The first upward growth park: how to provide stakeholder management to implement the first upward growth park?

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Introduction

The management tasks to prevent peat subsidence have a variety of interfaces with spatial planning, nature management and environmental management. Therefore, an integral coordination between provinces, municipalities and water boards is needed (van den Born et al., 2016). There is an urgent need for new insights that can contribute to restoration and preservation of peat soil (Smolders et al., 2019). An example of an innovative grassroots initiative to mitigate peat subsidence is the ‘upward growth park’ as proposed by Erik Hobijn. Druijff and Kaika (2021) argue that grassroots initiatives like these are worth scaling up, given their innovative nature. However, a defence framework must be set up around them before any attempt to scale up begins. This framework should include sustained noncompetitive funding streams and stakeholders who will seek to learn from the initiative, help it grow and establish sustainable networks. At this stage, Hobijns idea of an upward growth park lacks a support base, partnerships with stakeholders and a physical location to implement the upward growth park. In this paper, design thinking methodology is applied to the project case of the upward growth park to increase the support base for this innovation. Innovations with a wider support base - created through design thinking - have more chance to scale-up and become beneficial to the societies these innovations are being implemented to (Brinkman et al., 2023).

1. Methodology

Design thinking is a methodology with a solution-based approach for solving wicked problems (Dam, 2023). These problems are often ill-defined, neglecting the needs of the client and the user. Stage 1, the empathize phase, is about empathizing the user's needs. In order to get to know the needs of Hobijn a meeting was held. This meeting provided a great opportunity to ask questions about his needs as a client along with the users' needs. Creating an empathy map allows for better understanding regarding how the client and users feel about the project.

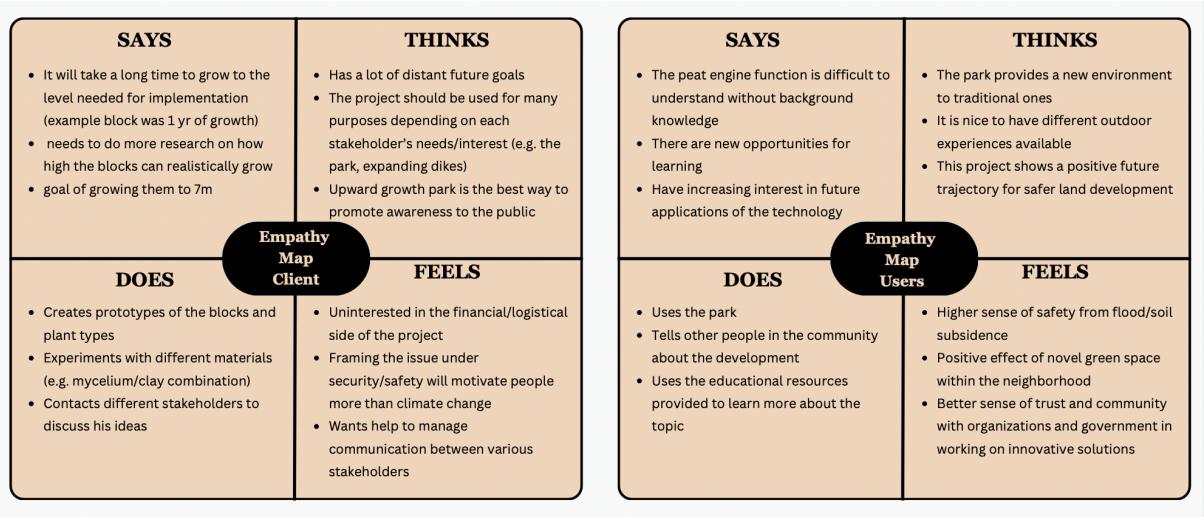


Figure 1: Design thinking based Client and Predicted User Empathy Maps (own source)

An empathy map predicting needs and perceptions of the hypothetical completed project can further advise on factors to prioritise. These empathy maps were based on the design thinking method of determining what the subject says, thinks, does, and feels in order to gain a deeper understanding of their perspectives (Gibbons, 2024). The client needs analysis revealed the importance of providing recommendations on logistical and organisational aspects of the project. Client needs were identified as stakeholder management, funding and implementation of at least a part of the ‘Veenmotor’ invention in an upward growth park. User needs had to be predicted, due to the preliminary stage of the project. The hypothetical future users of the park should feel that it benefits the community, and become more interested in the educational and awareness initiatives.

In stage 2, the define phase, information gathered during the empathize stage is organised. The client and user's needs are more broadly defined in this stage. After organizing, it was possible to formulate a problem statement in a human – centred manner. This stage helped the design team to collect ideas to establish features that can solve the wicked problem.

Problem statement: How to provide stakeholder management to implement the first upward growth park?

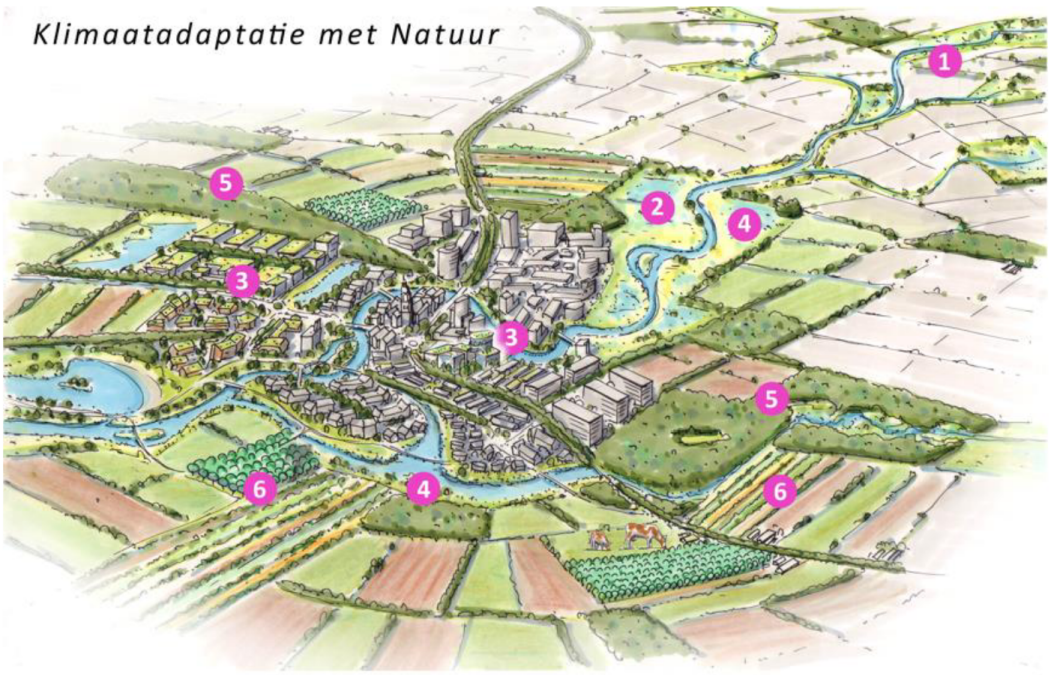
In stage 3, also known as the ideation phase, questions were asked in the team to find solutions. 'How should we get in touch with the stakeholders?' and 'What is a great location for the upward growth park?' are examples of questions asked. The design team looked at the problem definition from different perspectives. There was a solution seeking session, which resulted in

a poster to be presented and discussed. In stage 4, the prototype phase, the best possible solution was chosen. The best solution was determined to be the provision of a geodesign workshop for the development of a low peat bog forest within a park. These prototypes can be shared and tested outside the design team. At the end of the prototype stage, the design team had a better idea about how users think and feel when they interact with the prototype. In this stage, most emails were sent to different stakeholders to look if they are interested. Stage 5 is the test phase, where it is time to test the solutions. However, because of limited time in the Future Societies Lab of the University of Amsterdam, this stage cannot be totally provided (Dam, 2023).

2. Relevant policy

2.1 National policy

The Structural Vision for Infrastructure and Spatial Planning (2012) shows that the central government has an interest in slowing down subsidence because of flood risk management and freshwater supply in peat meadow areas. Provinces and municipalities, in collaboration with the water boards, make agreements about the spatial choices to promote this interest. The Ministerie of Landbouw, Natuur en Voedselkwaliteit Accompanying Report to 'Climate adaptation with nature between city and countryside' version 2 states that in order to prevent heat stress and urban flooding, measures are best taken in and around the urban area itself as shown in figure 2. When mitigating flood risks in urban areas and combating drought, it is important to consider the entire water system. The figure below shows some examples of natural measures that contribute to climate adaptation in and around cities (Ministerie van Landbouw, Natuur en Voedselkwaliteit, 2023).



Maatregel	Klimaateffect
1. Natuurlijke sponzen bovenstrooms	Overstromingen, droogte
2. Vasthouden water	Overstromingen, droogte
3. Meer groen, minder verharding	Wateroverlast, droogte, hittestress
4. Natuurlijke waterberging	Wateroverlast, droogte, hittestress
5. Natuurlijke bosontwikkeling	Hittestress, droogte, overstromingen
6. Natuurinclusieve landbouw	Droogte, hittestress, wateroverlast

Figure 2: Impression of spatial adaptation of climate adaptation tasks in and around urban areas (Ministerie van Landbouw, Natuur en Voedselkwaliteit, 2023)

2.2 Provincial policy

In Noord-Holland, there are active joint initiatives and programmes of the water board, the province and stakeholders, including Landschap Noord-Holland (Provincie Noord-Holland, 2022). They created an Innovation Programme Veen (IPV) that will allow for substantial mitigation of land subsidence in the post-2021 period. This programme is further investigating the opportunities of paludiculture and wet crops.

The province of Noord-Holland is also responsible for granting a subsidy - the 'Snl-vergoeding' - to agricultural land-owners who decide to convert their land to nature inclusive agriculture (BIJ12, 2023.). Through this subsidy, they can be compensated for loss of income because agricultural land has more monetary value than land dedicated to nature (Staatsbosbeheer, 2022).

2.3 Municipal policy

The Amsterdam Climate Adaptation Strategy (ACAS) (2020) states that Amsterdam's city parks and streets with well-growing trees are important for keeping the city cool and sufficient water storage. Due to increasingly frequent and heavy downpours and subsidence, they are regularly flooded. One of the municipality's aims is to slow down subsidence in Amsterdam's parks and peatlands (in collaboration with the province of North Holland and the water boards). In addition, they want to investigate the effect of subsidence on soil life.

3. Academic literature review

3.1 Troubled peatlands

Peatlands are endangered globally. Their uses mainly consist of providing for agricultural land-use and forestry (Bonn et al., 2016). The provisioning services of agriculture and forestry are being distributed due to an increasing and urbanising global population (Winiwarter, 2014). Higher demand for agricultural production is necessitated by these population trends. Furthermore, the growth of the population also has effects on the provisioning of drinking water (Campbell et al., 2017). The extraction of water from soils in peatlands has caused the peat to oxidize. This in turn leads to environmental degradation and climate change caused by CO2-output (Bonn et al., 2016; Erkens, Van der Meulen & Middelkoop, 2016). According to Hompenöder et al. (2020), peatlands sequester twice as much CO2 compared to the global forest biomass despite only inhibiting 3% of the earth's terrestrial surface, exacerbating the threats of climate change. In contrast, the global forest biomass inhibits 50 to 65% of the earth's terrestrial surface (Reichstein & Carvalhais, 2019). Simply put, this means that burning all of the world's forest biomass emits twice as little CO2 as letting 3% of the peatlands dry out. Therefore, we argue that the dewatering of peatlands has to stop in order to stay within planetary boundaries (Steffen et al., 2015; Campbell et al., 2017).

Mitigating the implications of troubled peatlands can be considered to be a multidisciplinary problem. Its causes and impacts are too diverse and complex to be solved by a single discipline. To further illustrate this issue, we can build on the findings of Erkens et al. (2016), who have studied the processes and implications described in the previous paragraph. We have summarized these findings in table 1. This table depicts the implications caused by drainage of water in order to foster agricultural land use on peatlands in one of the most densely populated countries of the world, The Netherlands. In order to support further urbanization processes on a global scale whilst operating within safe boundaries to the earth's carrying capacity, alternatives to the above have to be considered. Ideally this would occur by regenerating the vulnerable peat landscapes.

Table 1 Implications of soil subsidence of different geographical scale levels (after Erkens et al., 2016)

Local	**Regional**	**Global**
Flooding	Eutrophication	Increased CH4 & CO2 emissions
Increasing costs for renovation, restructuring and renewal	Soil subsidence	Extreme weather events that enhance local and regional implications
Damages:	Water safety issues	

Infrastructure	Water suction effect of deep polders
Road networks	Increased dewatering
Public space	Saltwater intrusion
Housing foundations	Drinking water supply

3.2 Growing peat

An example of landscapes with growing peat are low peat areas. Low peat areas possess little relief and are fed by water from rivers, streams, creeks and ponds. Upwelling groundwater also contributes to water supply of peat lands. Characteristic of natural low peat areas are reed beds, which are locally rich in mosses and ferns. Some forests are also present, such as willow thicket, alder forest and birch forest (Van t' Veer, 2022). The growth of peat with independent plant growth by paludiculture is not much more than 2 mm per year (net effect) (Van t' Veer, 2024a).

To grow peat it is important the soil does not dry out. This is a major problem in a large city where it gets 7 degrees warmer than the surrounding polder and natural areas (KNMI, n.d.). During very dry and hot summers, a lot of evaporation can occur, which could oxidize the introduced peat soil (Van t' Veer, 2024a).

In locations with peat mosses, special water management is needed. Irrigation with nutrient-rich and carbonate-rich surface water leads to loss of peat moss. Management aimed at retaining rainwater as long as possible is much more effective. To allow peat mosses to grow as well as possible, the groundwater in the peat moss cover should preferably be 0-12 cm below the surface as in young peat moss reed beds (Van t' Veer, 2022). This means that peat forming is best stimulated when co-creating good agreements between land users (e.g. agriculture and forestry) and water management (e.g. water boards, drinking water companies) (Staatsbosbeheer, 2022).

3.3 Ecosystem services

According to Bonn et al. (2016, p. 8) 'ecosystem services are functions of ecosystems that provide benefits to human well-being'. In the Millenium Ecosystem Assessment report these ecosystem services are classified as regulating, provisioning, cultural and supportive services (Mace, Norris & Fitter, 2012). Peatlands are considered as one of Earth's ecosystems. Peatland ecosystems provide human societies with three of the four types of ecosystem services: regulating, provisioning and cultural (Bonn et al., 2016).

Carbon sequestration leads to climate regulation and is therefore a beneficial ecosystem service provided by peatlands (Bonn et al., 2016). Peatlands can regulate CO2 emissions with Carbon Capture Storage (CSS) (Humpenöder et al. 2020). Only 3% of the global land area is covered

by peatland, but it stores twice as much carbon compared to global forest biomass. Thus, preserving and restoring peatland is crucial to mitigating climate change.

One of the regulating ecosystem services of peatlands is retaining rainwater, which releases during dry periods. This reduces the risk of flooding and the effect of prolonged drought in certain types of landscapes. This means that in areas prone to fluvial or marine flooding (e.g. deltas like The Netherlands), peatlands could act as a natural sponge by sequestering large amounts of water. The retained water could also prevent the drying out of soils, given that drought affects water safety in flood prone areas (WUR, n.d.) due to tears and cracks forming inside peat dikes. Vegetation could potentially trap pollutants and sediment in the stream before it enters other bodies of water (Gacia et al., 2019). Furthermore, filtering capacities of peat affecting drinking water can be regarded as a provisioning ecosystem service. Paludiculture is the practice of crop production on wet soils, predominantly occurring on peatlands. The wet crops that can be grown with paludiculture provision clothing, insulation and other products.

Cities are known as sites where evaporation occurs in higher volumes than the surrounding countryside (KNMI, n.d.). One of the causes of this higher volume can be explained through the Urban Heat Island [UHI]-effect and the lack of sufficient blue/green infrastructure within the city landscape. Wetter peat landscapes regulate the heat by reducing temperatures (Temmink et al., 2023). Contrary to the UHI-effect, cities also experience increased volumes of rainfall. Applying the regulating and provisioning services of peatlands while increasing blue/green infrastructure (e.g. in the form of an upward growing park) in cities will aid to adapt to increasing rainfall, mitigate UHI-effects, increase biodiversity and mitigate soil subsidence.

Regulating and provisioning ecosystem services are tangible and perhaps even measurable because of their often material benefits. Less tangible, but just as important, are the cultural ecosystem services that peatlands can provide to human societies. This ecosystem provides primarily non-material benefits. Characteristic examples of peatlands are the possibilities for recreation, spiritual and aesthetic enrichment, along with providing a sense of place to certain communities (Bonn et al., 2016). Given that peatlands take quite some time to grow, it is of essential value to conserve this cultural heritage of the past within landscapes.

3.4 Reference project

A pilot project ‘Omhoog met het veen’ on the Ilperveld (figure 3) near Amsterdam shows that it is possible to restore low peat with paludiculture (wet productive peatland use). To restore the peat, a start was made by removing the top 10 cm of the rich top layer to remove excess nutrients. Two compartments with their own water levels were created: a water compartment to store rainwater and a compartment in which so-called peat moss pockets were created. For this purpose, a dike was constructed between the two compartments. Ploughing of the grassland plots was carried out with precision. Cuttings of peat moss and peat moss pearls were then incorporated into the soil (Van Riet et al., 2018).

After only 3.5 years from the project’s inception, the peat moss vegetation formed an 8-12 cm thick layer of recently formed peat. Unfortunately, several years after completion of this trial, the peat moss growth had already largely disappeared, due to oxidation during two very dry summers. Again, net peat growth appears to be little more than a few mm. per year. Eventually

a low peat bog forest, as shown in figure 4, was grown at Jagersveld. This forest is able to hold rainwater long term (Van t' Veer, 2024).

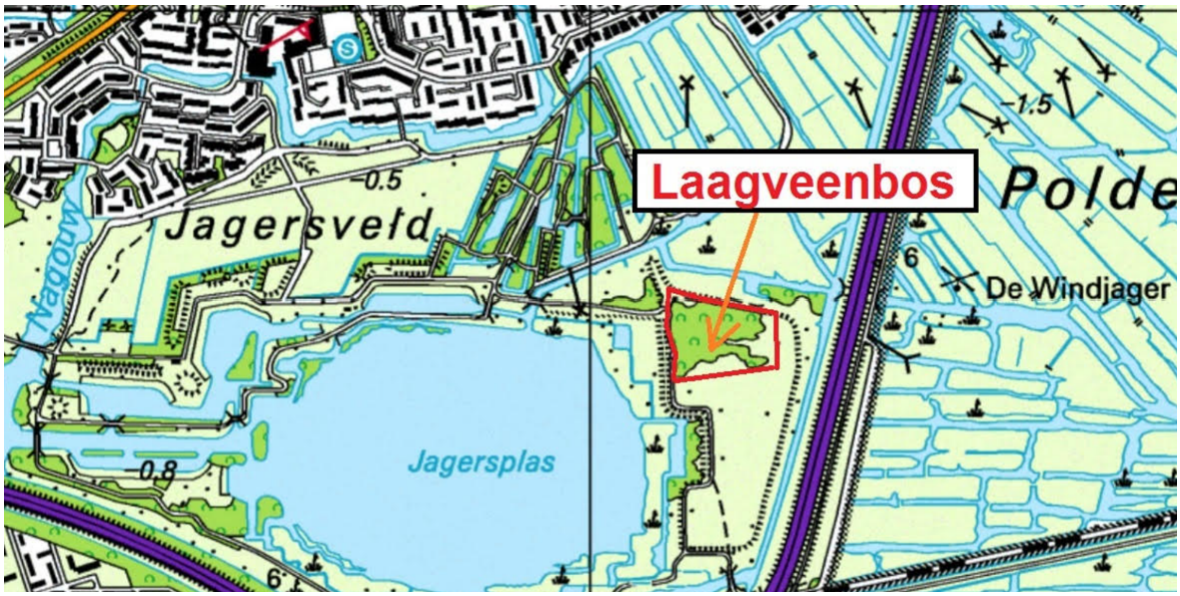


Figure 3: Low peat bog forest on the Ilperveld east of the Jagersplas, Municipality of Zaanstad (Van t' Veer, 2024a)

Figure 4: Impression of incipient peat growth in the low peat bog forest of the Ilperveld with a variety of leaf mosses on willow branches, ferns and bog plants (Van t' Veer, 2024a)

4. Invention of Erik Hobijn

Hobijn wants to work with what he calls "root concrete" of reeds. Root concrete is grown in controlled containers. The root concrete is eventually situated in a 'Veenmotor' This means the root concrete is in a peatland surrounded by clay dikes. The land then grows upward, expected by one or two meters per year. Eventually the root concrete is preserved, because when the root mass is a few meters thick, it is pruned, after which peat moss for preservation is placed on top of these reeds. Hobijn learned about this preservation method from Radboud University Nijmegen's research center B-Ware, who also work on peat restoration. The aim is to alter the process of soil subsidence (figure 5) and raise dikes, parks, meadows, and residential areas by 7 meters. Through research into various cultivation processes Hobijn is looking for ways to optimize root concrete (cf. h2owaternetwerk.nl, 2023).

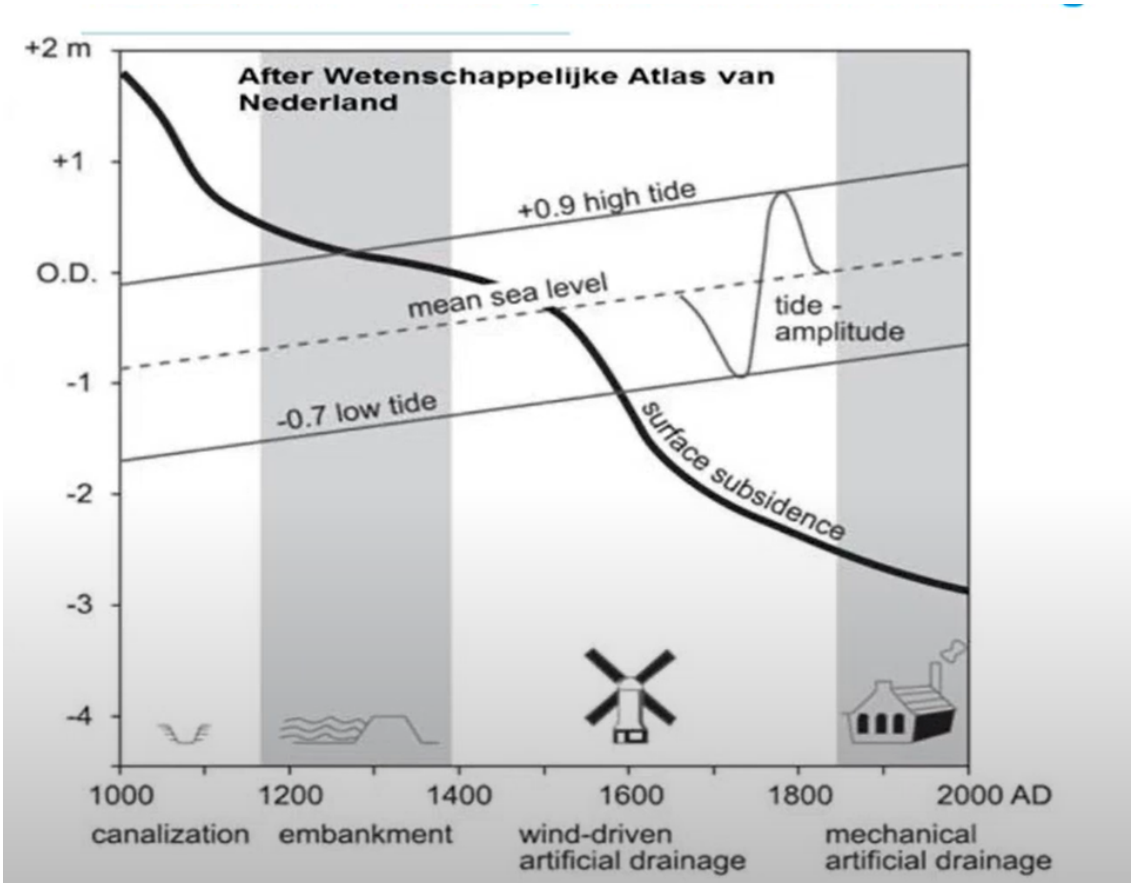


Figure 5: A thousand years of anthropogenic driven soil dewatering and subsidence (Erkens et al., 2016)

4.1 Scaling-up the innovation

Scaling-up bottom-up innovations like the upward growth park require careful consideration of prevailing policies. As mentioned before in chapter 2, multiple prevailing policies exist on different scale levels. These range from the municipality level to provincial and national policy. As further described in chapter 3, regrowing peatlands could have global benefits. Drawing upon this thought, we propose a suggestion to scale-up this technological innovation within

current policies. Consecutively municipal, provincial and national policy will come to the foreground.

There is a preference to realize the upward growth park in the form of an art installation within the city limits of the municipality of Amsterdam. The ACAS aims to adapt to soil subsidence. This aim could provide the upward growth park an opportunity for scale up, as it shares a common interest.

If the co-creation of the upward growth park with the municipality of Amsterdam proves mutually fruitful, the municipality could potentially propel the VeenMotor (figure 6) to the provincial level, as the municipal ACAS interacts with the provincial IPV. The municipality of Amsterdam could link the upward growth park and the Province of North Holland through the interacting policies and the mutually aim to mitigate soil subsidence.

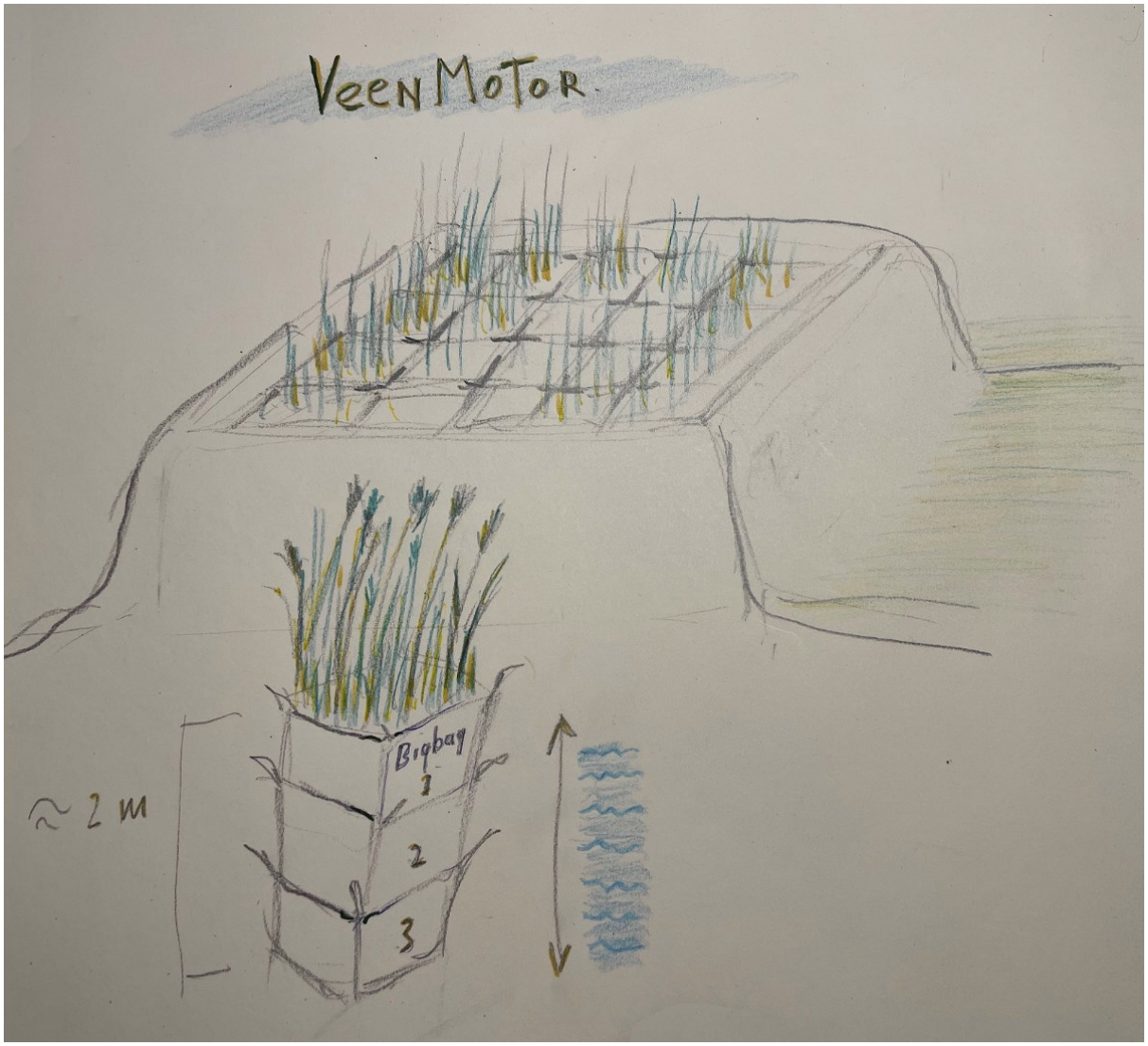


Figure 6: The stacking of reeds in the Veenmotor concrete illustrated, managing the water levels stimulate the upward growth of the reeds (Hobijn, 2024).

If the innovation desires to scale-up onto the provincial level, interests of agricultural land owners should be addressed. Subsidies like the ‘Snl-vergoeding’ could potentially sway agricultural land owners in favour of supporting the upward growth park without causing

significant harm to their livelihoods. This could result in acquiring the much needed land that is needed to realize the upward growth park (see: chapter 6.1) along with the cultivation of reeds. The Snl-vergoeding is valid within all 12 provinces of the Netherlands, meaning that a horizontal diffusion of this innovation on the provincial scale ultimately leads the innovation to the national scale.

By converting conventional agricultural land to nature inclusive agriculture in a joint venture with Hobijn's innovation to regrow the peat, mitigation of soil subsidence will be promoted while also accommodating to the increase of biodiversity. This then results in mitigating flood risks, droughts, saltwater intrusion and adapting to sea-level rise (see: chapter 3). This fits the national policy framework described in the Structural Vision for Infrastructure and Spatial Planning (2012). The scaling-up of this innovation has successfully taken-off from the bottom-up and is now ready for spatial diffusion on a global scale (Rogers, 2003).

5. Results

5.1 Low peat bog forest

A recommendation is to implement the upward growth park in the peri-urban area of Amsterdam. This recommendation for peri-urban areas is in line with the version 2 report of the Ministry of Landbouw, Natuur en Voedselkwaliteit as mentioned in chapter 2. However, provinces and municipalities, in collaboration with the water boards, make agreements about the spatial choices to slow down land subsidence in peat lands. The ultimate choice has to fit in the agreement about the spatial choices (see: chapter 2).

Amsterdam was built on the marshy ground of the Amstel Delta, which often flooded and consisted mainly of marsh and peat soil. Around Amsterdam, marshes and much peat have disappeared through reclamation and peat extraction. Neighborhoods outside the old center of Amsterdam are built on former polders. Due to the artificially low water levels, the soil in and around Amsterdam is increasingly sinking (Van t' Veer, 2024b).

An upward growth park needs a minimum size or former agricultural land of 1 ha (Van t' Veer, 2024a). This is hard to find within the city, but can more easily be found in the peri-urban area. A climate buffer is an area that can capture and retain water during precipitation excess and release water in times of drought. In particular, wetlands with peat and pocket forests are suitable to function as climate buffers. Some locations in peri-urban areas have been found, for instance the meadows along Ouderkerkerplas, marsh forest Hoge Dijk or the Middelpolder (Daemen, 2024). These locations of several hectares have space for a development of an 1 ha upward growth park.

Hobijn encourages the reed growth in containers at his workplace. There he allows the roots to interlock to create root concrete with reeds which are a part of the Veenmotor. However, farmers can also grow with paludiculture large amounts of root concrete. After rewetting, the cultivation of flood tolerant plant species like reed with root concrete can provide an alternative product for farmers. However, farmers need to keep in mind that root concrete requires a different cultivation system than is common in wet farming. This other large-scale cultivation system can be tested on a farmer's area under Hobijn's guidance.

After being sold by Hobijn or a farmer, the root concrete with reeds is placed in the ploughed-off grassland with vernalization. This root concrete with reeds can grow with nutrient-rich water. For peat mosses to grow, rainwater (less nutrient-rich) must be able to be collected and retained. Mowing the thatch can be done later, then peat moss cuttings are planted to preserve the root concrete and occasional peat moss beads are sprinkled on top. Rainwater of the winter can be stored in a basin, which can be used again as a water supply in the summer. Even then, Van t' Veer (2024a) expects water shortages, so it is impossible not to let nutrient-rich water in or let the peat soil dry out for several weeks. As long as that is a few weeks, and the rest of the time everything is soaking wet, then there is not too big of a problem (Van t' Veer, 2024a). Rainwater will give marsh a chance to develop again. In addition, due to the increased groundwater level, the marsh will stop the current degradation of peat and peat formation will occur. The peat can store an extra large amount of CO2, providing a climate buffer effect.

Reed ridge will grow in the area after the peat moss implementation. Subsequently, willows, alders and birches may also grow. Thus, a beautiful low peat bog forest may co-exist. A low

peat bog forest retains and collects seepage and rainwater, allowing the water to penetrate further into the soil, creating a higher water table. This then also immediately acts as a climate buffer. In very wet periods, the upward growth park actually absorbs a lot of water, preventing flooding. Additionally, in dry periods the low peat bog forest can slowly release the water to the surrounding area. Besides that, the low peat bog forest can store an extra layer of (clean) water that can later be used as drinking water. Finally, the upward growth park can reduce heat stress in the city during heat periods.

5.2 Art installation

In addition to realizing an upward growth park with a low peat bog forest for piloting and R&D we would like to make people acquainted with the idea of the upward growth park and more specifically of the root concrete by means of an art installation. Since the realisation of the park may take time, an art installation could be the design method to present the concept and get it accepted by the public. With a work of art, the urgency of the matter and the solutions can be presented in a way that could help involve citizens and get them familiarized. An art installation can make the problem of peat subsidence and its possible solution tangible to citizens while possibly creating a narrative and experience they can share. This results in drawing more attention to the problem and generating active engagement.

Hobijn is interested in presenting his ideas in the form of an exploded view drawing. This is a technical drawing in which an object is drawn as if its parts are pulled apart, seemingly to be exploded (Encyclo, n.d.). It shows all the various components and how it should be assembled. An example art installation with whom Hobijn has previously collaborated is The Exploded View Beyond Building, which is an exhibition in the shape of a house. The house is a sustainable and modular presentation of biobased building materials and exhibits the different materials and their usage throughout the house (The Exploded View, n.d.). Presenting the upward growth park as an exploded view art installation will provide the opportunity to explain the roles of the separate parts before the realization.
While we are not artists, we have thought about the following options to be part of the exploded view. One part is a demonstration of the causes of peat subsidence and the concerns it brings presented by a prototype of well hydrated peat soil and dried out peat soil.
The second part demonstrates how controlled reed cultivation forms root concrete. This can be done similarly to the reed cultivation in the yellow pellet containers but instead in see-through containers to give a better view (Gevouwen Oevers, 2023). By showing a side by side of reed growth with lots of water that has it afloat, and growth with as little water as having them grow in soil demonstrates how their roots can be manipulated (De Ingenieur, 2023). The third part could consist of the other materials that are preferably implemented into the project, such as mycelium or the growth of peat moss and other plants on root concrete.
To support the storyline, an interactive information point from a QR-code can provide visitors with animated videos of the upward growth park, diagrams and designs to give more explanation. Additionally, we would like to enable people here to leave their thoughts and ideas or give them the possibility to contact the artist.

5.3 Stakeholders

Druijff and Kaika (2021) say that grassroots initiative ‘upward growth park’ needs a defence framework around it before any attempt to scale up begins. This framework should include stakeholders who will seek to learn from the initiative, help it grow, and establish sustainable networks. Besides that, sustained and noncompetitive funding streams, which could also be provided by some stakeholders. Hobijn recognizes the importance of stakeholder involvement and collaborating with them within their own interest (Hobijn, 2024). To make the project successful Hobijn believes that a revival of the Dutch concept of ‘poldering’ will be a good form of consensus-building between stakeholders that provides many different perspectives. The concept of poldering will later be expanded on.

To lay the basis for stakeholder collaboration, a stakeholder analysis has been done to identify the actors that would be able to influence the project (Eden & Ackermann, 2001). Some of these stakeholders have been identified through Hobijn’s mentions and previous collaboration. Previous collaborations have been formed by personal approach from Hobijn (Hobijn, 2024). There are many actors who could be involved in realizing the upward growth park. However, when identifying stakeholders we have chosen to focus on actors that could help to realize an upward growth park or would benefit from doing research in the park and help scale-up. These stakeholders are shown in the stakeholder map of figure 7 and will be explained below.

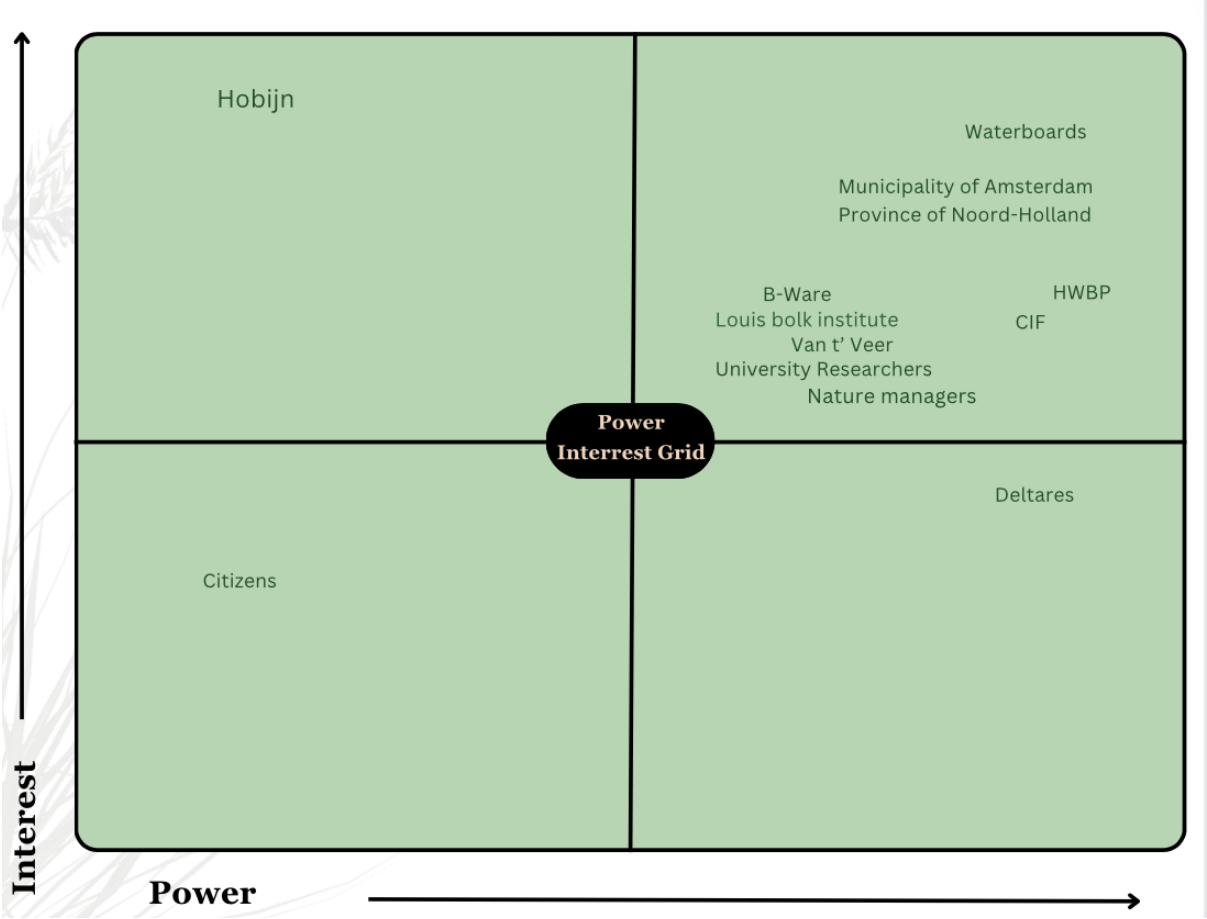


Figure 7: Stakeholder map following the structure of a power-interest grid (source: own source)

The stakeholders have been mapped by placing them into a power-interest grid. Their position on the map shows their measure of interests in the project and their degree of power in influencing it (Eden & Ackermann, 2001). We consider interest and influence since interest helps to identify the stakeholders. By combining this with their influence and motivation, it helps to prioritize and define their stake. The stakeholders have been grouped into research & knowledge, governmental bodies, nature management and funding. Some may fall into multiple categories. The most important stakeholders will be explained further.

Hobijn is the initiator of the project and has a high interest in the success and scale up of the project. He is dependent on other stakeholders for the creation of an upward growth park. Currently, his influence over building the collaboration is great as he chooses who he shares his ideas with. However his overall power is low relative to his interest.

Research & knowledge

B-Ware is a research centre connected to the Radboud University of Nijmegen. It has been experimenting with the peat preservation method and has shared this with Hobijn to collaborate on its development. B-Ware's interest lies in peat restoration and preservation, therefore a part of the Veenmotor could be part of their testing grounds and help them accelerate in reaching their goals (B-Ware, n.d.). With their available knowledge on peat and their research abilities they make a powerful stakeholder. Furthermore, their connection to the Radboud University helps to connect to students, raise attention and enable publications. Previous contact has shown their interest in the project and participation in a geo-design workshop has been accepted. Van t' Veer & De Boer Ecologisch Advies en Onderzoeksbureau has a lot of contact with researchers from The RU Nijmegen. These research entities can work together to provide knowledge about peat growth.

Louis bolk institute is a knowledge institute researching sustainable farming (Louis Bolk Instituut, n.d.). They focus on social transitions that could contribute to this, a part of the Veenmotor could be part of this. Their power lies in their ability to research large scale farming of root concrete and conduct research in the fields of sustainable agriculture, nutrition and health. The upward growth park would be of interest as an R&D location.

Deltares is a knowledge institute with expertise in the field of water and subsurface (Deltares, n.d.). Their knowledge, software and research abilities in the field of land subsidence and dike construction make them a powerful consultant for Hobijn as well as policy makers. Their focus topics connected to Hobijn's interest include drought, floods, sea level rise, subsidence, water supply, and water, soil and health (Deltares, n.d.). However, they have mainly shown interest in the carbon storage abilities of the root concrete. Hobijn has established contact with a grass specialist studying the effects of grass on dike safety, somewhat connecting to Hobijn's work with reeds. Another contact is a land subsidence engineer who we have contacted to attend the geodesign workshop, however, interest has not been confirmed. The bottleneck with Deltares is their necessity to be approached by the waterboards for their participation.

Governmental bodies

There are several governmental and municipal bodies responsible for water management that demonstrate vested interest in Hobijn's project. The Waterboard Amstel, Gooi and Vecht and drinking water facilitator Waternet are active in Amsterdam. They are key stakeholders due to

their work relating to Amsterdam's entire water cycle (Waterschap Amstel, Gooi en Vecht, n.d.). Waterboard Amstel, Gooi and Vecht are responsible for making the plans considering water and dikes, while Waternet is responsible for keeping the groundwater levels. Water levels influence land subsidence and will play a great role in the realisation of an upward growth park. Therefore, the power of the waterboard lies in accepting the necessary water levels for the park. While Waternet's power lies in their responsibility over keeping the water levels (Waternet, n.d.). Waternet has shown specific interest in the filtration abilities of the root concrete

Current contact between Hoogheemraadschap Rijnland and Hobijn is a great step for expansion to Zuid-Holland but is not a direct stakeholder to be involved with an upward growth park in Amsterdam.

The importance of the water boards is shown by their influence to move other organisations such as Deltares. Deltares will likely participate when approached by them. Likewise will the Hoogwaterbeschermingsprogramma (HWBP) which is an alliance of water boards and Rijkswaterstaat (Hoogwaterbeschermingsprogramma [HWBP], n.d.). With Rijkswaterstaat's responsibility in managing and developing the national waters and protecting against water, their interests in projects that could help their work on dike reinforcement should be high (Rijkswaterstaat, n.d.).

The municipality of Amsterdam has interest through climate adaptation goals, and needs to adapt to heat, drought and flooding (Gemeente Amsterdam, n.d.). See the importance of collaborating with residents and partners such as companies, housing associations and knowledge institutions as well as small initiatives. Power through land ownership for a possible park. Have previously helped with funding Hobijn. Ability to move other stakeholders. Van 't Veer (2024b) said that the city ecologists of the municipality of Amsterdam would be interested maybe to take over this project of an educational upward growth park from us as master students and provide geodesign workshops.

Nature Management

Boskalis is specialized in maintenance of waterways and protection of coasts and banks. Interest in the project could come from the potential of the upward growth park to be a pilot and R&D location for their investigation into mycelium-enhanced sludge to use less clay as mentioned by Hobijn. Clay is used for forming new dikes and strengthening existing dikes. Boskalis power lies in their knowledge on dike maintenance and reinforcement done on behalf of The Hoogwaterbeschermingsprogramma HWBP, Water boards and Rijkswaterstaat (Boskalis, n.d.). This actor being well-known by these stakeholders makes our stake in collaborating with them higher.

Nature managers like Staatsbosbeheer, Natuurmonumenten, landschap Noord-Holland and recreatie Noord-Holland are of importance due to their land ownership that could provide sights for experimenting with a low peat bog forest or upward growth park (Daemen, 2024).
Staatsbosbeheer manages and protects the Dutch green heritage consisting of 270,000 hectares (Staatsbosbeheer, 2024). It is of great interest for them to be able to protect this land against droughts and climate change effects, giving them an interest in our research.
Landschap Noord-Holland works on different projects to protect and enhance nature and are responsible for 96 nature areas (Landschap Noord-Holland, n.d.). That could provide more sites for the upward growth park.

Funding

Previous stakeholders considering funding have been Creative Industries Fund NL (CIF) who have provided a grant for research into an upward growth park. This is the national cultural fund for design, architecture and digital culture and finances innovative design projects such as Hobijn's (The Creative Industries Fund NL, n.d.). With that it gives room for experimentation and to connect design with other disciplines and sectors. Waterboards and the municipality of Amsterdam have also made investments due to their climate goals.

Additionally, HWBP aims to find new innovative methods and techniques to improve dikes and make them a better fit for the environment. Their annual investing budget is 10 million euros to stimulate organisations to create new innovations and to apply them in practice. . Funds like these have great influence on the feasibility of the project making these stakeholders powerful.

Poldering

The Dutch expression 'poldermodel' is a way to create collaboration between stakeholders. This part of Dutch Democracy aims to build support, consensus and personal commitment by having extensive negotiations among each other (Vogelij, 2015). The poldermodel is rooted in the collaboration that was needed between the different actors involved in the creation of polders (IsGeschiedenis, n.d.). It has been adapted over the years and is best known as the Dutch consultation culture of the 1980's and 1990's.

We would like to bring back this Dutch consultancy culture by means of geodesign workshops. Since some stakeholders have already shown interest in collaborating in a geo-design workshop, others need to be approached by specific actors to get involved. We propose to build more traction and knowledge on the project by first making it into an art installation as discussed before.

5.4 Citizen engagement and educational outreach

In addition to including perspectives from organisations and the government as stakeholders, the process should also prioritise engaging with the community. The citizens will be the users of the finished park, ultimately making them an important part of the project's success. By engaging with the community within the stakeholder collaboration process, members of the community will have more positive feelings around their involvement in the planning process. Overall, the technology of the peat engine has not been widely studied yet. A lack of public understanding around this subject poses an issue to accessibility of potential park users. There should be active citizen engagement initiatives and educational outreach done to promote awareness of the project. Sharing the experimental process with affected citizens will positively affect feelings of trust and inclusion in the development process (Uittenbroek et al., 2019).

For the purpose of increasing awareness of the project, online educational resources should be developed. For example, a website consisting of background information, diagrams, experiment updates, or educational videos could be accessed via QR codes displayed near the

selected park location or the art installations. Utilising online educational materials provides a low cost and easily accessible form of sharing information with the public (Caputo et al., 2023).

The technology proposed by Hobijn can act as a small-scale mimicry of the natural history of the region, notably the formation of low peat forests. Creating a park with the intention of being an educational era can be utilised as a method of raising awareness on the topic (Van t' Veer, 2024a). Once the project is realised, it can be used as an educational visit for schools, providing an opportunity for students to learn about the project and soil subsidence. Additionally, the continued collaboration with universities should be beneficial. Even though these low peat bog forests can be quite inaccessible, there are still opportunities for recreational co-use here through smart design with stone paths (Van t' Veer, 2024b).

5.5 Stakeholder Engagement through a GeoDesign workshop

At this point in the process of Hobijn's plan to create an upward growth park, increasing collaboration between stakeholders is necessary in order to move forward. The project requires outside funding and planning that is expected to come from involved stakeholders. The idea he has proposed is for stakeholders to be able to take the idea and use it to their own interests, along with the eventual creation of the park. Currently, various stakeholders have been in contact with Hobijn, consulting on their perspectives on his project. Including a variety of stakeholders within the process would benefit from communication among each other along with Hobijn. By creating opportunities for inter stakeholder collaboration, trust will be built among differing perspectives and co-creation prospects can be optimised (Soma et al., 2018). This process of collaboration and dialogue should ideally be consistent over the entire process of implementing the project.

The idea of staging a geodesign workshop could be used to prompt further stakeholder collaboration. Geodesign is a specified framework of stakeholder engagement used to structure participatory planning. Outlined by Carl Steinitz (2012), the framework for geodesign addresses the process of planning through adopting a model based framework, prioritising design outcomes and a schedule for procedural techniques (Miller, 2012). The integral idea of geodesign is the collaboration between diverse stakeholders across multiple disciplines (Li & Milburn, 2016). For this project, Hobijn ideally requires stakeholder input from varying disciplines such as governance and natural sciences. The collaborative structure of geodesign prioritises communication, sharing knowledge, co-creation, and group based decision making (Miller, 2012).

Stakeholders participate in all stages of the geodesign framework, which consists of six models: Representation, Process, Evaluation, Change, Impact, and Decision models (Miller, 2012). The first three are assessments, while the rest address interventions. The outcome of this framework is the production of scenario planning and impact analysis. First, the current context is analysed, which informs the future decisions made on what needs to be addressed. Then, the Change model is focused on visualising future scenarios based on the consultation of all stakeholders' perspectives. Finally, the last stages of Impact and Decision models aim to determine the viability of the plan and outline the concrete steps for operationalising the project

(Miller, 2012). By including all stakeholders in the process, it ultimately results in the reduction of technological barriers to entry and knowledge gaps that would hinder productive co creation.

In practice, the geodesign process starts with the initial two day workshop. This usually consists of 30-40 representatives encompassing a variety of stakeholders and disciplines (Pettit et al., 2016). A larger participatory group allows for productive perspective sharing during the process. The participants would create a scenario of the ideal project outcome, using gis software or other methods, within representative groups. These design proposals are shared with the other stakeholders, and are discussed and evaluated. This stage of the process designates the priorities of each stakeholder and promotes further collaboration through finding commonalities among the proposals. Following negotiation, a second draft of the designs are produced. After analysing these, the groups can collaborate on a consensus design (Figure 8). Including multiple rounds of draft proposals provides time for revising the designs to represent the interests of all participants. The two day workshop is meant to end with one final design proposal that has been agreed upon by the stakeholders. Scenario visualisation and highlighting perspective convergence during the design process encourages more productive consensus as a result (Slotterback et al., 2016).

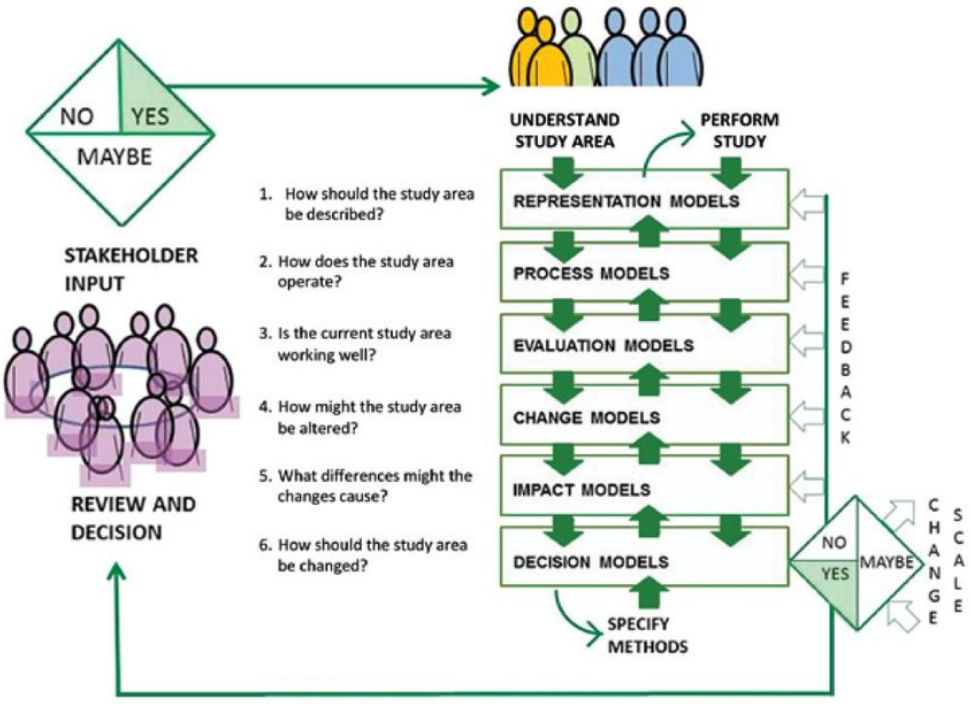


Figure 8: Geodesign Workshop structure (Steinitz, 2012)

Within any process of stakeholder engagement and planning, there is a risk of falling into unproductive and unequal power dynamics. If stakeholders are not included in the process equally, impact on the final outcome can be dominated by those with existing higher levels of influence (Purcell, 2009). Practically, this dynamic manifests in planning where powerful stakeholders such as the government enact greater influence than other less powerful groups, even though they may have the same amount of vested interest in the outcome. Given the concerns raised on combating unhelpful power dynamics, it is necessary to be cognizant of

how equitable participation can be prioritised among stakeholders. The geodesign workshop allows for the reduction of power dynamics if the framework and structure are followed as designed. Steinitz' (2012) conceptualisation of the geodesign framework (Figure 8), requires collaboration at every stage. There is an emphasis on integral design, or the necessity of interdisciplinary collaboration and differing value systems. This works synergistically with science and value based design, informed by scientific information and societal values respectively. The reinforcement of equitable collaboration at each step of the process is meant to neutralise remnants of bureaucratic power structures. By following this structure, the ontological diversity of stakeholders should be reflected within the consensus design, as the geodesign framework cannot be completed without agreement given by all stakeholders. Additionally, the geodesign workshop is organised and overseen by an independent facilitator who is not part of any stakeholder representative group. This acts as another barrier towards unproductive stakeholder dynamics. Usually this facilitator is an academic or planner with sufficient knowledge in planning and technological design processes to guide the workshop. This role will diverge from the traditional function of "planner" and step back into a facilitator role in order to encourage stakeholder self sufficiency over top down planning (Davis et al., 2021).

The ideal outcome of integrating the geodesign process into the project would result in the conceptual park idea being converged into a clear future goal with an outlined plan of implementation. At the current stage, the project of creating the upward growth park lacks clarity of vision and a plan of action. The idea of holding a workshop for stakeholders would ideally result in consensus building and knowledge sharing between participants, informing the future progress of the project. Utilising geodesign as a basis for the planning process is proposed as a way to combat the project's current status of vagueness. Additionally, it will be beneficial to prioritise communication, especially during the early stages, given the experimental status of the technology.

The first step would be to stage the initial geodesign workshop with the identified interested stakeholders, and establish a schedule of following meetings. Stakeholders that have been identified for this process represent differing perspectives, from interest in the development of the root concrete technology to carbon storage potential. As previously discussed, notable stakeholders include the municipality of Amsterdam, B-Ware, water boards, Deltares, and Waternet, along with various others.

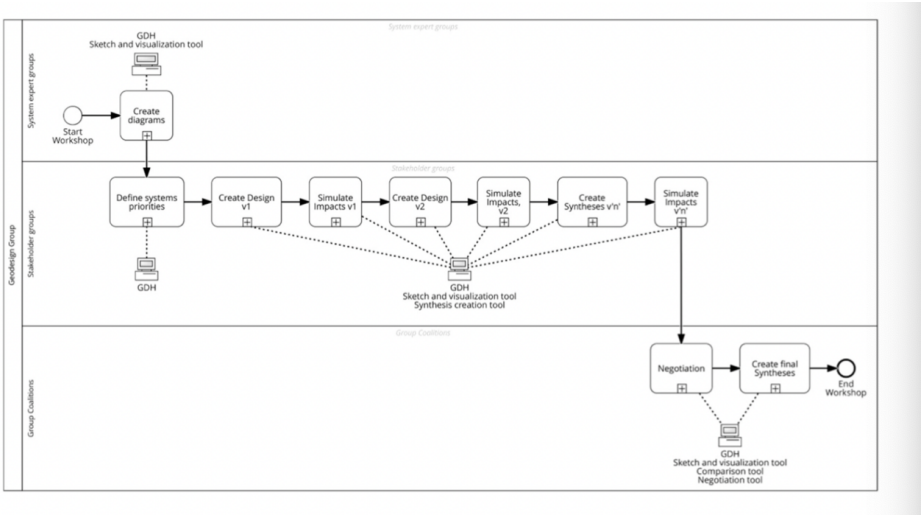


Figure 9: Group based design workflow (Cocco et al., 2019)

According to the geodesign structure, the workshop would follow the outlined workflow (Figure 9; Cocco et al., 2019). Beginning with defining priorities and creating groupings, the stakeholders would then move on to the design proposal and impact simulation steps. The process will then repeat according to the outlined framework. Groups can be formed in different ways, either by representatives correlating to their original stakeholder or by the representative's own subject expertise (Cocco et al., 2019). In this case, stakeholders have been identified and grouped by interest and organisation type. This report identifies them in the "Stakeholders" section (6.3) as: Research & Knowledge, Governmental bodies, Nature Management and Funding. Grouping stakeholder representatives by area of expertise can allow for productive knowledge sharing, especially in the second and subsequent rounds of scenario visualisation and design proposals. This maximises the expert knowledge to be shared among the workshop participants as a whole. Providing the highest possible amount of relevant information will ideally lead to the most complete and coherent consensus design.

With regard to the limited time frame of this report, it was not possible to coordinate plans with each identified stakeholder. However, operating under the assumption that such organisation should be possible in the future, the potential outcome of the stakeholder geodesign process can be imagined. Ideally, the project would receive support from the municipality, providing the resources for planning meeting logistics and location. Given these circumstances, the hypothetical predicted outcome of the geodesign process would include representatives from each of these stakeholders participating in the two day workshop in order to reach consensus on a future vision and recurrent communication plan for realising the development of Hobijn's technology and upward growth park.

6. Conclusion

The proposal to organize a geodesign workshop serves as a strategic step towards building effective stakeholder management necessary to realize the first upward growth park with a low peat bog forest. The realization of this park will need the collaboration of stakeholders from different categories to provide the necessary knowledge, research, location, and funds. Building stakeholder contacts takes time and some only move when approached by others. Therefore, to strengthen the project's visibility and generate a strong support base, we would like to see the idea and its importance explained through an art installation. This creative approach can foster increased support and understanding leading to acceptance and endorsement of citizens and stakeholders. Moreover, our recommended location for the park is in a peri-urban area of Amsterdam. The park should be seen as an R&D location for experimenting and improving on growing peat while being an educational site that engages citizens with the importance of peat restoration.

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