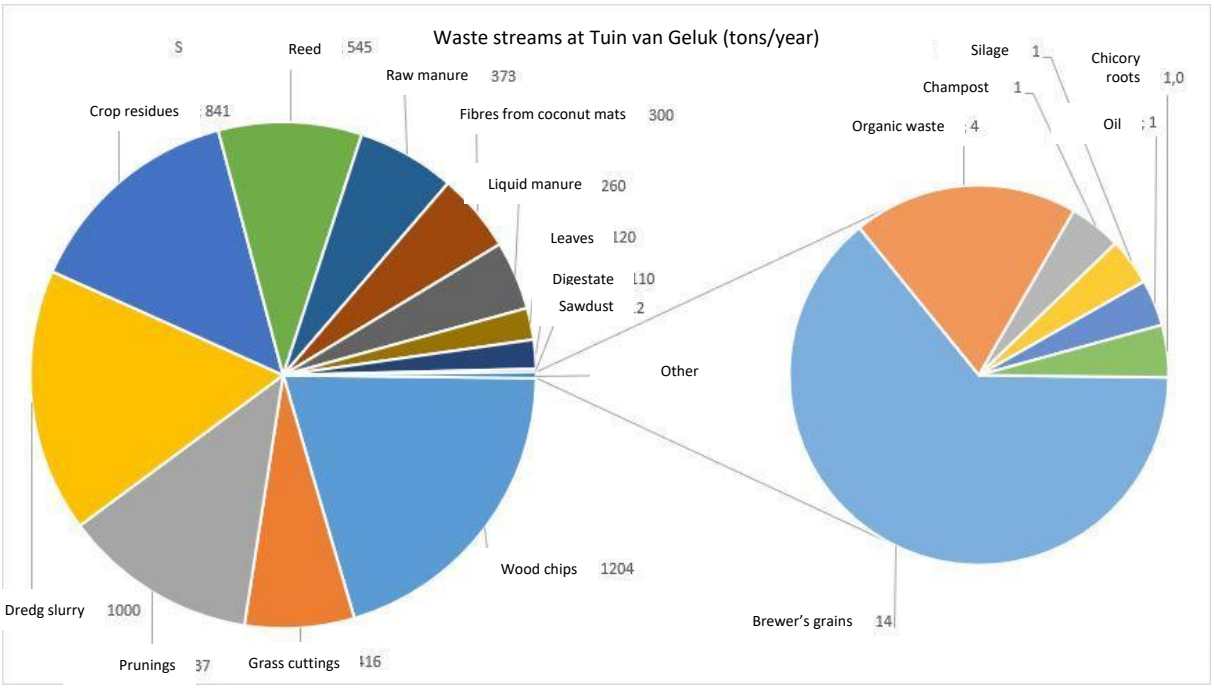


Figure 1 Organic waste streams in the Tuin van Geluk

2.2.3 Product needs

With regard to products that can be made from waste streams, there is a demand from entrepreneurs/organisations in the area for electricity, gas, heat, compost, fertilisers, stable floor material for livestock and animal feed. With animal feed, the demand is mainly for feed for cows, sheep and horses, such as stale bread, brewer's grain or animal feed chunks, while the feed that can be produced from waste streams concerns chicken feed (insect larvae breeding).

Figure 2 shows the demand for products in the area. Quantitative data were available for very few entrepreneurs, and often it concerns products that the entrepreneurs are not yet using, but which they think they *could* use. This applies, for example, to compost, insects (chicken feed) and heat. The care nursery is a major consumer of gas, but most other industrial buildings and adjacent houses are also heated with gas. The companies that are certified organic require an organic version of products such as compost and animal feed. Finally, based on the interviews there was also a clear demand for local ingredients, if they could be produced in an affordable way (for example for the brewery or restaurant). However, this falls outside the scope of RE-ORGANISE.

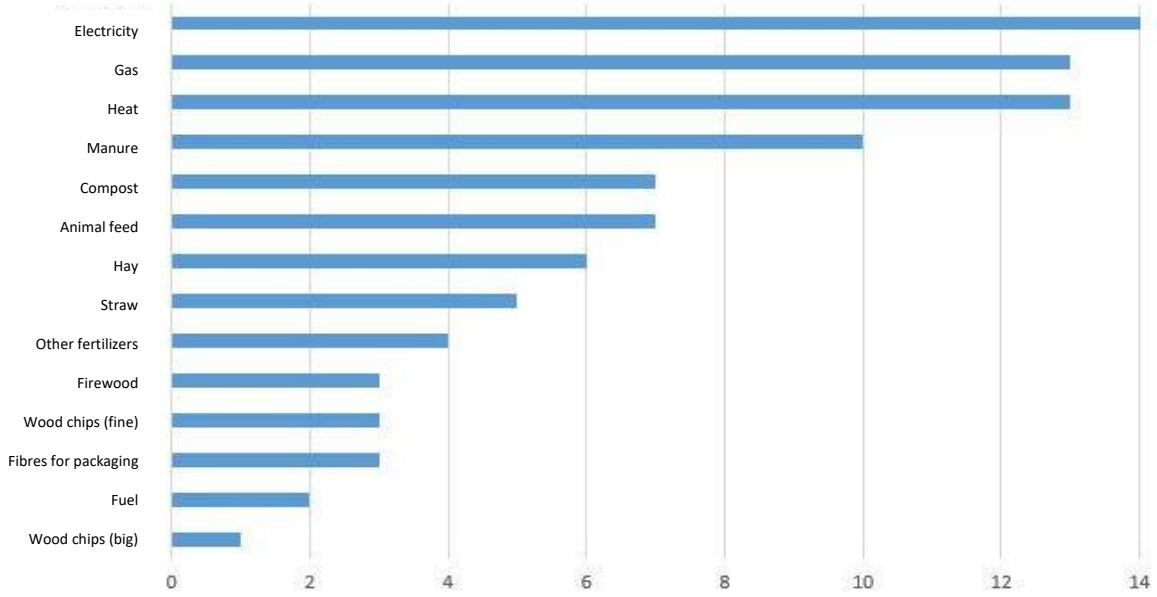


Figure 2 Amount of firms per type of product demand in Tuin van Geluk

Motivations from stakeholders in the area to participate in symbiosis

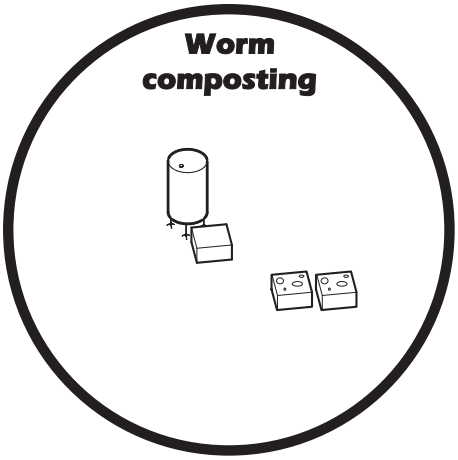
The majority of stakeholders is willing to take part in a local symbiotic network. The motivations are different for each entrepreneur. For at least seven respondents, ecological sustainability is an important part of their business philosophy. In principle, they are also prepared to invest time and/or money. It is important for different entrepreneurs to get materials they need from close by: sometimes because they market their products as "local products" (marketing benefits), at other times because this way they can better control the product's origin. Finally, there are also entrepreneurs who are primarily interested in potential cost savings, for example if waste streams no longer have to be disposed of against payment.

Barriers

The interviews also mentioned a number of obstacles for closing local loops. The most important are:

- Uncertainty about the continuity of the company. This is particularly important for farmers who can no longer afford a lease but who do business on land with a user agreement. This can in principle be cancelled annually by the municipality.
- Various entrepreneurs hardly have any waste streams because they already use everything themselves. This applies, for example, to manure and crop residues from farmers who grow in the soil.
- There is already competition for waste streams: the demand for brewer's grains for animal feed and wood chips as lying material, for example, is greater than the supply.
- In the case of sheepskin, there is no demand. For other waste streams, there is currently locally no possibility to convert them into products. An example is the fibre-rich substrate mats from greenhouse horticulture.
- The presence of both organic and non-organic companies is an obstacle to the possible cooperative production facilities. An organic arable farm cannot accept compost made from the waste streams of its non-organic neighbour.
- Different entrepreneurs have no place for waste stream processing equipment, or have no time to maintain it. Many entrepreneurs also need more knowledge to implement technological concepts.

Appendix 1: Technologies in Re-Organise: The Game



Worm composting occurs when worms break down organic material into a stable compost product. In this process, organic waste streams such as raw organic material and crops are converted into worm compost, a high-quality organic fertiliser. The worms themselves can also be harvested in worm composting. For example, they can serve as animal feed.

The organic waste streams may only consist of raw material. There must be no biocides and there should be as little citrus waste as possible. The more homogeneous the organic wastestream, the better the worm composting process.

Small-scale worm composting is an easy-to-use technique that requires little investment (50-100 euros) and labour. Worm composting can take place on 1 m2 and there are no restrictions of legislation or nuisance on this scale.

Input

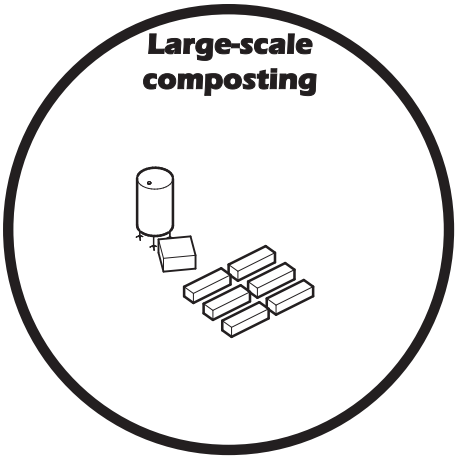
Raw organic material	50 kg/year

Output

Organic fertiliser (worm compost)	2 kg input - 1 kg output
Animal feed	

Required assets

Small investment	(1 card)	Outdoor space	(1 card)
Knowledge	(1 card)	Indoor space for winter	(1 card)
Maintenance time	(1 card)		



Composting occurs under oxygen-rich conditions, when micro-organisms break down organic material into a stable form. In this process, organic compounds are oxidized, releasing heat and water vapour. Compost consists of stable organic material and minerals. Compost is an organic fertiliser.

The organic residual stream must consist of organic material with a maximum moisture percentage of 65%. It is important that the input material consists of both carbon-rich materials and nitrogen-rich materials. Biocides and citrus waste must be avoided. The more homogeneous the organic waste stream, the better the composting process.

Large-scale composting is a technique that requires a great deal of knowledge and labour, as well as large investments. Large-scale composting takes place on at least 50 m2 and the Environmental Management Act must be observed. With bad composting, odour nuisance is a potential big risk.

Input (minimal)

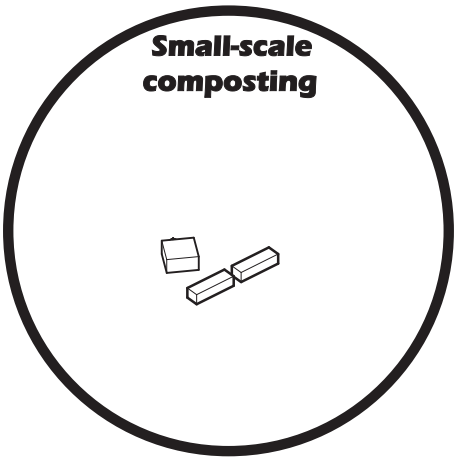
Raw organic material	1000 kg/year

Output

Organic fertiliser (compost)	2 kg input - 1 kg output

Required assets

Big investment	(3 cards)	Government permit	(1 card)
Knowledge	(1 card)	Machines	(3 cards)
Maintenance time	(3 cards)	Outdoor space	(1 card)



Composting occurs under oxygen-rich conditions, when micro-organisms break down organic material into a stable form. In this process, organic compounds are oxidized, releasing heat and water vapour. Compost consists of stable organic material and minerals. Compost is an organic fertiliser.

The organic residual stream must consist of organic material with a maximum moisture percentage of 65%. It is important that the input material consists of both carbon-rich materials and nitrogen-rich materials. Biocides and citrus waste must be avoided. The more homogeneous the organic waste stream, the better the composting process.

Small-scale worm composting is an easy-to-use technique that requires little knowledge and labour, as well as only a small investment (0-100 euros). Small scale composting can take place on 2 m2. There is no legislation that needs to be taken into account, but with bad composting, odour nuisance is a potential risk.

Input (minimal)

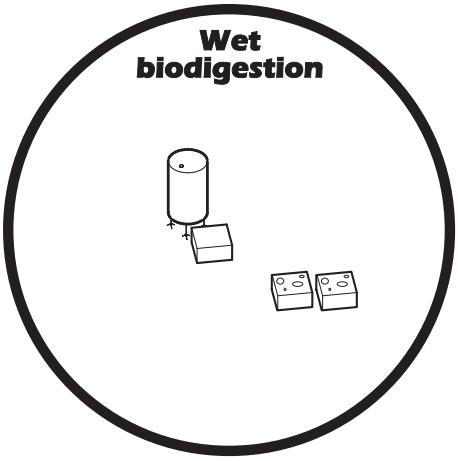
Raw organic material 1000 kg/year

Output

Organic fertiliser (compost) 2 kg input - 1 kg output

Required assets

Small investment	(1 card)	Outdoor space	(1 card)
Knowledge	(1 card)		
Maintenance time	(1 card)		



Wet biodigestion occurs under anaerobic conditions, when micro-organisms break down organic material into a more stable form. In the process, organic compounds are broken down and biogas is released. The reactor must be heated for an efficient process. Heat can be extracted by converting the released biogas in a gas engine into electricity and heat.

The wet digester must not be fed with pumpable streams with a maximum dry matter content of 15%. Material with a high sulphate content must be avoided because it has a strong oxidizing effect and is therefore harmful to the installation and the gas engine.

Small-scale wet digestion is a technique that requires some knowledge and labour input. Large-scale digestion requires more knowledge and requires continuous process control. Investments for a small digester with gas engine amount to around 15,000 to 20,000 euros. A large digester costs around 300,000-500,000 euros. For digesters with a higher annual input of 600m3, the Environmental Management Act must be complied with.

Input (minimal)

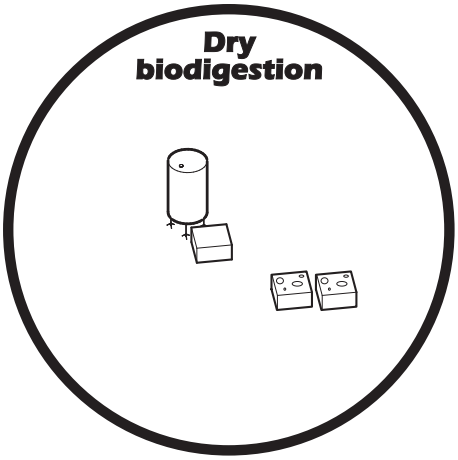
Manure, stale bread,
fat, crop residues,
chicory roots — 15000 kg /year

Output

Biogas (for heat/electricity) — 100 kg input- 10 m3 output

Required assets

Big investment	(3 cards)	Government permit	(1 card)
Knowledge	(1 card)	Machines (shredder)	(3 cards)
Maintenance time	(3 cards)	Outdoor space	(1 card)



Dry biodigestion occurs in anhydrous and anaerobe conditions, when micro-organisms break down organic material into a more stable form. In the process, organic compounds are broken down and biogas is released. The reactor must be heated for an efficient process. Heat can be extracted by converting the released biogas in a gas engine into electricity and heat.

The dry digester must not be fed with stackable material with a minimum dry matter content of 15%. Material with a high sulphate content must be avoided because it has a strong oxidizing effect and is therefore harmful to the installation and the gas engine.

Small-scale dry digestion is a technique that requires some knowledge and labour input. Large-scale digestion requires more knowledge and requires continuous process control. Investments for a small digester with gas engine amount to around 15,000 to 20,000 euros. A large digester costs around 300,000-500,000 euros. For digesters with a higher annual input of 600m3, the Environmental Management Act must be complied with.

Input (minimal)

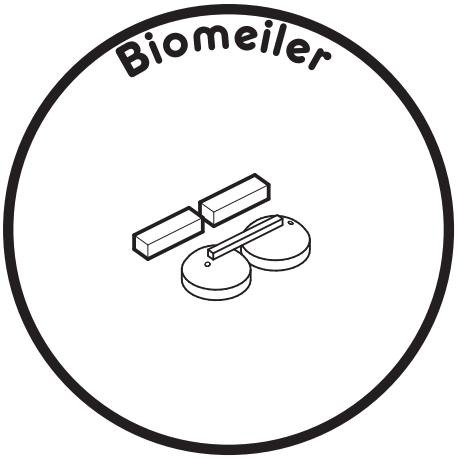
Raw organic material, crop residues, verge grass cuttings, garden waste (pruning) — 5000 kg / year

Output

Biogas (for heat/electricity) — 100 kg input - 10 m3 output

Required assets

Big investment	(3 cards)	Government permit	(1 card)
Knowledge	(1 card)	Machines (tractor)	(1 cards)
Maintenance time	(2 cards)	Outdoor space	(1 card)



The biomeiler process occurs under oxygen-rich conditions, when micro-organisms break down organic material into a stable form. In this process, organic compounds are oxidized, releasing heat and water vapour. Compost consists of stable organic material and minerals. Compost is an organic fertilizer. The heat that is released is generated by pumping water through hoses processed in the biomeiler. With this a house or barn, for example, can be heated.

The organic waste stream must consist of organic material with a maximum moisture percentage of 65%. It is important that the input material consists of both carbon-rich and nitrogen-rich materials. Biocides and citrus waste must be avoided. The more homogeneous the organic waste stream, the better the composting process. Ideal materials for processing in a biomeiler consist of wood chips as a carbon component, and animal manure as a nitrogen component.

It costs around 1500-2000 euros to set up a biomeiler. A biomeiler of 3 meters high and 10 meters in diameter will take up around 75 m2 of land. In the event of a poor process, odour nuisance is a potential risk. Max. life span: 2 yrs.

Input (minimal)

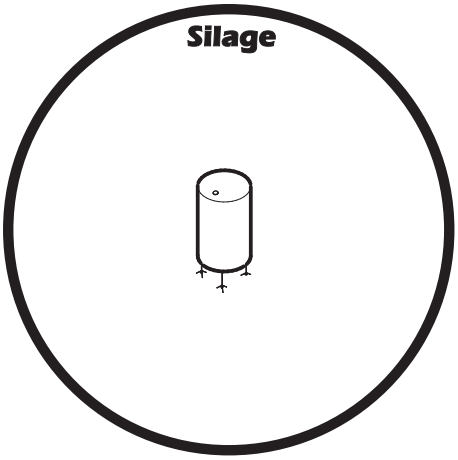
Raw manure, wood chips	2000 kg / y

Output

Compost	2 kg input - 1 kg output
Heat	10 kg input - 15 kWh/y output

Required assets

Low investment	(1 card)	If > 400 tons: gov. permit	(1 card)
Knowledge	(1 card)	Machines:tractor, shredder	(2 cards)
Maintenance time	(1 card)	Outdoor space	(1 card)



Silage occurs under lactic acid conditions, when lactic acid bacteria convert organic material into a stable form. In this process, sugars are converted into lactic acids. The organic material becomes sustainable due to the acid environment.

The organic residual stream must consist of organic material with a maximum moisture percentage of 65%. The input material must contain sufficient sugars. Too much protein has an adverse effect on the process, because protein has a buffering effect on the acidification. Materials such as grass, corn, and garden waste can be ensured.

Small-scale silage requires little knowledge and labour, and only small investments (0 to 1000 euros) are needed. Small-scale silage in, for example, air-tight closable bins can take place on 1 m2. There is no legislation that needs to be taken into account.

Input (minimal)

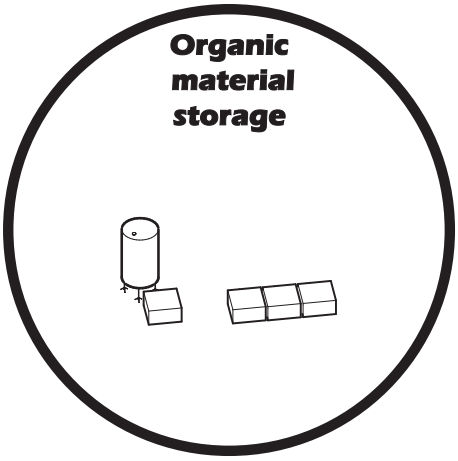
Natural grass cuttings, brewer's grains, ditch crops — 1000 kg / year

Output

Animal feed — 1 kg in - 0,8 kg out

Required assets

Investment	(2 cards)		
Knowledge	(1 card)	Machines: tractor	(1 card)
Maintenance time	(1 cards)	Outdoor space	(1 card)



The storage of organic material must happen under oxygen-free conditions, when organic material is converted to a more stable form. In this process, sugars are converted into lactic acids. The organic material becomes sustainable due to the acid environment.

Wet materials - such as manure, digestate from the biodigester, glucose-rich streams and fats - and dry materials - such as straw, wood chips and solid manure - can be stored well.

Storing on a small scale requires little knowledge and labour, and only small investments (0 to 1000 euros) are needed. Small-scale airtight closable trays only take up 1 m2. There is no legislation that needs to be taken into account.

Input (minimal)

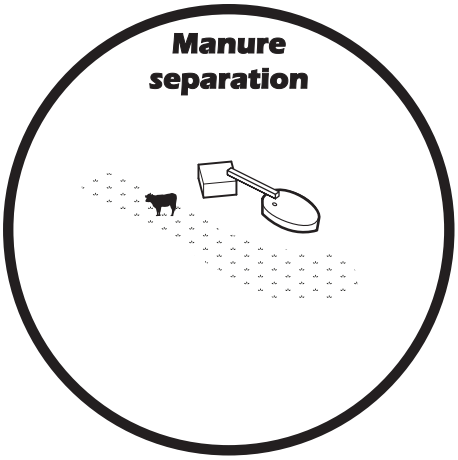
Manure (fresh), fat, straw (dry stalks), wood chips, thick manure, grains, digestate	1000 kg / year

Output

Animal feed, or stabilized fertilizer (from digestate or manure)	1 kgin- 0,8 kg out

Required assets

Investment	(2 cards)		
Knowledge	(1 card)	Machines: tractor	(1 card)
Maintenance time	(1 cards)	Outdoor space	(1 card)



A thin and a thick fraction is produced when separating manure. The thin fraction can be used as an organic fertiliser and the thick fraction can be used as a fiber material in a box stall, as a fiber-rich fraction for paper or biocomposition production, or as an organic fertiliser. A digester can also be fed well with the thick fraction from manure.

To be able to separate manure properly, it must be mixed and pumpable. It is important that the manure is not contaminated with stones and sand.

A manure separator is easy to maintain and operate, but requires a major investment of around 15,000 to 20,000 euros. A manure separator including pumps takes up around 8 m2. There is no legislation that needs to be taken into account.

Input (minimal)

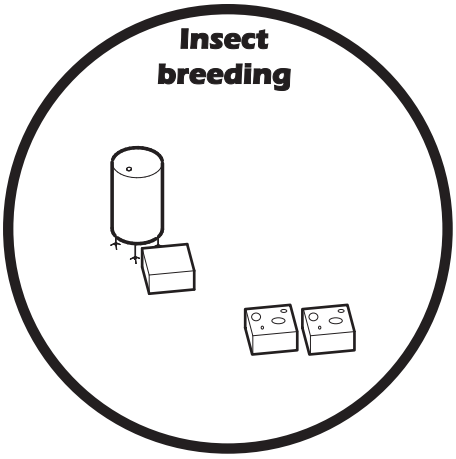
Digestate, manure	1000 kg / year

Output

Thin fertilizer	1kg input - 0,8 kg output
Thick fibers/fertilizer	1kg input - 0,2 kg output

Required assets

Big investment	(3 cards)	Machines: tractor	(1 card)
Knowledge	(1 card)	Outdoor space	(1 card)



When breeding insects, a waste stream such as organic waste is often used as food for the insects. Streams such as brewers grains, chicken manure, milk powder or egg powder can also be used. During insect breeding, insects that are suitable as animal or human food are released. An organic fraction is also released that can be used to ferment or compost. The insects are grown under controlled temperature and humidity conditions.

To be able to properly grow insects or worms, the organic waste stream must be free of biocides and toxic components such as plastic and heavy metals.

Growing insects on an industrial scale requires major investments. Small-scale insects, especially larvae, can be cultivated, but the investment costs increase with larger systems. A permit is necessary.

Input (minimal)

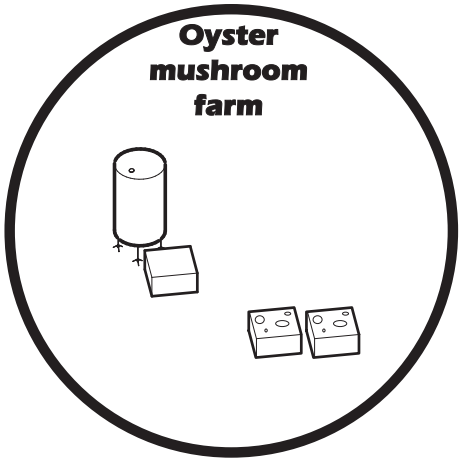
Raw organic material, kitchen waste (Swill), brewer's grains, chicken manure 1000- kg / year

Output

Animal feed 3 kg input - 1 kg output

Required assets

Investm. < 10000 kg/y	(1 card)	Machines: shredder	(1 card)
Investm. >= 10000 kg/y	(3 cards)	Indoor space	(1 card)
Knowledge	(1 card)	Gov. permit	(1 card)
Large maintenance time	(3 cards)		



Oyster mushrooms can be grown for human consumption on coffee grounds and straw. A substrate is made of these two products and the oyster mushrooms are grafted on it. The residual product is champost, an organic fertiliser. Brewers grains and straw are also suitable as substrate.
The substrate must be sterilized because it can contain pathogens. The substrate must be as homogeneous as possible to prevent production differences in the oyster mushrooms as much as possible.

To produce oyster mushrooms on a small scale, there are only low investment costs (100 euros). To produce oyster mushrooms on a larger scale and with higher production, climate cells and more automated production processes must be available. The investment costs for this can go up to 10,000-20,000 euros. It requires some labour to fetch sterilized substrate materials and to grow the mushrooms.

Input (minimal)

Coffee grounds, brewers grains, Straw	100 kg / year

Output

Oyster mushrooms	200 kg input - 1 kg output
Champost	1 kg input- 1 kg output

Required assets

Investm. < 5000 kg/y	(1 card)	Machines: car	(2 card)
Investm. >= 5000 kg/y	(3 cards)	Indoor space	(1 card)
Knowledge	(1 card)		
Medium work time	(2 cards)		

Appendix 2 Roles

You are a small-scale, socially driven beer brewer with the ambition to grow and you produce and sell local and regional specialty beers with a social and sustainable image. The story behind your company and the products is important and contributes to the "experience" of your end product. Closed local cycles, sustainability and biological raw materials fit in well with this. You wouldn’t mind making an effort for this, but it has to be cost-effective. Find partners to achieve your goal!

Necessities

Electricity	6000 kWh/year
Gas	5500 m3/year
Heat	2000 kWh/year

Waste streams:

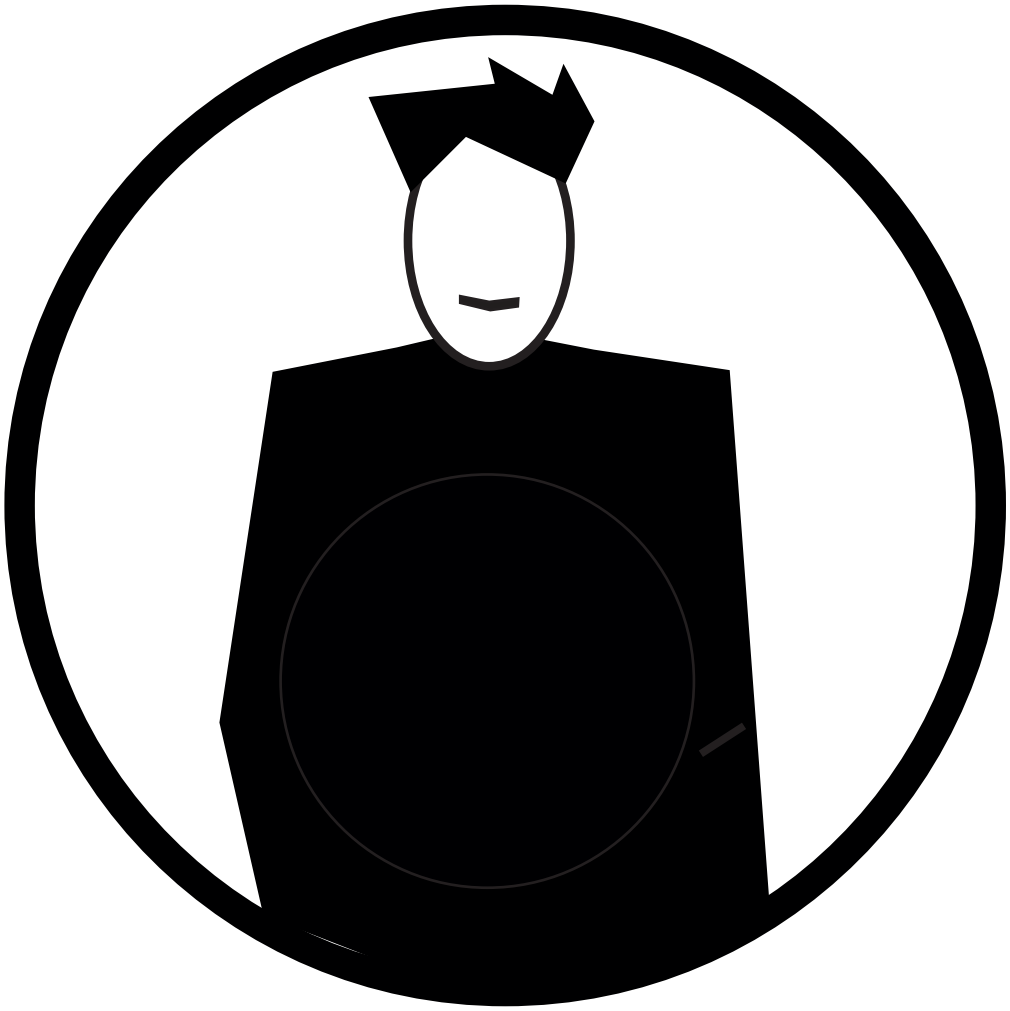
Brewer's grains	15 tons/year
Organic waste	2 tons/year

Other assets:

Small amount of money to invest	(1 card)
Bit of labour time	(1 card)
Small outdoor green space	(1 card)
Indoor Workshop and exhibition facility	(1 card)

BREWERY
Bierhier

You own a business park on the countryside, with office spaces, studios and small-scale catering establishments. Tenants are mainly sustainable creative people, mostly artisanal, and appreciate the rural nature of their workplace. Tenants are responsible for site maintenance, and self-employment plays an important role in this. You are open to new initiatives, and the organisation and costs involved are an important point of attention



Necessities:

Electricity	100	kWh /year
Gas	10000	m3/year
Firewood	20	tons/year
Heat	3000	kWh/year

Waste streams:

Reed	2	tons/year
Raw organic material	1	ton / year
Garden waste (pruning)	1	ton / year
Grass	10	tons / year
Coffee grounds	1	ton / year

Other assets:

Little amount of money to invest	(1 card)
Indoor space	(1 card)
Outdoor green space and amfitheater	(2 cards)

BUSINESS PARK
Maple

You are an experienced, entrepreneurial farmer with a mixed farm who grew up in this environment. You are bursting with ideas to further develop the area and you see opportunities to involve people from the immediate area in the production of food in an educational way. The use of local waste streams can also lead to financial benefits. You have a wide network of entrepreneurs and local government and you therefore know how difficult it is to get a farm started in terms of business economics.

Necessities:

Electricity	100 kWh/year
Gas	4000 m3/year
Liq. & solid manure (processed)	up to 10000 tons/year
Compost, animal feed	up to 10000 tons/year
Hay	up to 10000 tons/year
Straw	up to 10000 tons/year

Waste streams:

Verge grass cuttings	100	tons/year
Liquid manure	10	tons /year
Raw manure	80	tons /year
Ditch crops/reed	300	tons /year
Raw organic material	10	tons /year

Other assets:

Little amount of money to invest	(1 card)
Outdoor space	(2 cards)
Knowledge: composting, storage	(2 cards)
Machines (tractors, shredder, gardening tools)	(4 cards)
Network: other firms and government	(2 cards)

Agricultural contractor

Noest

Hogeschool van Amsterdam Play the City - Amsterdam

You are a successful and busy gardener and you work a lot on behalf of the government through tenders. You are personally interested in sustainability, but regulations, specifications, certificates and costs (market forces!) are very important points of attention in your business. You have a wide network of clients and suppliers.

Necessities:

Stabilized raw and liq. manure	up to 10000 tons/year
Stabilized organic manure	up to 10000 tons/year
Compost	up to 10000 tons/year

Waste streams:

Verge grass cuttings	50 tons/year
Garden waste (leaves)	20 tons/year
Wood chips	1200 tons/year
Garden waste (pruning wood)	300 tons/year

Other assets:

Knowledge: mushroomproduction	(1 card)
Machines (tractors, shredders, tools)	(3 cards)
Network: government, firms	(2 cards)

Gardeners
Groene Vingers

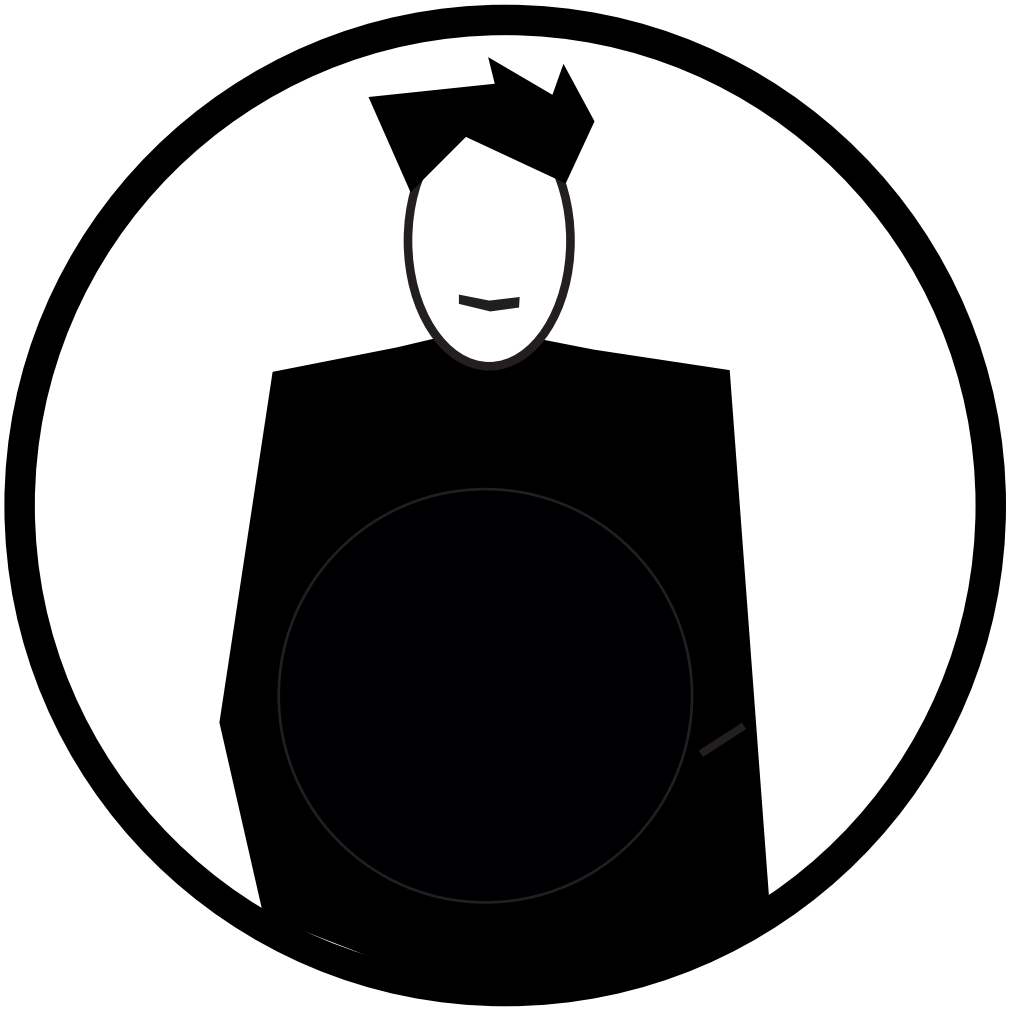
Hogeschool van Amsterdam Play the City - Amsterdam

In addition to your work as a green manager at a large company, you also take care of a small-scale livestock farm with 8 cows, 30 sheep and a few chickens. You find the idea of arranging everything circularly interesting, but how do you make sure all costs are covered? You are interested in new sustainable technologies and you think that cost benefits can be achieved. You are therefore willing to think about it or to put in some extra effort.

Necessities:	
Brewer's grain	2 tons/year
Animal feed	2 tons/year
Electricity	10000 kWh/year
Hay	25 tons/year
Stale bread	2 tons/year
Straw (dry grain stalks)	up to 10000 tons/year
Heat, or gas	4500 kWh/year, or 1700 m3/year

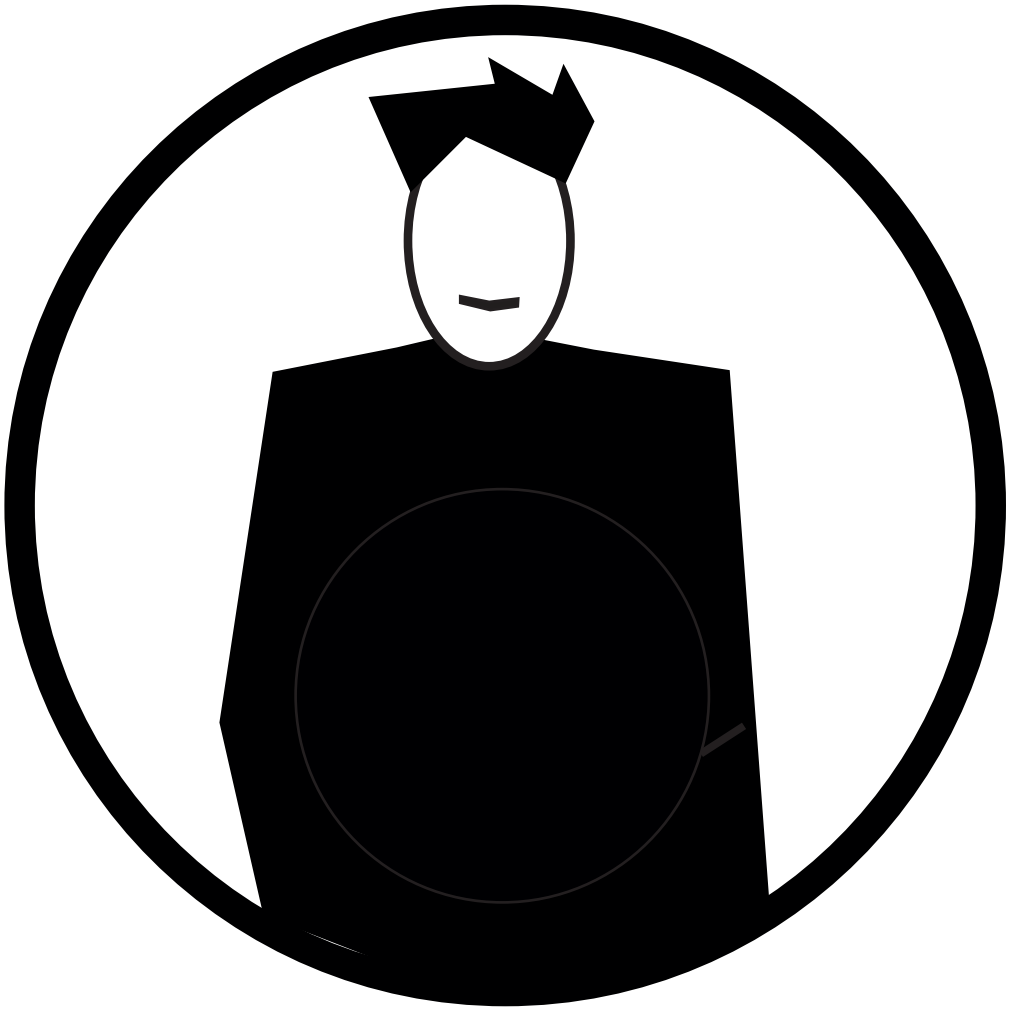
Waste streams:	
Raw manure	40 tons/year
Ditch crops/reed	10 tons/year

Other assets:	
Little amount of money to invest	(1 card)
Outdoor space	(1 card)
Machines: tractors, ploughs, shovel	(3 cards)
Knowledge: digestion, manure separation	(2 cards)



Cattle farmer
Nagel

You a board member of a non-profit horse stable with 26 ponies and 4 horses. The site is rented from the municipality and people come from the wider area to ride horses affordably and in a free environment. You do see opportunities to collaborate more intensively with other companies in the area, provided this is properly coordinated with the volunteers.



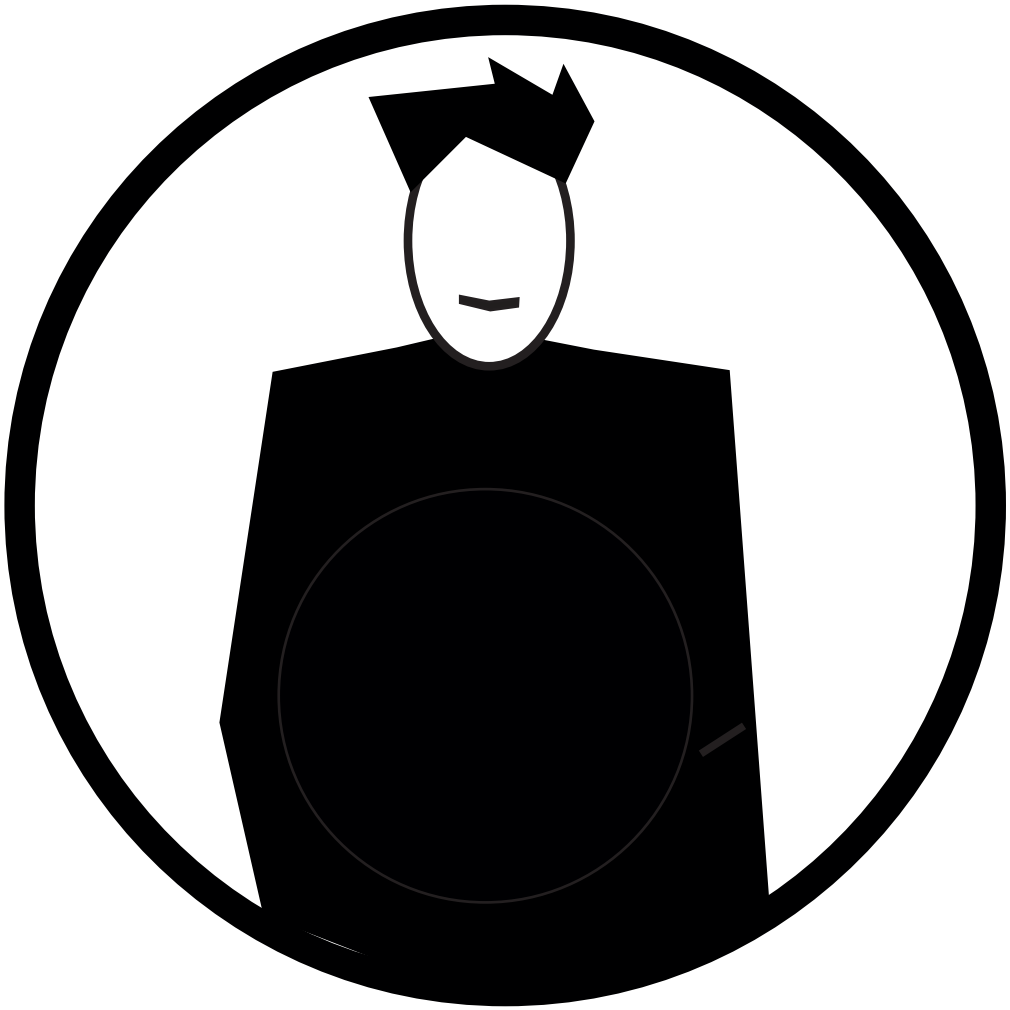
Necessities:	
Animal feed	12000 kg/year
Electricity	35000 kWh/year
Gas	2000 m3/year
Hay	50 tons/year
Saw dust	10 tons/year
Straw (dry grain stalks)	50 tons/year

Waste streams	
Raw manure	200 tons/year
Saw dust (used)	12 tons/year

Other assets:	
Little amount of money to invest	(1 card)
Outdoor space	(1 card)
Indoor space: canteen	(1 card)

Horse stables
Ezelsoor

You run a small-scale cattle farm with 30 cows and some young cattle and you grew up here. You have loyal customers, and you see opportunities to attract more people to the area through additional activities aimed at children and schools, such as polder sports and a pancake farm. Your interest in local life cycles mainly concerns the certainty of quality and healthy food. However, the current arrangements regarding lease and property rights make it difficult to make new plans.



Dairy farm

Zondernaam

Necessities:

Brewer's grain	15 tons/year
Animal feed	5 tons/year
Electricity, Gas, or Heat	5000 kWh/y or 2000 m3/y
Grass, or Hay	100 tons/year
Wood chips	up to 10000 tons/year
Chicory roots	5 tons/year
Stale bread	5 tons/year

Waste streams:

Raw manure	50 m3/year
Ditch crops/reed	10 tons/year

Other assets:

Little amount of money to invest	(1 card)
Knowledge about manure separation, silage	(2 cards)
Outdoor space	(1 card)

You own a nursery with 16 employees. You try to meet the demand in a regional / national market as efficiently as possible. If there are cost benefits or more revenue can be achieved with circular or sustainable business operations, then you certainly have an ear for it. For the time being, the eco-label is the starting point of your CSR policy, but you expect your customers to be unwilling to pay much extra for sustainability. You think that a sustainable image will become important from a marketing point of view.

Necessities:

Electricity	150000 kWh/year
Gas	850000 m3/year

Waste streams:

Crop residues (green)	400 tons/year
Raw organic material	1 ton/year
Coconut fibres	300 tons/year

Other assets:

Money for big investments	(3 cards)
Sheltered labour workers	(3 cards)
Outdoor and indoor space	(1+1 cards)

Nursery
Sloot

You are a gardener with 8 employees and a regular clientele. You want to deliver quality, but you think that for most customers the price is the deciding factor. You have a Green label because municipalities and housing associations think that is very important. You usually purchase materials from suppliers who can supply a total package and for the disposal of residual material tend to go for the cheapest option.

Gardener
Klein

Necessities:	
Stabilized organic manure/fertilizer	4000 tons/year
Compost	4000 tons/year
Wood chips	1000 tons/year

Waste streams:	
Grass cuttings	100 tons/year
Garden waste (leaves)	50 tons/year
Ditch crops/reed	10 tons/year
Garden waste (pruning wood)	200 tons/year

Other assets:	
Little amount of money to invest	(1 card)
Knowledge: composting, mushrooms	(2 cards)
Machines: tractors, vans	(2 cards)
Outdoor space	(1 card)

You are a director of the recreation board and therefore responsible for the development and management of the recreation area. The physical maintenance is outsourced. The municipality indicates the content that must be given to an area and you elaborate this in work descriptions for tenders. In principle, tenders are only concerned with price and continuity. A good relationship and clear agreements are important. Larger companies will therefore receive a tender offer sooner. What happens next with the waste streams hardly plays a role in business operations, if at all.

Necessities:	
Gas	50000 m3/year

Waste streams:	
Grass cuttings	1000 tons/year
Wood chips	1200 tons/year
Dredge slurry (raw org. material)	1000 tons/year
Ditch crops/reed	750 tons/year
Garden waste (pruning wood)	300 tons/year

Other assets:	
Knowledge: silage, storage	(2 cards)
Machines: tractors, pickup trucks, shredder	(3 cards)
Network: governmental institutions	(2 cards)

Gov. recreational area manager

You run a restaurant and want to be as sustainable as possible. According to you, circularity is primarily a question of good cooperation and focused on concrete actions. If the collaboration does not lead to concrete results quickly enough, it must be enforced. For your restaurant it is important that the appearance and look are taken into account when coming up with new technical solutions. In short: you are looking for aesthetic solutions.

Necessities:

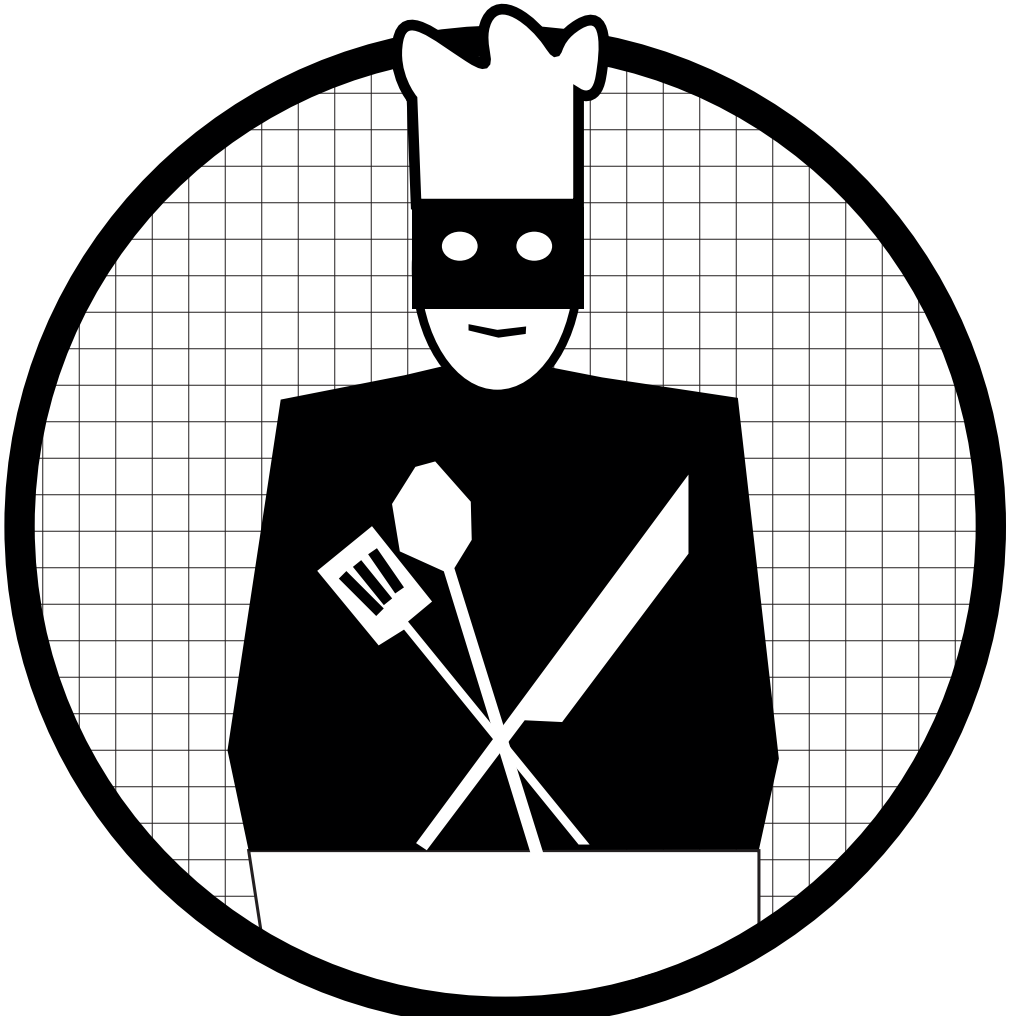
Electricity	60000 kWh/year
Gas or heat	2500 m3/y or 6500 kWh/y

Waste streams:

Crop residues (green)	1 ton/year
Organic waste	1 ton/year
Fat	1 ton/year
Coffee grounds	1 ton/year

Other assets:

Space for events and exhibitions	(2 cards)



Restaurant
De Boer

You are part of the board of an allotment garden association and you are particularly interested in the (future) possibilities of circular use of biomass and your own green management. However, according to you, entrepreneurs and users are hardly concerned with this, so it is more a matter of the long term. In the short term you do see opportunities for education with individual initiatives, but more long term collaboration is considered to be important.

Necessities:

Stabilized organic manure	up to 1200 tons/year
Compost	up to 1200 tons/year
Electricity	1800 kWh/year
Gas or heat	1500 m3/y or 3500 kWh

Waste streams:

Crop residues (green)	1 ton/year
Ditch crops/reed	10 tons/year
Garden waste (pruning wood)	100 tons/year

Other assets::

Little amount of money to invest	(1 card)
Knowledge: insectbreeding, wormcomposting, biomeiler	(3 cards)
Outdoor space	(1 card)
Network (local government, other firms)	(2 cards)

Allotment garden

paRADIJS

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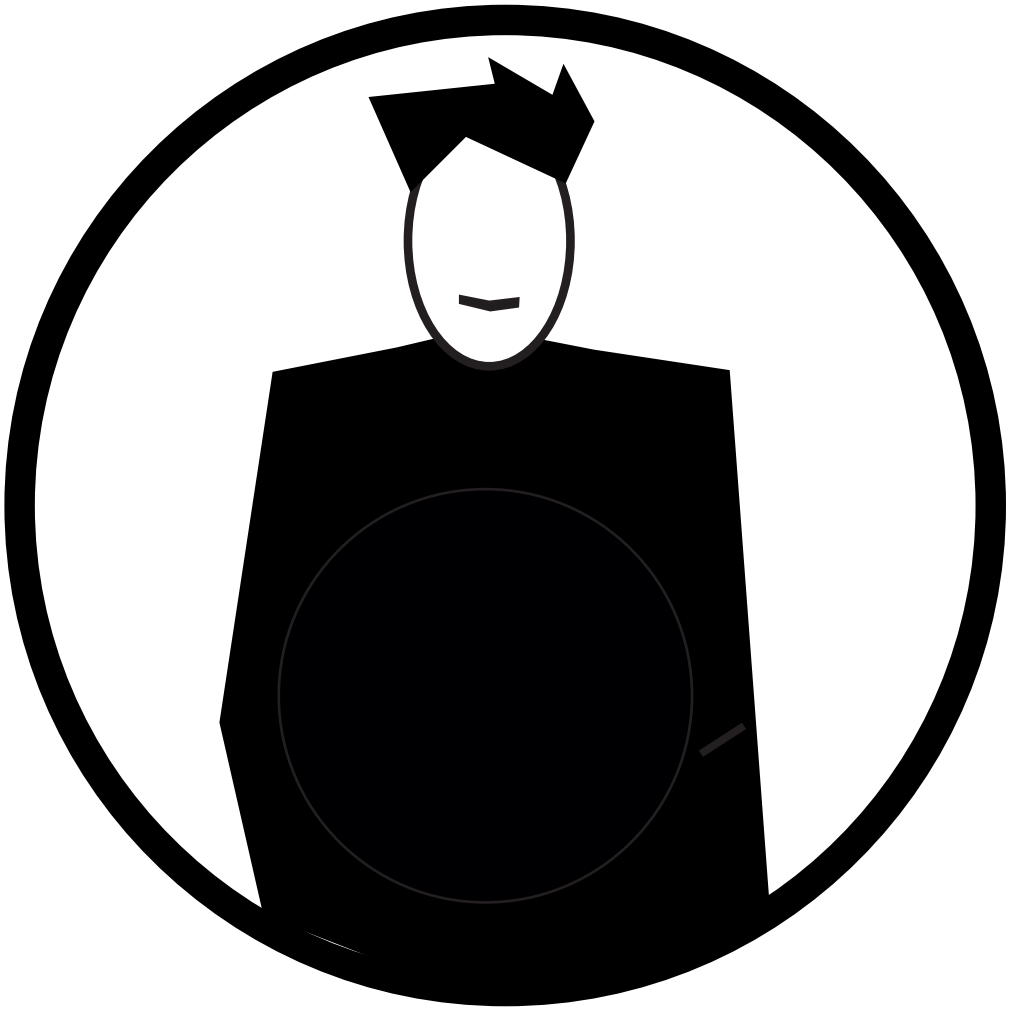
You manage various business parks on behalf of the municipality. One site borders urban agriculture and consistst partially built of restaurants and hotels. Activities such as green management and monitoring are outsourced to specialized companies. You personally enjoy sustainability very much and you like to participate in initiatives such as locally sourcing materials, closing cycles and planting flowers. Budgets and costs are leading for your employer, so all initiatives are assessed on that basis. Current issues are drainage, litter, cleanliness and pest control.

Restaurant

Business Park



Necessities:

Stabilized organic manure	up to 1000 tons/year
Compost	up to 1000 tons/year
Electricity	200000 kWh/year
Gas	30000 m3/y, or
Heat	70000 kWh

Waste streams:

Grass cuttings	10 tons/year
Ditch crops/reed	50 tons/year
Garden waste (pruning wood)	25 tons/year
Coffee grounds	1 ton/year

Other assets::

Money for big investments	(3 cards)
Indoor and outdoor space	(1+2 cards)

Parkmanagement

Symbicorp.

You are the owner of a fruit orchard and a proponent of small-scale business operations. You become enthusiastic about projects and techniques based on the principle of doing everything as simple as possible, preferably as close as possible to and around your own company premises.

Necessities:	
Compost	up to 20 tons/year
Electricity, Gas, Heat	2000 kWh/year
Firewood	2 tons/year
Animal feed	5 tons/year

Waste streams:	
Champost	1 ton/year
Digestate	5 tons/year
Crop residues (green)	2 tons/year
Organic waste	1 ton/year
Wood chips	1 ton/year
Ditch crops/reed	10 tons/year
Garden waste (firewood)	1 ton/year
Chicory roots	1 ton/year

Other assets::	
Little amount of money to invest	(1 card)
Exposition and meeting facilities	(1 card)
Outdoor space	(1 card)
Indoor shop for organic products	(2 cards)
Knowledge: biomeiler, digestion, compost	(3 cards)
Work time	(1 card)
Machines (shredder)	(1 card)

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Fruit gardens

Jumjum

You are an "organic grower" of herbs and vegetables and you have an ecological design of your garden. You are interested in organic, but you have doubts about the feasibility of it in this environment (particulate matter) and the quality. For you, efficiency in operations does not mean that you use the land as intensively as possible, but why bother when things can also be done easily". You mainly deliver to restaurants and there it is more about the service, freshness and taste than the price. Your vegetables are richer in nutrients because you enrich the soil with natural elements that belong in a healthy intestinal flora.

Necessities:

Stabilized organic manure	10 tons/year
Compost	10 tons/year
Wood chips	1 ton/year

Waste streams:

Crop residues (green)	2 tons/year
Raw organic material	1 ton/year

Other assets::

Little amount of money to invest	(1 card)
Outdoor space	(1 card)
Machines: tractors	(1 card)
Knowledge: composting	(1 card)

Arable farm

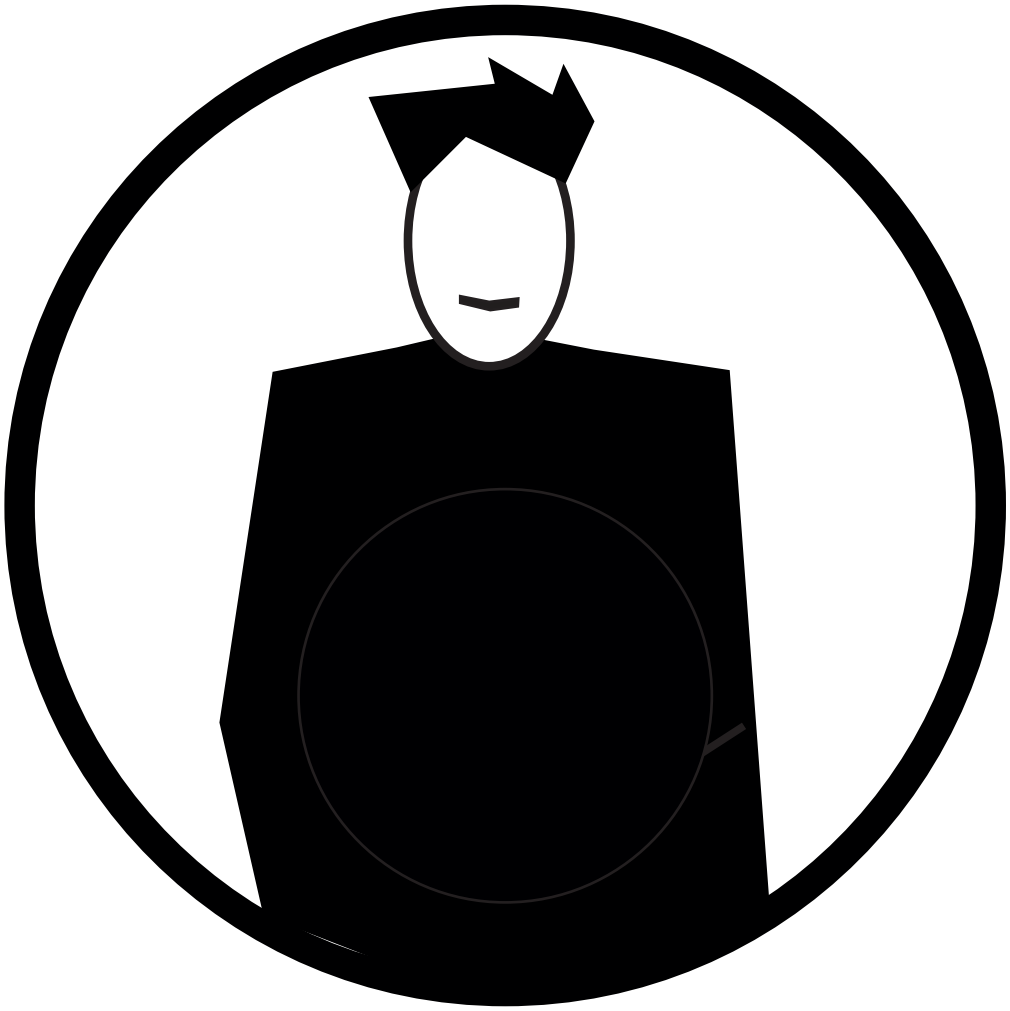
Uitdeklei

You own a small hobby farm on a unique spot of wet peat land next to the city with 14 cows, 28 sheep, 2 goats and 8 chickens. You prefer when products come from the neighbourhood; that is cheaper and it is nice to know from whom you buy it.

Necessities:	
Straw (dry grass cuttings)	5 tons/year
Hay	5 tons/year
Brewer's grain	2 ton/year
Animal feed	2 ton/year
Electricity	3500 kWh/year
Heat	4500 kWh/year
Grass	12 tons/year
Wood chips	2 tons/year
Stale bread	1 ton/year

Waste streams:	
Raw manure	10 tons/year
Ditch crops/reed	10 tons/year

Other assets:	
Little amount of money to invest	(1 card)
Outdoor space	(1 card)
Knowledge about manure separation, silage, storage	(3 cards)



Cattle farm

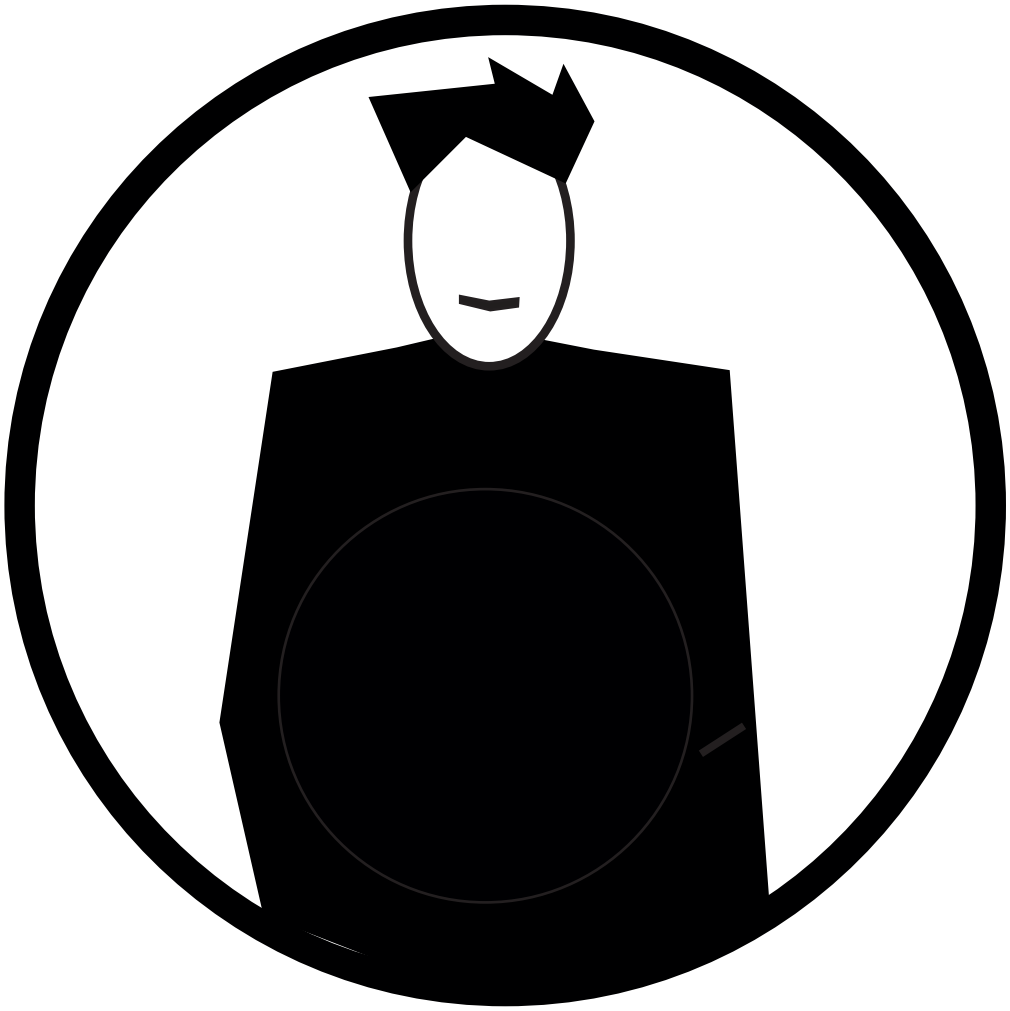
Benji

You own an organic arable farm with volunteers and you want to produce food responsibly. You also provide a pleasant place for people with a distance to the labour market. In addition to direct sales through a small shop, your products are sold to products from organic food. You have a preference for products and fertilisers from the immediate area because it is more practical and cheaper. You are also interested in waste streams that could come to the company, but they must be organic.

Necessities:	
Firewood	60 tons/year
Champost	250 tons/year
Electricity	15000 kWh/year
Hay	2 tons/year
Straw	2 tons/year
Compost	5 tons/year
Animal feed	250 tons/year
Gas or heat	2000 m3/y or 4500 kWh/y

Waste streams:	
Organic waste	1 ton/year
Ditch crops/reed	2 tons/year
Garden waste (pruning wood)	1 ton/year

Other assets::	
Little amount of money to invest	(1 card)
Outdoor space + shop	(1+1 cards)
Knowledge: wormcomposting	(1 card)
Sheltered employment workers	(5 cards)



Care farm

Blij

Appendix 3 Area map


Fruit Gardens Jumjum
Restaurant De Boer
Business Park Maple
Allotment Gardens paRADIJS
Nursery Sloot
Arable Farm Uitdeklei
Gerdener Klein
Governmental recreational area
Cattle Farm Nagel
Brewery Bierhier
Horse stables Ezelsoor
Cattle Farm Benji
Dairy Farm Zondernaam
Agricultural contractor Noest
Gardeners Groene Vingers
Care Farm Blij
Industrial Park Symbicorp.

Appendix 4 Business Model Canvas

- Example Business Model Canvas by the Ellen MacArthur Foundation and IDEO[1]

[1] https://www.circulardesignguide.com/post/circular-business-model-canvas

WORKSHEET

Business Model Canvas

A3 or bigger

The business model canvas has been developed by Osterwalder & Pigneur (strategyzer.com). You might have filled one of these in before - here we have added some prompts and questions that you might find helpful in the context of the circular economy.

If you need more space, create your own canvas using post-its.

KEY PARTNERSHIPS

How might you strengthen your partnerships with organisations across the value chain to benefit from circularity (flows of materials, information and capital) in the system?

What new or unexpected partnerships can you form to grow circularity within your organisation and the system?

KEY ACTIVITIES

What activities might best help you achieve your value proposition?

What might be the positive externalities (i.e. the consequences of your actions on others) of your activities? And how might you monitor and design out any negative externalities?

How might you create new forms of human, natural or financial capital?

KEY RESOURCES

How might you build a multi-disciplinary team within or across organisations to create value in a circular economy? How might you embrace connectivity?

What capabilities do you need to enable circular flows and feedback mechanisms and run your organisation successfully in the short and long term?

Where will your resources come from (renewable or finite source) and what will happen to them after use?

VALUE PROPOSITION

Start by asking yourself: what are the needs you are aiming to meet? Is it a product or is a service required to fulfil these needs?

Is there anything associated with your product/service that has potential value to others?

How will you create a compelling story about your value proposition?

How might you enhance your value proposition from the outset by designing for adaptability and continuous evolution?

CUSTOMER RELATIONSHIPS

What feedback loops will you build in with your customers to become more nimble and adaptable to their feedback?

How might you connect customers with other parts of the journey of your product/service or materials?

CHANNELS

How might you redesign your relationship with your supply chain?

How might you build feedback loops directly into your product/service that allow you to identify new opportunities?

What role could you play in the reverse logistics chain?

CUSTOMER SEGMENTS

Who will be the main customers or users of your product/service?

Who else might benefit from or will be affected by your materials/product/service? Also consider beneficiaries beyond your immediate value chain and industry.

COSTS

Which costs could be shared or lowered through other users and partners?

Could you shift from an ownership model of under-utilised assets to payment for access and usage?

How might you reduce cost volatility and dependence on the use of finite resources? What can you do to mitigate risk?

REVENUES

How might you diversify opportunities to increase resilience, growth and innovation?

How might "growing the pie" (through value creation elsewhere in the system) impact favourably on your own future success?

How might your business model help create other types of value? Human, social or natural capital?

How might new services increase revenue from existing products, assets or your delivery systems?

Appendix 5 Game preparation

- See excel document.
- If you can't find it, contact k.p.h.lange@tudelft.nl