Reinventing multifunctionality

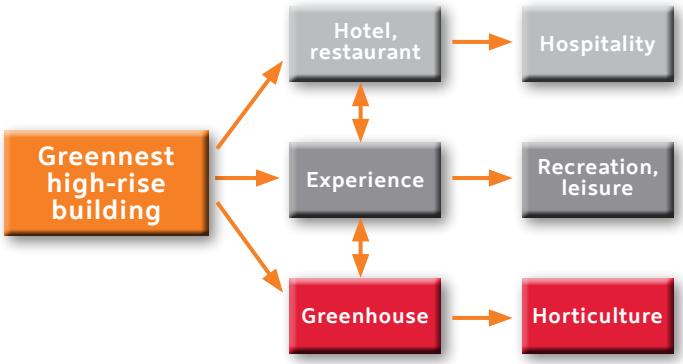
Combining goals, sharing means, linking interests

Future Value Now, Revised Edition

Artist impression: 3dok.nl Building design: MorePlatz architecten.

GREENNEST EXPERIENCE & HOTEL

A multiple layered park, which shows flowers and plants in a natural setting, is combined with a hotel and a rooftop restaurant. The Greennest is a visitors experience and hotel and greenhouse in one. It is planned as an iconic building, 60 meters high, with subtropical and Mediterranean climate zones inside. Greennest links the greenhouse sector and the hospitality sector. The hotel will contain 215 rooms divided over an area of 8,300 m². The experience offers sensational views on top of a rainforest and dramatic landscapes. The entire experience will extend across about 10,000 m². In cooperation with the municipality of Amsterdam, the Greennest Experience & hotel concept has been elaborated for an attractive high-visibility location on the A9 motorway in the Amsterdam South-East area. The location is easy to reach by car and public transport.



The hotel and horticulture experience programs are intertwined and form an integral whole with the high-rise building. The various biotopes are each given their own place in a stacked structure comprising six layers with a very ample storey height. The storeys are organized around a large atrium that widens out in the form of a funnel rising from the lobby through the higher storeys up to the roof. Hotel guests have their own entrance and are kept separate from the experience visitor flows. The lodges are suspended from the floor of the next storey. Each lodge has a view of the biotopes and features a small balcony placed between the crowns of the high plants of the storey below. The plinth course on the ground floor offers space for additional functions for both the hotel and the horticultural experience, such as conference facilities, food & beverage, retail and wellness.

The horticulture experience attracts many visitors, who come to marvel at the extraordinary design and savour the unique experience. The 4D elevator ride to the top floor immerses the experience visitor in a virtual journey through a plant from the roots to the flower. Awaiting him at the top – at 60 metres height – is a spectacular panoramic view across Amsterdam. Continuing his journey, the visitor proceeds from top to bottom through various theme-based floors highlighting diverse continents and biotopes of our planet. On the way he can sample a cup of tea in a Chinese tea garden, have a drink mixed in the Scandinavian 'berry bar', compile his own colour with different plant extracts, test the construction quality of bamboo, etc. Arriving at the bottom, he can enjoy a meal or snack in the green-bathed restaurant.

Involved parties
Innovation Agro & Natuur, Ministry of Economic Affairs, www.innovatieagroennatuur.nl, SIGN www.innovatieglastuinbouw.nl/engels, STIRR, Concrete Architects, www.concreteamsterdam.nl

Artist impression: 3dok.nl Building design: MorePlatz architecten.

Reinventing multifunctionality

Combining goals, sharing means, linking interests

Foreword

An embankment that serves as flood defence, road and tidal energy plant at the same time. These three goals are combined, and together share the means of the embankment. They link the interests of water safety, transport and renewable energy. This book gives dozens of comparable examples of multifunctionality from the Netherlands. This book also tries to explain the reinvention of multifunctionality that is going on in these examples. They're more than just a couple of functions on the same spot, they reinforce one another. What explains the growth of the number of authorities, companies and NGO's that work together on multifunctional projects like for instance a nature reserve that stores water, purifies water, and also serves for recreation?

Looking for an answer the Netherlands Enterprise Agency wants to reach out to partners all over the world. What do you think, do we have an angle here to better work on problems like climate change and urbanization? It is estimated that in 2050 more than 70 percent of the world population will live in cities. Many of these are located in a delta - New York, Shanghai, Tokyo, Nairobi, Singapore and Jakarta - and have to cope with the challenges that put their urban deltas to the test in terms of welfare and well-being. There is an increasing demand to solutions that secure the urban deltas' food supply, food security, sustainable energy use and safe water and delta management. A way to manage these challenges is multifunctionality: combining goals, sharing means and linking interests.

The Netherlands perform as a 'Sustainable Urban Delta'. The cooperation between the government, private sector, and knowledge institutes to commonly tackle challenges has been pivotal in safeguarding the sustainable development of the Dutch delta. Nowadays, this type of cooperation still provides the stable base for the multifunctional solutions that keep the Dutch sustainable urban delta a wealthy and lively place to live. At a time when space and money have never been so scarce, individuals, authorities and businesses are faced with new challenges. Professionals and users who are involved in area development, production chains and social services are looking for new earning models and cooperation. This publication demonstrates how we can begin with what is already there: people's qualities, areas, products and services. Through multifunctionality we can reinforce the developmental power that already exists.

More and more people are opening the treasure chest and discovering that a new combination of functions is achievable socially. We are convinced, however, that there are still many more possibilities. To put it even more strongly, the failure to combine means missed opportunities. It is important to escape from compartmentalised structures, because we cannot feel the loss of an opportunity from within our own compartment. We as the Netherlands Enterprise Agency encourage entrepreneurs in sustainable, agrarian, innovative and international business. And we can also learn from practices abroad. In this publication, we show that many ways have already been found, and we want to inspire and challenge people to seek new ways, by actually starting to practise multifunctionality.

Director of The Netherlands Enterprise Agency International programs
drs. Bas Pulles

Director of The Netherlands Enterprise Agency National programs
drs. Barto Piersma

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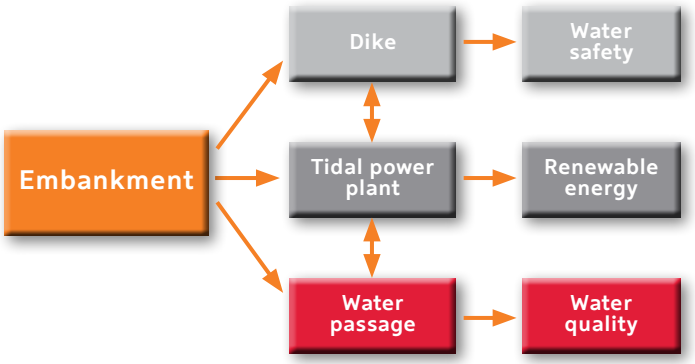
TIDAL POWER PLANT IN DUTCH EASTERN SCHELDT STORM SURGE BARRIER

Tidal Power Plant in Dutch Eastern Scheldt storm surge barrier
The nine-kilometre-long Oosterscheldekering (kering meaning barrier) was initially designed, and partly built, as a closed dam. After public protests in the 1970's, huge sluice-gate-type doors were installed in the remaining four kilometres. These doors are normally open, but can be closed under adverse weather conditions. In this way, the saltwater marine life behind the dam is preserved and fishing can continue, while the land behind the dam is safe from the water. In 2015 these open doors gave an interesting chance to install five tidal turbines to generate clean energy. The embankment of this storm surge barrier will now be a combination of water defences and hydroelectric power.



With five turbines in a 50 meter long and 20 meter wide structure this tidal power plant is the largest tidal energy project in the Netherlands as well as the world's largest commercial tidal installation. The tidal power plant was successfully installed in September 2015. First it was placed on a floating pontoon combined with lifters, and then installed between the pillars under the storm surge barrier. Taking into account the water levels, the tides and the weather, and with an installation window of just two hours, this was a highly precise operation.

The project to install five turbines in the Eastern Scheldt storm surge barrier marks an important step in the development of tidal energy. Tidal technology is innovative and could grow into providing a clean and reliable source of energy that could fulfil 10-20% of the world's electricity needs. Earlier in 2015, Tocardo installed three linked turbines in the Afsluitdijk, a 30 km long primary sea defence in the Netherlands, with a total capacity of 300 kW. Another Tocardo turbine in the Afsluitdijk has been providing electricity for over seven years now. Tocardo also deployed its first offshore floating project of turbines at the Island of Texel in The Netherlands.

Five turbines in the Eastern Scheldt storm surge barrier can show the world the advantages of tidal energy. Besides the fact that it is extremely predictable how much energy is generated – the tide is there every day – the turbines are installed in the water and will not be in sight like wind turbines. For the future focus is on upscaling the installations. However, this requires a large investment, a realistic rate for tidal energy and a touch of idealism. A home market as the Eastern Scheldt project is essential in this matter.

As manager of the Eastern Scheldt storm surge barrier, the Netherlands' Department of Waterways and Public Works Rijkswaterstaat develops innovative solutions. Whenever possible Rijkswaterstaat facilitates initiatives to test or build renewable energy installations like this tidal power plant in the Eastern Scheldt storm surge barrier. Rijkswaterstaat develops another one with a different technology in the Brouwerdam storm surge barrier just North of the Eastern Scheldt (see page 7). Both are in Zeeland, the most south-western province of the Netherlands, that is surrounded by water and is the only province with land in the sea. Since tidal energy is such a good match, the province of Zeeland has provided a significant financial contribution to the project in the Eastern Scheldt storm surge barrier.

Involved parties
Tocardo Tidal Turbines, designer and producer of tidal and free-flow water turbines. Huisman, designer, builder of the turbine's suspension structure. Strukton has been actively involved in the project planning and is fully responsible for project management during installation. Mammoet's involvement in the project comprises the transportation and installation of the tidal power plant. The Zeeland companies Istimewa, Van der Straaten and Hillebrand also play an important role in terms of the electro-technical installation and steel structures. Also involved were Rijkswaterstaat and the Province of Zeeland.

More information
www.tocardo.com
www.huismanequipment.com/en
www.strukton.com
www.mammoet.com
www.hillebrand.nu/en/home.htm
www.rijkswaterstaat.nl/english/index.aspx

Chapter 1

Reinventing multifunctionality

1.1 Introduction

Safety was always what legitimated the use of hard structures such as dikes and other hydraulic structures which had to be suitable for exercising strict control over the water system. The consequence of this is a transformation in the Netherlands of the river delta and the coastal area, and a disturbance of nature, up to now often without any effort to limit this disturbance. That has been changing gradually in recent years, under the influence of sustainable development and climate change. In hydraulic engineering, a paradigm change is taking place: more and more projects are embracing the dynamism of nature and water and relinquishing the strict control of the system. Multifunctionality fits into this seamlessly and can start to play an increasingly important role. The example of the Brouwersdam storm surge barrier gives prove of this:

In 1971 the Brouwersdam was completed, as part of the Delta Works that protect the south-western parts of the Netherlands from the North Sea. The Grevelingen turned from an open coastal inlet to a stagnant lake. From that moment the water quality and soil conditions started to decrease. Creating a water passage (culvert) through the embankment of the Brouwersdam will allow the tide to restore an estuarine dynamic in the Grevelingen water system. This will improve the water quality and the ecosystem in the deeper parts of the Grevelingen. The aim is to combine the culvert with a tidal energy plant with a capacity of 20 to 50 MW, and a yield of 67-85 GWh yearly. This plant can profitably produce electricity in a range from 5000 up to 35.000 households. The carbon reduction will exceed 45.000 tons a year. Project delivery and start of exploitation are planned for 2021.

Photo thanks to Rijkswaterstaat

Turning the Brouwersdam from a hard monofunctional structure into a multifunctional combination of dike and power plant has three effects: it's still a flood defence, it's also a power plant, and nature will be restored. Just south of the Brouwersdam is the East Scheldt storm surge barrier, also part of the Delta Works. Completed in 1986 this barrier had a culvert from the outset. In 2015 the culvert was used to create a tidal power plant. This project has the same three effects that the Brouwersdam will have. To have these three together it's essential to align the goals of flood defence, energy production, and nature restoration. All three condition the other two, or else there will be no combination. That's the essence of multifunctionality, and that's what this book is about.

Multifunctionality is more than just having a set of functions in one place, like a shopping mall or a high rise. It's about the mutual reinforcement of goals; reinventing multifunctionality is finding out what that really is. With the help of dozens of examples this book is the attempt to do just that.

1.2 Reader's guide

On the left-hand pages of this publication you will find descriptions of a large number of practical examples. All show the combination of two or more, sometimes up to five goals. The right-hand pages deal with the theoretical background of multifunctionality, intermitted by examples also. The chosen examples can be divided into the following categories:

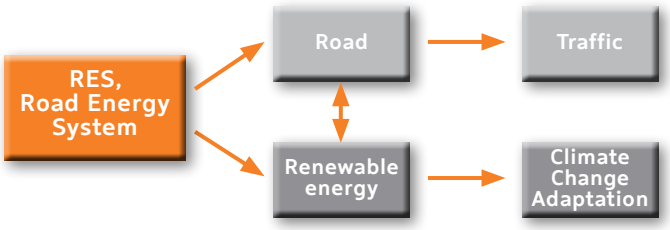
ENERGY-GENERATING ROAD, AVENHORN

HOUSING|CARE COMPLEX GETS HEAT AND COLD FROM ASPHALT
The municipality of Koggenland was keen to create a sustainable and energy-efficient housing|care complex. For its development, they sought collaboration with a housing corporation. This resulted in housing| care complex Vijverstate, which was completed in 2005. The complex has a care and welfare component for the residents and consists of 67 owner-occupied and rented apartments. The municipality set three important conditions: sustainable energy management, a healthy and comfortable indoor climate and competitive purchase and rental prices. In connection with the sustainable and energy-efficient aspect, the Ooms Avenhorn Group was brought in. In the project, a so-called Road Energy System (RES) was laid in the road surface on the south-east side of the apartment complex, by means of which all areas can be heated and cooled sustainably. The most important sustainable advantage is the use of solar energy and heat & cold storage with ATES (see page 60). There is no gas connection and electricity is only used for equipment. The cooling in the summer, in particular, makes a considerable contribution towards reducing CO2.

Energy performance measurements in the apartments show a reduction of 54% for heating and producing hot water, compared to conventional installations, whilst with cooling the reduction in carbon emissions is no less than 81%. The solar collector is 825 m2 in size and it is located in the asphalt. The system works in combination with ATES, which consists of two open wells with underground aquifers at a depth of 140 metres. The main contribution made by the RES is the regeneration of heat in the ground, which provides an optimum energy balance. This, in turn, helps to generate an optimum yield from the heat pumps. Distribution to the apartments is via pipes and heat exchangers. In the winter, an individual heat pump per apartment provides the power for low-temperature floor and ceiling heating, combined with hot water production via a storage boiler. After use, the cooled water is stored in the underground cold well. This is used in the summer to cool the apartments with top cooling according to personal needs. As a result, overheating of the living and recreational areas is prevented in an efficient and sustainable way, without energy guzzling air-conditioning systems.

Possibilities for large-scale use
The project in the municipality of Koggenland demonstrates that 8 m² of road surface generates enough heat to meet the heating needs of a household for a whole year. Translated into, for example, the A2 Highway near Utrecht (2 x 5 lanes), 100 metres of motorway would generate enough heat for more than 400 households. For office premises, the cooling is particularly interesting, with a high reduction in CO_2. A simple formula that proved applicable to the results in the municipality of Koggenland is the law of 10%:

• A little less than 10% of the road surface in relation to the residential surface area is needed;
• A little less than 10% of investment is needed in relation to the sustainable system as a whole;



• The total costs of the sustainable system are a little more than 10% of the total building costs;
• The fixed costs for residents fall by about 10%.

Naturally, this law of 10% cannot simply be transferred to motorways and other buildings. A feasibility study will have to show what the potential savings are for all parties involved.

It takes two weeks longer to install an energy system in the road surface. This can be done during the construction of the road, but also during widening or major maintenance work. Promising locations can be found where large-scale clusters of housing or utility buildings are located directly on a motorway or other road. An example is 'The Wall', a large shopping and office complex on the A2 in Utrecht. Not only does this cover a surface area of 50,000 m², but the length of this building (800 metres) is also interesting. This length also serves as a sound barrier (hence 'The Wall') for the residential area behind it. An important extra element of an energy-generating road is that safety on the road can be improved by using the heat stored to keep the road ice free. At the same time, the management costs are reduced dramatically.

Involved parties
Ooms Avenhorn Group

More information
http://www.restreets.org/case-studies/solar-roadway

- Water
- Air Quality
- Waste & Resource efficiency
- Big data
- Transport & Logistics
- Clean & Secure Energy
- Safe Public Environment
- Energy Efficient Buildings
- Health
- Resource Efficient Industry
- Efficient Use of Land & Subsoil
- Food Security

The table on page 4 makes it possible to search quickly for an example in a certain sector or a certain combination. The other examples, which are described in boxes between the text, can also be found in this table.

The thread running through the theoretical section is as follows. Chapter 2 looks at things in more depth and defines what multifunctionality is in the sense of combining goals, sharing means, and also linking interests. Chapter 3 provides the background to the phenomenon 'multifunctionality' on the basis of the relationship between economy, multifunctionality and sustainability. Chapter 4 deals with a special subject, how to make transport and mobility part of multifunctionality. Chapter 5 is the attempt to bring everything together in an idea of area development, and how all kinds of goals can combine within one area. Practical pointers are covered in Chapter 6, where we look at the question of how to achieve multifunctionality, and also what obstacles can be in the way of making sound combinations. We conclude with Chapter 7, which contains agenda points for further discussion and again briefly summarises how you can set about multifunctionality yourself.

Ocean Thermal Energy Conversion (OTEC)

OTEC is a marine renewable energy technology that harnesses the solar energy absorbed by the oceans. OTEC generates electricity by exchanging heat with the warm water from the ocean surface and with the cold water from the deep ocean. The technology is viable primarily in equatorial areas where the year-round temperature differential is at least 20 degrees Celsius.

One of the main advantages when comparing OTEC to other renewables, such as wind and solar energy, is the fact that OTEC is a baseload source, available day and night. This is a big advantage for tropical islands that typically have a small, isolated, electric grid, not capable of handling a large share of intermittent power. At the same time it can provide cooling, and potable drinking water when combined with desalination.

Ocean Thermal Energy presents the opportunity for energy independence in an environmentally friendly manner. Today it can easily reach grid parity in many regions of the world. This energy provides a source of power free of CO_2 and other greenhouse gas emissions. Additional industries such as agriculture aquaculture can also benefit from the deep seawater. Cold deep seawater can be applied to cool crops and enables agricultural activities even in the most hostile, arid coastal regions. The cold seawater from the deep ocean is rich in nutrients, such as phosphates and nitrates and is virtually free of pathogen. Therefore, it is ideal for use in aquaculture.

Dutch company Bluerise is currently developing an Ocean Ecopark in Curacao, where cold water from the deep ocean is first used to cool several buildings at Hato Airport and to produce electricity using an advanced OTEC power plant. After these initial applications, that same deep seawater is still cold enough to enable cost effective production of drinking water and (for example) the cooling of greenhouses. The electricity produced from OTEC will be used to power the distribution of the water from application to application and to return the water to a safe depth with minimal or no effect on the environment.

More information

www.bluerise.nl

SMART CHARGING POINTS IN THE UTRECHT REGION

The Utrecht district of Lombok has served for years as a testbed for experiments with solar energy and electric vehicles. In June 2015, this residential area experienced a world first with the revolutionary "Vehicle-to-Grid" system. At the heart of the Vehicle-to-Grid system is a 'smart' charging point that conveys locally generated solar energy to electric cars in the street. And not only that. When households in the street need electricity, the smart charging point can also feed energy back from the connected batteries. This means that, via the charging point, residents of Utrecht can power their washing machines in the evenings using solar energy generated during the day with the|their own solar panels.

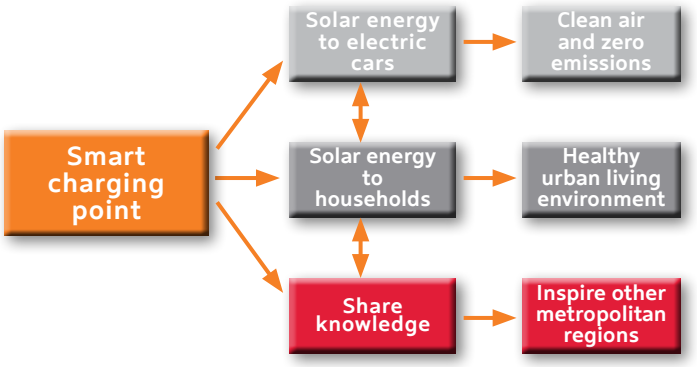
Starting as a small innovative solution, the Vehicle-to-Grid system opens the way to a new smart energy system, now being prepared in the whole Utrecht region. Aldermen from fifteen Utrecht municipalities have signed up to the ambition to combine 1000 smart charging points with 1000 electric shared cars and 10,000 m² of linked solar panels in the region. This will enable over 100,000 inhabitants, visitors, entrepreneurs, scientists, market developers, etc. to experience, to learn, to innovate, in 'real life' conditions, the benefits of a smart grid system. This opens up a totally new economy.

By implementing the Vehicle-to-Grid project on a regional scale, the region of Utrecht – together with the national government - is creating a large living lab for innovative smart grid solutions, thus providing a launching platform for international companies, for Europe and, of course, for local partners to create new business.

Why is the region of Utrecht doing this? Because the region supports a healthy urban living environment. A profile in which the public and private sector and the people of Utrecht have invested for decades and will continue investing. Here – in the Utrecht region – healthy urban living is seen as a global challenge for which Utrecht provides local solutions.

This showcase of the regional Vehicle-to-Grid system not only involves green power, but also clean air and zero emissions. Healthy Utrecht

Photo retrieved from http:||www.lombox.nl|nieuws|archives|03-2015|2



living. The smart electricity grid enables Utrecht to grow towards a Solar City, a City of E-mobility and a City of the Next Economy. It might also inspire other metropolitan regions to make way for the energy and mobility transition, learning from the shared knowledge Utrecht has to offer. Started and implemented in a residential area, of which there are millions all over the world.

Involved parties

Vehicle-to-Grid is an initiative of LomboXnet, the network operator Stedin, GE Benelux, Vidyn and Last Mile Solutions, supported by the province of Utrecht, Economic Board of Utrecht and the cities of Amersfoort and Utrecht. The alliance collaborates with (inter)national partners such as General Electric, Renault/Nissan, Netbeheer NL and the national government. Fifteen municipalities in the Utrecht region have signed up to the ambition to expand this initiative into a regional energy system.

More information

https://www.youtube.com/watch?v=Zo0BPZW32rQ

Chapter 2

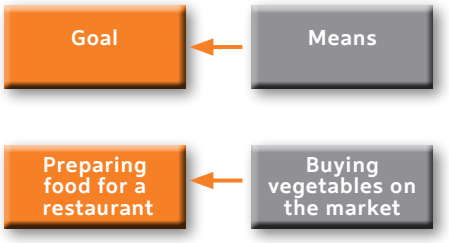
Combining goals, sharing means, linking interests

2.1 Goals, means, interests

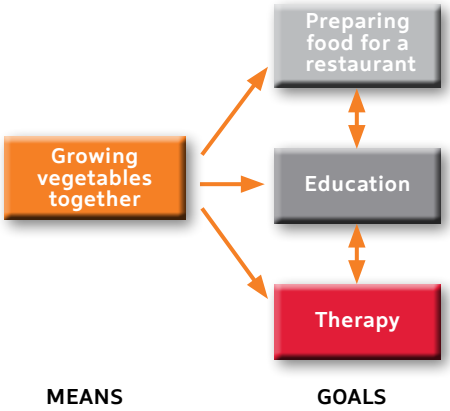
In the small village of Bakkum near the North Sea, clients of a psychiatric care facility are growing organic vegetables together with agriculture students. They have been commissioned to do this by a restaurant that boasts a Michelin star. Previously, clients grew vegetables on their own piece of land, as did the students, and the restaurant simply bought its vegetables at the market. Now they share a plot of land, where the agriculture students' lecturers can make sure the restaurant receives the high-quality produce it needs. By setting this quality requirement, the quality of the students' education improves, as does that of the clients' therapy. This represents the essence of multifunctionality. Economic profit results from reducing costs while, at the same time, increasing results. Reducing the costs is achieved by sharing means: in this case the piece of land, and the cheap workforce of clients and students. The results are increased due to mutual reinforcement between the various goals. Stand-alone goals lack this interplay and must be pursued in another way, with different quality and costs.

Normally, clients from a psychiatric care facility simply give the vegetables and flowers they have grown to visiting family and friends. The incentive provided by working for a restaurant is absent, so their therapy lacks an aspect shown to be effective in helping clients with certain conditions like autism and serious stress-related burnouts. Much the same applies to students. Education is the goal of their agricultural school and a range of means are used to achieve this goal, including cultivating the soil - getting their hands dirty, as it were. If this objective is not linked to other goals, the students have no reason to make more of cultivating the soil. Thus most students take the vegetables and flowers they have grown home with them. The incentive provided by working for a restaurant provides is absent, so their education lacks an aspect shown to be effective in helping many students learn.

From the restaurant's perspective, the situation is much the same as it is for the psychiatric care facility and agricultural school. If the goal of preparing good food is not linked to the goals of therapy and education, the restaurant will simply buy its produce at the market. Their vegetables won't have the same quality as the organic ones that have been grown with care by the students and clients. And they won't have the same remarkable background story, a story that the restaurant's customers are sure to appreciate. The motivation to deliver that kind of quality is particularly important to a restaurant with a Michelin star. When we set a goal for ourselves without considering other goals, we miss out on opportunities for utilising the means that others have to offer: means which may be useful in reaching one's own objectives. Setting individual goals is the way that most people and organisations tend to pursue their goals and implement their respective means. This can be represented with a simple diagram as follows:



This book aims to demonstrate through its many examples that increasing numbers of people and organisations are no longer simply identifying individual goals, but that they are putting their means to coordinated use to serve two or more objectives. This works as follows:



AEB, WASTE-TO-ENERGY

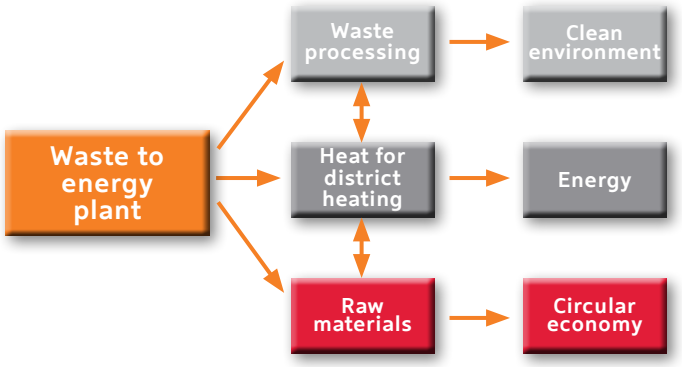
Since the beginning of the twentieth century AEB, Afvalenergiebedrijf Amsterdam, has become the world's largest Waste-to-Energy company at one single location. AEB Amsterdam converts 99% of the 1.4 million tons of municipal and industrial waste that is delivered annually into sustainable energy and raw materials.

For AEB, waste is source of energy with production of 1 million MWh of electricity annually, enough to service 320,000 households. Also, a lot of heat is generated: up to 600,000 gigajoules a year over the last few years. This heat is used for district heating: hot water and central heating for Amsterdam households. The technology of AEB's High-Yield Waste Processing Plant in Amsterdam has the highest waste-to-energy rate of any existing processing plant in the world, at 30%. This high yield is also achieved with the lowest emissions of harmful substances, using a flue gas treatment system specially developed at AEB.

For AEB, incinerated waste is also a source of raw materials. First valuable metals such as iron, copper and aluminum are extracted. The remaining matter is used as fill material in the construction of roads. And products are also extracted from the flue gas. These are used in the asphalt industry. Additionally, gypsum is extracted and can be put to use in construction.

AEB aims to strengthen the circular economy by optimizing its processes and making them more environmentally sustainable. AEB is also implementing more efficient recycling methods so that no raw materials are lost in the production and consumption chain. During the coming years, AEB will be working on the following projects:

- Processing of the mineral fraction of bottom ash to produce a good quality and freely applicable replacement for sand and gravel.



- Separating plastics from the residual fraction so that they can be recycled. The organic fraction is used to produce valuable biogas in a fermenter. The biogas can be processed to produce green gas that is equivalent to natural gas but more sustainable.
- Capturing CO_2 from emissions from the waste-to-energy plant and supplying pure CO_2; researching ways to capture pure CO_2 from the flue gases of the waste-to-energy plant.

Internationally, AEB offers services from consult to operations and co-design in order to spread its world-leading technology and knowledge around the globe.

Involved parties
AEB, City of Amsterdam

More information
www.aebamsterdam.com

What is crucial here is proper coordination of the goals. For example: the school has holiday breaks that the restaurant cannot possibly work around, but nor can the school expect the restaurant to close during the holidays. The care clients can compensate for the students' absence; this requires coordination with the care facility. An inevitability of the entire model is that students and care clients come and go. The lecturers at the agricultural school, the owners of the restaurant and the counsellors at the care facility are responsible for ensuring continuity. This also illustrates how the coordination of such divergent goals as food preparation, providing education and administering therapy requires special attention and effort. A completely different case provides an equally apt illustration: the incineration of waste by AEB in Amsterdam.

The waste incinerator at that facility also serves to generate a supply of heat. This requires a different form of incineration than usual, one that is suited not only to the goal of waste processing but also to that of supplying heat. This demonstrates once again the distinction that is the focus of this book; it shows an alternative to the usual way of doing things in which means are put to use to achieve only a single goal. Coordination like the one in the AEB example is not the norm everywhere, but it is the norm among the examples in this book.

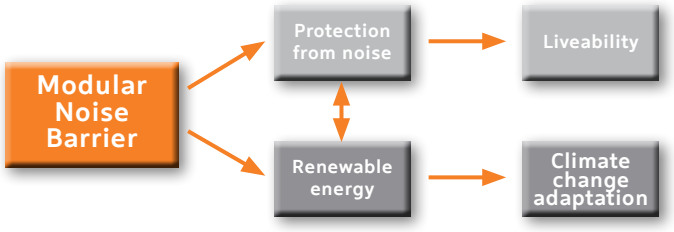
Why do we implement a means to reach a goal, and why should we put a means to use in serving two or more combined goals? Is the latter preferable? Every goal has a latent interest behind it, as illustrated by the following example:

Generating solar power with noise barriers along motorways

The Modular Noise Barrier (MNB) was developed by Rijkswaterstaat, the Directorate-General for Public Works and Water Management, to prevent the roadscape from becoming fragmented and messy in appearance due to the use of very different noise barriers. In 2014, the question at hand was whether or not it is viable to have PV solar panels on, or in, a noise barrier. Based on the application of solar power in the MNB, the proposed solution was to fully integrate solar panels into the design of the noise barrier. With integration, the cassettes from which the noise barrier is constructed are replaced with cassettes fitted with solar panels. The solar panels are mounted on a frame that is filled with a sound-absorbing material such as rock wool or fibreglass.

The total scope of the programme for erecting noise barriers could encompass up to 500 km of noise barriers. To get an idea of the potential solar power that could be generated, let us assume an example of a stretch of barrier, 50 km in length. If we imagine that 25% of this barrier is positioned favourably facing east or west, solar panels will be applied over a distance of 12.5 km. If one layer (cassettes of 1 metre high) of the noise barrier is to be fitted with solar panels, this could generate 1,700,000 kWh of electricity per year and reduce annual carbon emissions by almost 1,000 tonnes. With 500 km of barrier in place, this reduction would be 10,000 tonnes.

In this example, the barrier is a means to achieve the goal of noise reduction as well as the goal of generating renewable energy. Each goal is the result of a latent interest: noise reduction serves the interest of liveability and renewable energy furthers the interest of climate adaptation. By combining both goals, and implementing a single measure to achieve them, these interests are linked in an interlocking fashion. This works as follows:



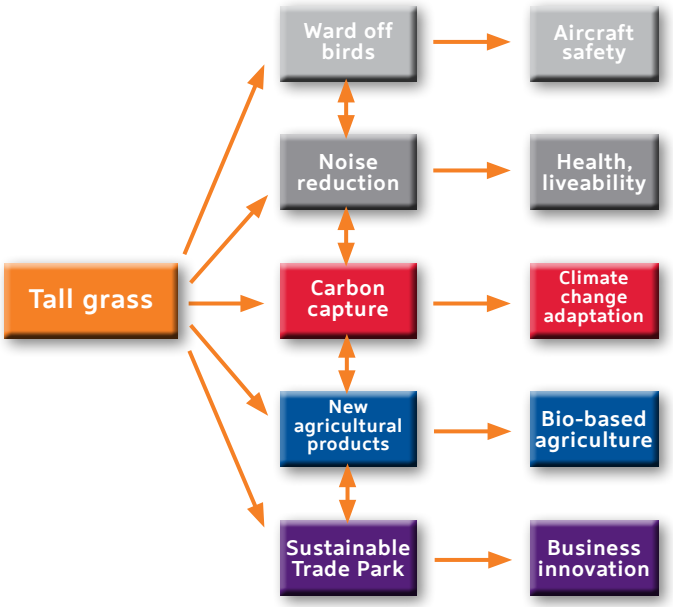
TALL GRASS AT SCHIPHOL AIRPORT

The grassy polder around Amsterdam Schiphol Airport attracts geese and that is dangerous for aircrafts. This has been an issue for years and it divides the airport, farmers and also the government. It forces up costs, but now a creative solution could not only heal the divisions, but also convert the costs into benefits. Tall grass (Miscanthus Sinensis Giganteus) is a tall plant that forms a relatively cheap and effective alternative to a noise barrier and - the main surprise - the geese appear to avoid patches where it grows: they do not like the grass to eat and they feel unsafe between the high tufts.

Giant Miscanthus, also elephant grass, helps to ward off bird flocks, increasing aircraft safety. It effectively reduces noise and captures carbon dioxide, softening the effects of climate change. From a farmer's perspective, cultivating Giant Miscanthus also has several advantages. Growing elephant grass can be a rewarding alternative to cultivating grain. The plant has a high tolerance to brackish groundwater, it needs little fertilizer and pesticides, and provides a renewable source of feedstock (for instance lignocellulose) for bio-based technologies and a range of high-end products such as building materials, automotive and aircraft performance materials, public space furniture, bioplastics for catering cutlery and shopping bags, as well as chemicals, biofuels and kerosene.

Farmer Petrie began growing elephant grass experimentally in the immediate vicinity of Schiphol. In December 2011, the Dutch Government gave the green light for a 'Green Deal' to support a local sustainable project whereby a group of farmers would start trial cultivation of Giant Miscanthus on the Schiphol Trade Park site. For both the farmers and SADC, the developer of the trade park, the plantation is a statement of innovation and sustainability, inviting future business developments. Using the business park grounds allows the farmers to grow and test Miscanthus on an economic scale along with a wide range of other crops such as flax, fibre hemp, sorghum, quinoa, rapeseed and mustard. The 60 hectares of Miscanthus planted were harvested for the second year in the spring of 2015. There are already 100 hectares of elephant grass growing in the Haarlemmermeer region.

A Rotterdam-based compounding company is currently testing Miscanthus feedstock in biopolymer production lines. The success of this project lies in the collaboration between different partners from the agriculture and chemicals sectors. Government support has been crucial in getting partners to meet and keeping the process moving forward.



The project offers new opportunities for setting up profitable bio-based business cases. New funding could further bridge the gap towards industry.

Elephant grass adds value to the area for all parties. Suddenly, farmers no longer pose a problem for Schiphol either, but a possible solution for the difficult and costly goose problem. Thanks to all these positive developments, Schiphol itself has also attracted more interest. What began with a small plot belonging to farmer Petrie, is now leading to an innovation with unprecedented potential. The discussion is no longer about dealing with the goose problem for the lowest possible cost, but about creating new values.

Photo retrieved from www.wageningenur.nl|nl|Dossiers|dossier|Olifantsgras-Miscanthus.htm

Involved parties

Dutch Government, Dept. of Economic Affairs
Dutch Service for Land and Water Management (DLG)
Wageningen University and Research Centre (WUR)
Schiphol Area Development Company (SADC)
Group of farmers

More information

http://sustainableurbandelta.com/olifantengras-bij-schiphol/
http://www.thegrounds.nl/en/projects/elephant-grass
http://www.wageningenur.nl/

Housing, food, clothing, education, health, culture, mobility, energy, water and numerous other interests are values towards which people work individually, but also collectively in the public and private sector, as well as within communities. As a general characteristic, these interests are considered to be of social—and often also economic—value. Therefore, care is of value, as are nature, clean air and food. People improve their living conditions by looking after these interests, both in the material and the emotional sense. This means that one's work is never done: think of water safety or accessibility, both of which still require effort after a hundred years. There is never enough education and never enough food; there is an ever-present need for these things. In other words, an interest is never fully satisfied, because interests such as care or housing demand our continuous attention. In order to attend to an interest, one first sets a goal. It may be possible to have satisfied the interest once the goal has been achieved. In the case of water safety, which must meet the standard of providing protection against flooding, the goal is to satisfy the standard. For example, the standard might be that flooding occurs no more than once every five hundred years. The community then takes the action necessary to achieve this goal, such as constructing a dyke.

When a means serves two or more goals, the interests behind the goals are linked as well: they are all interlocking links. What is crucial here is that the goals are formulated taking their interlocking nature into account, and that is a new concept. AEB's decision to link waste incineration to heat supply in their Amsterdam facility meant using an entirely different method of incinerating refuse. For one thing, heat conduits are damaged when they are allowed to heat up and cool down too quickly, placing some restrictions on their use. It is no different than the case of the modular noise barriers, in which a solar panel must be constructed so that it actually fit on or into the barrier, while blocking noise as well as a regular barrier. Something new in society is happening here compared to the past and also to many instances in the present: goals are being coordinated to allow a single means to contribute to achieving multiple goals, whilst effectively serving all involved interests. In this book, we refer to this as reinventing multifunctionality. Where does this concept come from and why are people doing this more often today than they have in the past?

2.2 Finiteness of resilience and natural resources

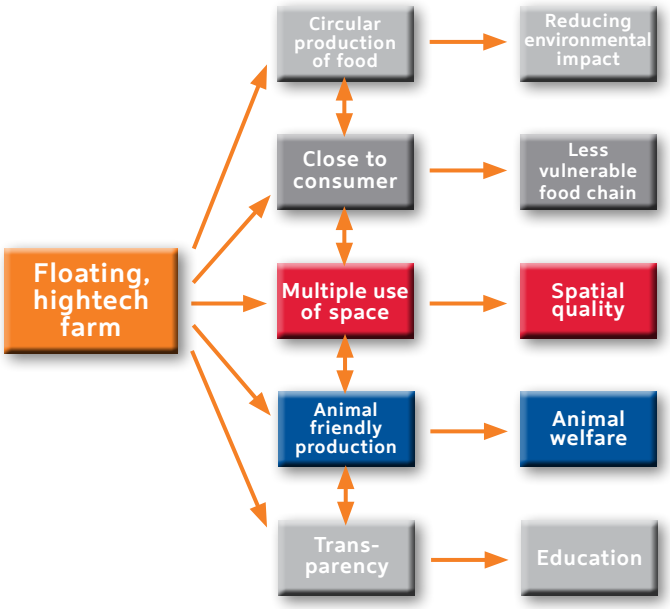
Many interventions in the physical environment have been made—and continue to be made—as if this environment had infinite resilience. One example is the emission of substances which are not cleaned up, or in any case not adequately disposed of, by natural processes. Another example would be wildlife areas that have become too fragmented to be self-sustaining. A nigh-infinite number of permits have been issued to date, granting individuals permission to use space to their own advantage, without concern for the fact that the quality of the environment as a whole might suffer as a result. Where disadvantages to development have been recognised and the use has therefore been prohibited, an exemption can often be granted – potentially on condition of compensation. The environment suffers as a result of this, yet there is an assumption that the global environment is so resilient that an extra localised setback should pose no problem. Meanwhile, it has become clear that this ability to bounce back has its limitations; the air quality is currently under threat and harmful substances seem to be finding their way even to remote corners of our planet. The same pressures apply to resources: space has been scarce in our country for years and we are running out of fossil fuels.

There is a growing awareness that both the resilience of the physical environment and its natural resources are finite. Yet despite this knowledge, most human action is still organised as if resilience and natural resources were infinite. Even when faced with shortages, we do not perceive these as absolute or non-negotiable. Our assumption is that the shortages are temporary, either because we feel we live on an infinite planet or because we are confident that technology will come up with a solution. This way of thinking is hard-wired into the profile of virtually every company and often applies to government bodies as well. The consequence of this assumption of inexhaustibility is that people and businesses act as if there can always be more, and faster. Now that the finiteness of resources is beginning to become tangible, there is an increase in phenomena such as sharing, intensive utilisation and circular economy. None of these ideas are new, but each of them had been previously overshadowed by the idea of inexhaustibility.

FLOATING FARM IN THE PORT OF ROTTERDAM

WHAT IS A FLOATING FARM?

In order to make the food chain less vulnerable and to reduce the burden on the environment, floating, high-tech farms are a solution. Here, with multiple use of space, fresh-daily food (dairy) is produced in an animal-friendly and sustainable manner. The production is circular: cycles of nutrients, energy and water are closed as much as possible. Cities in delta areas with a strategic location on the water and with waterways into the heart of the city are especially suitable for this floating, high-tech solution. Expertise on maritime technology and agro knowledge is united.



Fresh-daily food close to the consumer

Not only a valuable floating structure develops as an alternative to the sparsely available land in cities, also the production and sale of fresh-daily food occurs in a circular way, and close to the consumer. Therefore, there are barely any waste flows, the logistics chain is shortened and healthy fresh-daily products are introduced to the consumer. As the provision of educational information about food and awareness are important fundamentals in the concept of the Floating Farm, it is accessible for the public. 'The hold' of Floating Farm is transparent, therefore all installations can be viewed easily. Visitors can see the cattle. They will find out how the cattle feed is produced, they will learn how dairy products are made and they can tap fresh dairy produce on the spot from the dairy wall, in order to taste and buy it.

Production

The start of the Floating Farm will be the processing and sale of milk, yogurt, cream, butter and buttermilk via the dairy wall. The design of the farm assumes the closing of cycles and is, insofar as possible, self-sufficient in terms of water supply and treatment, energy generation, waste processing and feed for the cattle. For example, a large share of the cattle feed is produced on the floating structure. Cattle feed (grass) is grown on the float with the use of LED lights. Seeds are germinated on special beds in short cycles. This production can continue throughout the year, enabling the cattle to eat fresh 'grass' on a daily basis. The cows' ration is supplemented with residual flows from the urban food and beverage industry and, if necessary, with hay and straw from the nearby countryside. Urine and manure contain a lot of nitrogen and phosphates, which can be processed into nutrients for compost and biogas. The urine immediately sinks through the special pasture floor, leaving the dried manure behind.

This is how small-scale stock farming is combined with innovative milk processing, information technology and automation. This happens in an animal friendly, interactive and transparent manner, which makes it educational and fun for children and adults to see and experience

Involved parties

Stichting Courage, Uit Je Eigen Stad in Rotterdam, Beladon

More information

http://beladon.com

Intensive utilisation concerns the use of existing products, such as buildings or cars, and provides ideas on how to make better use of them. A school building can also be used in the evenings for choir practice, meals, meetings or even performances. In a similar way, a car might see many more hours of use each day if we were to make it a shared car. Combining goals and sharing means is a special form of intensive utilisation of products. Think of the combination of a school and a library into a single building. The pupils have more books at their disposal, which the school needn't provide, and the library gains ready access to an important group of clients, school children. Both users of the building share its costs, in keeping with a limited, or even shrinking, economy. Now that people are becoming more aware that both environmental resilience and natural resources are finite, intensive utilisation (including combining goals and sharing means) is gaining in importance. A phenomenon such as combining goals and sharing means can only be truly understood in circumstances involving finiteness. We would therefore argue in favour of a reversal in the current thinking based on inexhaustibility. That is to say, society can better operate from the assumption that both resilience and natural resources are finite.

The transition towards combining goals and sharing means is a radical one. The individual and sector-specific development of goals and utilisation of means are deeply rooted habits in our country. In years past, individual means on a specialised basis have been continually optimised, with the only condition being that others should not suffer as a result. As a consequence, many goals and means have become strictly separated. When people start to combine these aspects, new competencies are called for. Change is necessary to help people realise that they can achieve mutual advantage by working together, even ultimately increasing mutual freedom. This movement could be considered a paradigm shift. Excellent examples of this shift can be observed in instances where people work with nature.

At a young age, children in primary school are taught about the usefulness of leaves that fall to the ground and remain there, ultimately helping to create a fertile humus layer in the soil. More organic material gets into the soil, with benefits including an improved structure and more efficient storage of water, nutrients and CO_2. The biodiversity in the soil increases as a result. This in turn helps to increase food production and resistance to stressors including climate change; to promote disease-fighting capacity and the binding of contaminants;

Ecosystem service	Nature and scale of services
Water regulation	Halving surfacing leads to approx. 25% (clay) – 50% (sand) reduction in run-off. This water is absorbed by the soil.The costs saved on drainage /sewerage in the city are estimated at € 5,000 per hectare of non-metallic ground per year. With rainwater drainage via surface infiltration, approx. 50% of the metallic surface is needed to allow water to infiltrate. Via infiltration facilities known as wadi, approx. 15% of the metallic surface is needed to allow water to infiltrate.
Regulating temperature and humidity	Non-metallic ground and greenery around buildings lead to energy savings of up to 50% on air conditioning. The surrounding land is 3-8 degrees cooler than the city; large parks cool the urban area up to a radius of 1-2 kilometres. Cooling by a few degrees via small, green elements (0.1 ha) at regularly-spaced intervals requires approx. 1.5% of the urban surface area. 10% increase in greenery on non-metallic ground results in a decrease in temperature of a few degrees in urban areas.
Greenery in the city	Green surroundings/landscaping increase the value of a house by 5 to 15%. Greenery contributes to the health and well-being of the people living in the neighbourhood. Greenery on the ground is cheaper to manage than surfaced ground (€ 0.02 – 0.45 for green versus € 3.60 for paved public space).

THE UTRECHT "BIOWASMACHINE"

HEAT AND COLD STORAGE IN THE GROUND IS COMBINED WITH BIOLOGICAL SOIL WASHING

Heat/cold storage assists with soil remediation

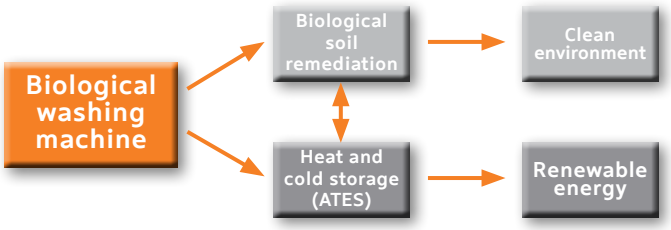
In Utrecht's station area, historical cases of contamination caused by chemical laundries and metal companies can no longer be cleaned up separately but are tackled as one whole. Here, there is a conscious effort to combine this with heat and cold storage (ATES). The concept has been given the name 'Biowasmachine' (biological washing machine). In the coming years, the biological washing machine, in collaboration with surrounding ATES systems, must limit the pollution of this area, which covers more than six square kilometres.

The groundwater flow carries plumes of contamination along with it in a natural way, but also provides cooling or heating for all kinds of urban functions. As ATES systems pump up groundwater, extract heat from it or emit heat into it, a blending and movement of the pollution occurs. As a result, bacteria can perform decontamination better. On the scale of the city, the plumes remain in place in this way. The ATES systems are, as it were, the engine of the washing machine.

When aligning the system, great care is taken to ensure that the polluted groundwater does not come into direct contact with the cooling water for the homes and offices. The extra mixing as a result of the pumping up and subsequent return of large flows of groundwater into the soil speeds up the degradation process of the pollution, which contains chlorine. Every new ATES system that starts to supply the homes and offices in the area with sustainable heat and cold makes the washing machine run faster.

Faster groundwater cleaning through heat/cold storage

Thanks to the system for storing and extracting heat and cold, contaminated groundwater can be cleaned at least ten times as quickly as with existing technologies. That has been revealed by doctoral candidate Zhuobiao Ni from Wageningen University in his thesis, which he defended on 8 December 2015. This gives prove of the benefits of the Utrecht biological washing machine.



In principle, an ATES system is only currently applied with clean groundwater, for fear of spreading soil contamination. There are around 11,000 locations in the Netherlands where the soil pollution is associated with risks given current or future use. These locations are found mainly in cities, where ATESs can easily be applied economically. It is possible to pump up and treat groundwater contaminated by soil pollution, but the pump would have to operate for twenty to thirty years. With localised biological soil remediation too, it usually takes a few decades to break down these pollutants, and it is very expensive. However, the Utrecht biological washing machine makes a difference.

Zhuobiao Ni demonstrates that heat/cold storage stimulates and accelerates biological soil remediation. The system is just like a washing machine: the micro-organisms which 'eat up' the contamination attach themselves to the dirty soil particles and can, in this way, take up a lot of contamination. The organisms also seek out the warm well where they multiply much faster. It is a self-reinforcing process by means of which the bacteria can render ten times more pollution harmless. This is how the Utrecht biological washing machine works, and it is much cheaper. In situ soil remediation in Utrecht's station area allegedly cost about € 100 million, as opposed to € 11 million with the 'biowasmachine'.

Involved parties

Municipality of Utrecht, project developers and installers, users, energy suppliers, managers of public space, groundwater managers

More information

http://rwsenvironment.eu/subjects/soil/projects/citychlor/pilot-project-7/

Zhuobiao Ni, Bioremediation of Chlorinated Ethenes in Aquifer Thermal Energy Storage, Thesis Wageningen University 2015.

as well as the soil's self-cleansing ability. Such capabilities are referred to as ecosystem services – in this case those of the topsoil. It is not only the soil that provides ecosystem services, but also agents including water, plants and animals.

Ecosystem services are functions served by the physical environment for the benefit of society. This includes things like groundwater purification and providing biomass for food and energy. These services are capable of reinforcing one another. This entails the virtually continuous combining of means as the intensification of one function inevitably affects the other. An increase in the amount of organic material, for example, leads to more biomass to be harvested and, at the same time, to an improved ability to retain CO_2. This is how ecosystem services work: they interact—combine—with one another almost as a matter of course, as one service reinforces the other in a very natural way. Combining functions is therefore an integral part of the ecosystem-service concept. The example of the "Organic washing machine (Biowasmachine)" demonstrates how the soil itself can cope with contamination. By linking an existing ability of the soil with the solution to a problem, a business case is created. In contrast to the previous method, which typically led to soil exhaustion, the resilience of the soil will now be increased. Another example is the project Building with Nature that focuses on finding ways to benefit from water instead of fighting it.

Building with Nature

Building with Nature is an approach to planning, design, construction and maintenance that relies as much as possible on ecosystem services while delivering as many ecosystem services as possible. For instance, applying Building with Nature to the design of water defences provides multiple benefits. In addition to flood risk management, opportunities are also created for leisure, nature development and food production, among other things. In Dordrecht, on the shores of the river Merwede, Building with Nature concepts have been applied in designing a public park with a strong water and shoreline ecosystem, thereby creating opportunities for both nature and recreation. Is it possible for ports to develop in such a way that nature and the environment also benefit? Building with Nature offers potential solutions here, as it does in other areas.

Sand Motor

The maintenance of the Dutch coast consists, broadly speaking, of a five-year cycle of sand replenishment. Is it possible to realise savings in this area, and to make coastal maintenance more natural and sustainable while generating added value for leisure activities? In 2011, to the south of The Hague, a large sand bank was created that will be distributed along the coastline by the wind, waves and currents over a period of some twenty years. It will supply the beaches and dunes with new sand in a natural fashion, providing protection against rising sea levels while, at the same time, creating additional space for nature and leisure activities. Many people have already discovered the possibilities for leisure created by the Sand Motor and nature in the area is flourishing.

Koehoal salt-marsh development using a Sludge Motor

Can a 'Sludge Motor' use clean sludge from the port of Harlingen to extend a salt marsh? The clean sludge will be deposited in a carefully selected location, from which it will then be carried by the current to the salt marsh. This will result in the creation of a Sludge Motor for delivering extra sediment to the salt marsh. As a result, young salt marshes and sludge banks will be added to the salt marsh naturally, providing important resting and feeding grounds for a range of wading birds. Over a period of three years, the project will investigate the best location at which to deposit the sediment; how it is dispersed; and how it can contribute to the salt marsh's development. More information: www.ecoshape.nl

FARM "DE GROOTE VOORT", LUNTEREN

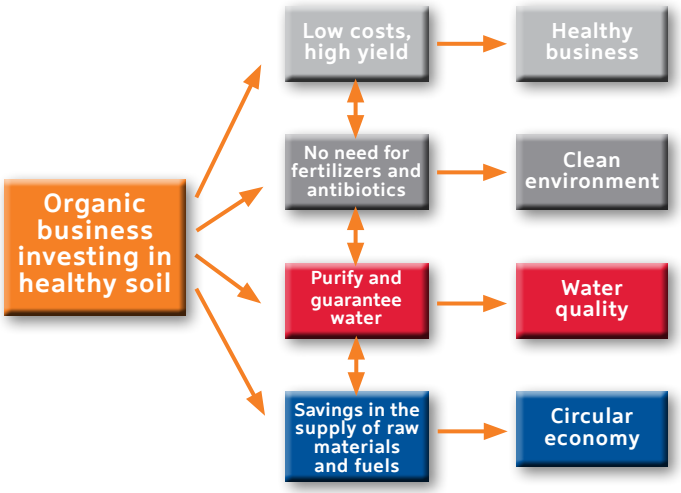
OWN BUSINESS SYSTEM IN WHICH EVERYTHING IS CONNECTED

Since as far back as circa 1600, the land around the farm "De Groote Voort" has been managed by the Van de Voort family. The farm is situated on a centuries-old road, right in the centre of the Netherlands. The current farm was built in 1925. Peter van de Voort headed the farm through the era of artificial fertilizers and milking machines. The industrial period has now ended and son Jan Dirk van de Voort made it into an organic business, re-introduced cheese making and, together with his wife Irene, developed Remeker cheese. 'De Groote Voort' encompasses eight meadows, which in total span over thirty hectares. The ground is the basis, the first living organism on the farm, and is cherished very dearly. By investing in the soil, for instance by using fermented stable manure, life in the soil flourishes and there is abundant grass. A large number of functions relating to soil, grass and manure are mutually reinforcing and form a cycle.

Apart from grass, clover forms the basis for organic farming. As this binds nitrogen from the air in a natural way, there is no need for fertilizers. In addition to grass, the cows are given crushed grains, which are purchased elsewhere. On the farm, the deep stable has been re-introduced to enhance the manure. This generates savings in the supply of raw materials and fuels. In addition, the soil is used to retain, purify and guarantee water, so that no extra supply of water is needed. Thanks to the yield from living soil (and the available minerals present) and the specific dose of herbs in the feed, the cows do not need any antibiotics and mortality among the young animals is lower. The result is healthy cattle and a high yield of organic milk, cheese and meat, which can be sold at a good price. On the other hand, costs are low for fertilizers, minerals and antibiotics.

Organic farm utilises ecosystem services sustainably

The budgets for fertilization and health are, in fact, combined. In other words, there is a simultaneous circuit in the production of food, manure, water and health, whilst in most cases manure, water and health have to be "imported". Creating a simultaneous circuit of production



all takes place on the same land and by one user, the farmer. The water board saves costs for water storage and water purification and the surrounding area spends less money on nature management and benefits from natural processes such as pollination. On the other hand, the changes on the farm, such as the more spacious cowshed, the feed and crushing machines and the cheese-making equipment call for heavy investments. The Agricultural Economics Research Institute (LEI) calculated that organic farming generated more than € 10 million a year in social profit due to the avoidance of costs connected with water purification and climate change. Extrapolated for the total acreage of 47,000 ha, this means a social service with a value of € 220 per hectare.

Involved parties

The cheese is sold direct from the farm to private individuals, health-food stores and specialist cheese shops, which supply the catering trade. There is also a sales network for the meat. Farm 'De Groote Voort' forms part of a network of organic farmers.

More information

http://www.remeker.nl/en/

2.3 Working with nature as an example of combining goals and sharing means

Working together with nature is a more sustainable option than working against nature. Good examples of this principle are the Sand motor and the Sludge motor. Instead of posing a threat to the community, the water becomes an instrument that promotes its safety. The Ecoshape Foundation encourages such solutions and, within the context of the innovation programme 'Building with Nature', researches if there is evidence of a paradigm shift, from strictly controlling the water system to embracing its natural dynamics. A paradigm shift takes place when an old way of thinking and acting is replaced with a new one more in keeping with the altered circumstances. The new way of acting not only solves the problems, it also eliminates the old method's disadvantages. As previously demonstrated in the introduction to this book with by examples of the Brouwersdam and East Scheldt storm surge barriers, such a shift appears to be in evidence in hydraulic engineering. There the former, highly controlled methodology may well have resolved safety issues, while at the same time creating new problems like the destruction of ecosystems.

Another example of the paradigm shift is the move in cities from protecting only against rainfall to also using this free and clean water for plants and cooling. Green roofs are particularly well suited to growing plants and retaining water. Plants are beneficial for the liveability of the city; it's also beneficial to prevent water from disappearing into the sewers immediately. Retaining it on green roofs and in other green parts of the city helps to prevent heat islands from forming, and to keep the city cooler in general. Utilising rainfall is making good use of the ecosystem. The Building with Nature initiative is based on this principle, as are projects involving Climate Buffers.

Climate Buffers

Climate change places the Netherlands in a difficult position. With its straight¬jacket of dikes and dams, the land has lost its ability for natural and spontaneous adaptation. Instead of waiting for the effects of climate change to overtake us, we must start preparing the landscape now by increasing its capacity to absorb excess water and allowing its natural systems to adapt. Instead of raising our dikes yet again, we must make space for sand dunes, tidal marshes and mudflats to grow along with the rising sea. Natural climate buffers offer protection and green space, as well as new opportunities for the economy, for recreation and for tourism.

Natural climate buffers can make a major contribution to climate-proofing the Netherlands, as they are able to adapt to and keep up with climate change. Climate buffers are beautiful, water-rich areas that offer great opportunities for outdoor recreation and waterfront housing. And they offer numerous other benefits as well. For example, water retention in climate buffers will help our economy (securing water supplies for cities, farmers and industries), moderate our local climates (reducing urban temperatures during hot summers), improve our safety (halting peat soil subsidence), and preserve our ecosystems (providing habitat and maintaining biodiversity).

Climate buffers not only protect humans against the rising water, they also help plants, birds and animals to survive rapid climate change. On top of other environmental threats, for many species climate change means changing food supplies, shifting breeding zones, and disappearing forage areas. Though fairly resilient, natural systems in the Netherlands are so strapped for space, that rapid climate change might well be a deathblow for many of the species in our country. We may be able to turn that tide, however, by using large, robust climate buffers. These zones literally provide nature with the space necessary for adapting to all the changes. Greater habitat availability increases the chance that endangered plants, birds and animals will reach maturity and survive lean years.

More information

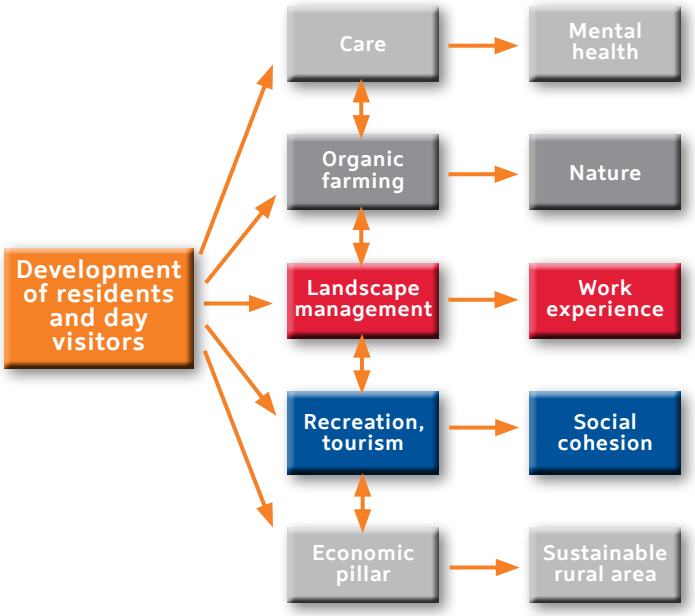
www.klimaatbuffers.nl/climate-buffers

"BUURDERIJ DE WILDE HAAN", BALLOO

A social care farm that has evolved in a short space of time into a connection between numerous people and physical elements in the area.

Housing and work for people with an impairment

'Buurderij de Wilde Haan' has been operating in Balloo, in the northern province of Drenthe since 2010. Started as a social care farm, the Buurderij soon developed into a connecting element for the local community. It is a place where people with an impairment live and work: young adults with autism or other (psychiatric) impairment. There are eight apartments with their own and shared facilities which have been adapted to the specific requirements of the target group. There is also room for day activities. The Buurderij is a recognised work experience facility. By means of tailored programmes, the personal development of residents and day visitors is stimulated. Contact with nature and its rhythm is very important for the clients. This covers caring for the animals, working in the greenhouse or kitchen garden, landscape maintenance in the neighbourhood, but also working in the kitchen or serving in the restaurant.



Promoting social cohesion is an important goal; they try to create a small-scale commune in open contact with the neighbourhood. The group of residents take care of their own residential environment, so that it is welcoming and pleasant for both themselves and the neighbourhood. The recreational/tourist function of the Buurderij is also geared towards social cohesion: open premises where people from the neighbourhood and tourists can make a contribution or just enjoy the rural atmosphere. In this way, the residents can get to know the neighbourhood from their own safe environment and build up relations with their neighbours. When they are ready, the residents take an active part in the community, for example in (sports) clubs or for local entrepreneurs.

Things like this just happen

In 2010, various functions were not part of the plan. For instance, the Buurderij has become an attraction and meeting place for tourists and for the neighbourhood. A petting farm, a rustic café serving drinks and snacks, and a shop selling organic produce are being created. In the meantime, the Buurderij has also become an important partner for the municipality, not only when it comes to landscape maintenance, but also in enabling people to gain work experience so that they can enter the labour market. You can devise such partnerships, but sometimes they just happen. How things develop in the coming years depends partly on new connections with people and the surrounding area, and which of these connections prove to be the most viable.

Organic and sustainable

Organic vegetables and flowers are grown in the greenhouse. A herb garden as also realised. Some of the produce is used by the residents and in the restaurant. The rest is sold in the shop and to restaurants in the vicinity. Management, maintenance and development of the Buurderij are all sustainable. Clients maintain a piece of woodland for the National Forest Service and in exchange for this the Buurderij gets wood for the heating plant. They make sure that the premises and the planting are in keeping with the natural environment and contribute towards the restoration of the local Ash landscape. On the basis of this function, the Buurderij has become an ambassador for the landscape of the 'Drentse Aa', and is allowed to promote this officially as 'host'. That makes the Buurderij a new economic pillar of the rural area, contributing towards the preservation and development of the landscape and how it is experienced. On the agenda is the extension of an adjacent cowshed to create a knowledge centre. It will provide education and a place for research relating to the care clients and how the environment can work for them whilst they work for the environment. It is in keeping with this philosophy and the growth pattern of the Buurderij that clients will, in time, also find work with cows in the neighbour's new cowshed or elsewhere.

Involved parties

Foundation 'Buurderij de Wilde Haan', care institutions, municipality, National Forest Service subsidy providers, volunteers, donors

More information

http://www.landbouwzorg.nl/index.php?pagid=67&dg=zb

2.4 Conclusion

Combining goals and sharing means is an integral part of the concepts 'ecosystem services', 'climate buffers' and 'Building with Nature'. All three concepts are based on the principle of finiteness. The examples in this book show that a change is underway in many other, extremely diverse, social fields towards production and projects based on these principles. We note that such paradigm shifts are taking place in a large number of sectors, making use of new methods and concepts, and that this provides plenty of opportunities. More changes are possible when people accept the fact that they are acting under finite conditions. They then also take account of the depletion of raw materials and realise the economy's limitations. People start to look for other modes of production, which are in keeping with an economy that has limits. This can rightly be called a paradigm shift. The nice thing here is that an economy based on finiteness is not itself finite. Based on the idea that resilience and natural resources are finite, there is in fact a great deal of 'economy' to be created.

Peat helps clean up Volgermeerpolder

The Volgermeerpolder is an area of more than a hundred hectares that was used by the municipality Amsterdam between 1927 and 1981 as a dump. In the 1950s and 1960s, a great deal of industrial waste was dumped, including at least ten thousand barrels of chemical waste containing toxic substances, such as dioxin. Through its campaigns, the Volgermeer Citizens' Committee managed to get the dump closed in February 1981. A short time later, fears of a chemical time bomb emerged. It was supposedly simply a matter of time before the poisons from the heavily polluted Volgermeer would spread uncontrollably into the surrounding environment. Thirty years later, the peat is providing natural and sustainable insulation and a technique has been developed to enable nature to repair itself.

Following intensive research, a remediation plan was developed based on the innovative remediation method "natural cap". The pollution is not removed, but rather packed in foil. Then, a layer of clean soil is deposited on top of the foil. The soil in this case came largely from excavation for the construction of the North-South Metro Line in Amsterdam. The landscape is then arranged in paddy fields, which collect rainwater. In these paddy fields, peat forms. In this way, a layer of living organic material gradually replaces the artificial capping structure. That makes the area ideally suited for visiting waterfowl, and the relatively rare vole and grass snake have already been spotted in the polder as well. Cycle paths and footpaths have been created, enabling the public to once again enjoy the polder. The project is a collaboration between the municipality of Amsterdam, the Water Department, private parties and the Centre for Wetlands Ecology, in which diverse research institutes and universities are working together. This clean-up of one of the largest cases of soil contamination in the Netherlands has now been completed after ten years, at a total cost of around € 100 million.

More information

www.volgermeer.nl/info/General/

BALADE WAALWIJK: MANY DIFFERENT PARTIES UNDER 1 ROOF

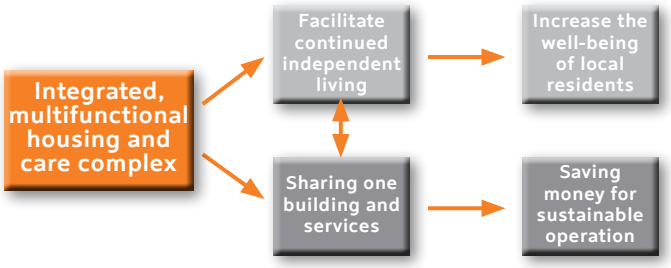
27 organisations under one roof

In 2000, a primary school and gym serving the Baardwijk, Laageinde and De Hoef (BaLaDe) districts were in need of major renovation. The adjacent day nursery and playgroup were also looking for suitable accommodation. The municipality of Waalwijk decided to approach housing corporation Casade. At the same time, a project was under way to set up a residential care service zone for the three districts, with an accompanying structure of facilities, whilst two local schools wanted to merge to form a community school. Casade wanted to oblige the municipality, but concluded that newbuild would be the best solution, in terms of the objective, finances and sustainable quality. In their experience, combining different functions under one roof could result in cost savings and improvements in the level of service. The municipality and Casade then consulted all social organisations in the neighbourhood. Some were in need of new accommodation and many saw the advantages of combining functions under one roof. A complex was created covering a total surface area of 21,000 m2, containing 57 standard apartments, 30 units for 'assisted living', small-scale group living, a café and lounge, conference rooms, a reception and a shop, among other things. When it comes to welfare, there is a Social Support Act counter, youth area and social workers, whilst various other areas of care are represented, including care for the elderly, care for people with an impairment and first-line care such as physiotherapy and a general practitioner. In total, 27 organisations are now involved, 12 of which are main tenants. This makes BaLaDe one of the biggest integrated, multifunctional housing complex in the Netherlands. Recently, the mission was summed up as: 'To increase the well-being of the local residents and to facilitate continued independent living'.

The first financial advantages already emerged during the planning stage, because it was possible to combine different budgets. The building development aspect was complicated, but the combinations associated with the legal and tender costs yielded advantages. With the design, thought was given to sustainability and flexibility. For instance, the roof of the gym serves as a terrace for the elderly people suffering from dementia in the group accommodation. Account was also taken of a possible decline in student numbers. Classrooms which are no longer needed in the future can easily be converted into apartments or other facilities. By programming the functions well, it was possible to avoid things like double sets of pipes and costly constructions. Various areas are used by different parties. Catering facilities and conference rooms can be reserved by both internal and external clients.

Being attuned to what clients want is truly sustainable

BaLaDe opened its doors in 2010. Experience from the first years of operation show that it can sometimes be difficult to organise 27 parties with twelve tenants. Some of the goals and the potential associated with several parties under one roof are not being fully realised as yet. The catering facility, for example, was designed as a meeting point for local residents and to provide work for people with a disability, but at first no-one came forward to operate this. In addition, there could be more activities and rental. Multifunctionality and multiple use are



not coming into their own enough as autonomous aspects. BaLaDe therefore drew up a business plan, and they appointed a manager who is responsible for the broad objective: joint facilities and steering. Local residents, users and tenants must experience BaLaDe as one organisation and rate the brand as distinctive and positive. In addition to the already established social organisations, socially involved organisations are also being brought in. The shared support services, both live and online, have been looking for ways of doing more collectively, for example at reception and with security. This leads to savings, which is a good thing in times of cutbacks. The same applies to communication and online services, which are becoming increasingly independent of time and location. They have therefore been looking at how social media and online services can help publicise the services which BaLaDe offers, but also help improve the coordination between programming and services.

More information

http://www.wonenzorg.nl/english

Chapter 3

Multifunctionality as economic motor

3.1 Introduction

Climate buffers will cost millions of euros, but they will help prevent billions of euros of flooding damage, and positively affect the quality of life and health of people in surrounding towns and cities. Considering this it is clear that the costs of climate buffers will be fully compensated by their benefits. Calculations have shown that climate buffers often prove more economically attractive than present land and water management strategies. In addition to finiteness of resilience and resources as explanation of the rise of multifunctionality in the previous chapter, there's an economic explanation and climate buffers help to give that. They're exemplary for other multifunctional solutions wherein goals are combined and means are shared. The all over consequences thereof for the economy inspire here to look at the macro-economics of multifunctionality.

The example of climate buffers also shows that there's more profit than money. Other benefits are a better physical environment, and a better quality of life for people. Multifunctionality gives a fair chance to create a sustainable business case that's good for people, planet and profit, and this chapter will give proof of that. Furthermore, looking at the business case draws attention to the micro-economics of multifunctionality. How's this business case financially, how are costs and returns organised? This chapter will describe that. Finally it will describe a last economic feature of multifunctionality, it's a part of the sharing economy since sharing means is at the very basis of multifunctionality.

3.2 A macro-economic explanation of the rise of multifunctionality

The first examples of combined goals in recent times, involving housing and care, are already more than thirty years old, and those involving integrated centres for children (community schools) date back more than twenty-five years. At the same time, there are also some highly physical combinations, such as the dual use of flood defences. Although the examples are extremely diverse, there is a consistent thread in the ascent of multifunctionality. Wherever the old method of production becomes too expensive, combinations crop up. For this reason, the many combinations in care and education come as no surprise, because these social sectors have been subject to cuts for decades now. Agriculture too is under increasing pressure and that explains the emergence of 'social care farms' like the Wilde Haan, and multifunctional farms like De Groote Voort in Lunteren.

The fact that some sectors, such as water management, have traditionally had their own costing system seems to provide a good explanation for why the number of combinations involving such themes as water safety and quality is of a more recent date. The project Building with Nature demonstrates how many possibilities there still are in this area. That not only applies to combinations in which water is an element. Every social function is eligible for combining and almost no single combination is inconceivable. The only restriction is related to whether a combination is profitable or not. The gradual profitability of one combination after another creates the impression that the rise of multifunctionality is an economic development. And so it is, but not exclusively.

Naturally, a combination must be profitable, because otherwise there is a great chance of it not being realized. Profitable here, however, also means socially profitable, therefore not only financially lucrative but also socially lucrative. This is because combinations are very often paid for (or partly paid for) by the government and it does not necessarily have to make a financial profit, but it does need to show a social profit and budget savings. Another important reason why more and more combinations are becoming profitable, both financially and socially, is related to the desire to make society more sustainable. This endeavour towards sustainability is very much related to economic reasons. This is because the costs of compensating for non-sustainable action are increasing further.

PEAT AND WET FARMING TO COMBAT SUBSIDENCE

In the Netherlands, there are around 290,000 hectares of peat moors, much of which is used for farming. The soil on these peat moors subsides by no less than 1 cm a year. Subsidence is a big problem in these areas, not only due to settlement, but also to the rise in the relative sea level, as can be seen in the illustration below. The subsidence is caused by draining the soil, as a result of which the peat oxidizes, CO2 is released and the soil consolidates.

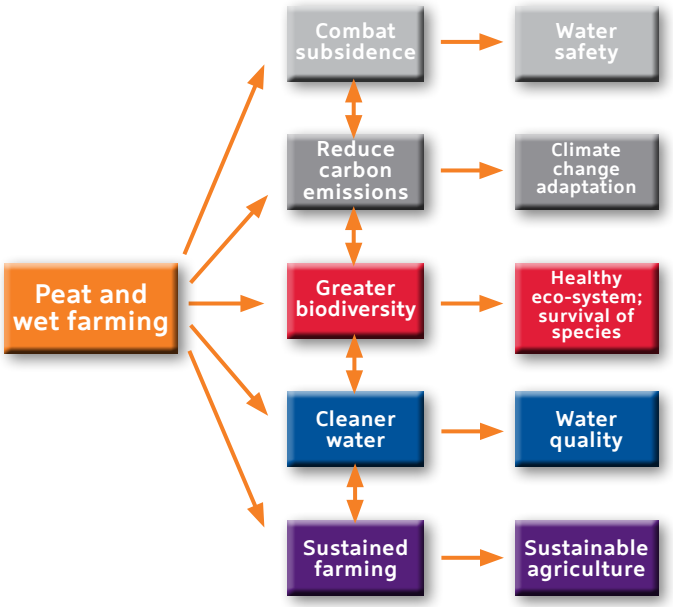
At the moment, the water level in the Netherlands is adjusted regularly, to comply with the wishes of farmers to keep agricultural land dry. Another consequence, in addition to subsidence and carbon emissions, is that the level of the peat meadows is too high, so that birds such as the black-tailed godwit and meadow birds die of starvation, because they are no longer able to get the food out of the ground. A lot of subsidies are currently needed to protect these birds.

Rehydrating peat soil

Instead of draining further, an alternative solution to combat subsidence is to rehydrate peat soil. This has been tested in the successful Ilperveld experiment. The test bed there revealed that rehydration led to the growth of peat moss, nitrogen was extracted from the air, bog formed and there was no further subsidence. A possible solution to combat subsidence on the one hand and sustain farming activities on the other is peat formation combined with wet farming. By combining these functions, it is possible to create added value and achieve the following five advantages:

- Combat subsidence
- Reduce carbon emissions
- Greater biodiversity
- Cleaner water
- Sustained farming

Peat formation can reduce both carbon emissions and subsidence. To supplement this, wet farming can increase biodiversity by growing new types of (wet) crops, which can also attract new marsh fauna, for example. Peat combined with wet farming can also lead to an improvement in the water quality, because plants (such as reed mace) extract fertilizers from the water. Finally, wet land provides opportunities for sustainable agriculture.



In order to find out how wet farming can be competitive and economically viable, Landschap Noord-Holland is carrying out a pilot project involving cattle farming in combination with wet farming and water management (level management). In addition to this, a communication process has been launched in the province of Noord-Holland, to inform farmers about the problems and possible solutions.

Involved parties

Landschap Noord-Holland

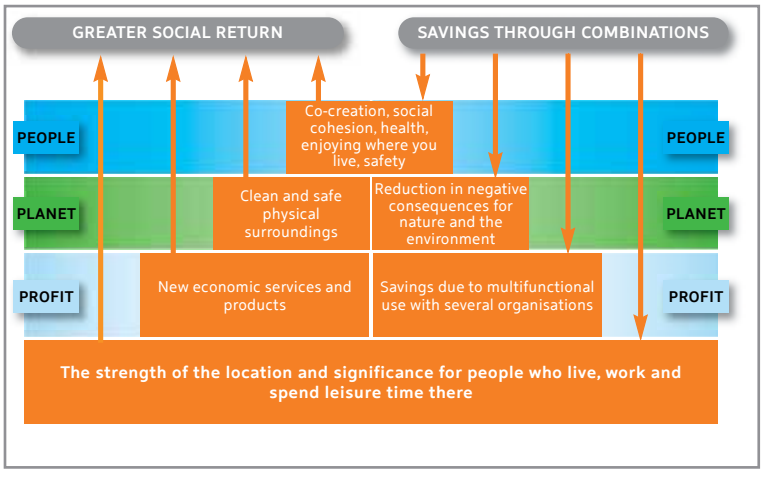
More information

www.wetland-ecology.nl/en

3.3 Mixed earning model

Most examples of combining goals and sharing means are more or less natural combinations, they are things which fit 'logically' together, which are combined and reinforce one another in a natural way: costs are saved by using the same physical space. Solar panels can be installed on a noise barrier alongside a road and greenery can be planted on the other side, which in turn can collect fine dust. The slope can serve as a depot for excess dredged material. The greenery on the side of a neighbourhood can, for example, serve as a public garden. Moreover, the barrier means it is possible to use land nearer to the road for living or working, among other things. In the city of Ede, a cinema has been set up in this way, and along the A2 Highway in Utrecht there are commercial premises in the form of an elongated noise barrier.

Combining goals and sharing means is geared towards the sustainable advantages of a place and the opportunities to reinforce these. It makes the hard and soft values of a place visible. On the one hand, this gives rise 'naturally' to a greater social return and, on the other, this produces savings. By using one place for several purposes at the same time and making smart combinations you can save a lot of money. We illustrate the coherence between the functions and the earning model by means of an 'up/down' diagram, which looks like this:



The starting point is always the strength of the area. With that as starting point, you can earn on different fronts. Purely economically, new products and services arise, which can be marketed. By combining, savings are also made. Together, these form the profit side of the combination. When it comes to ecology, it can be a question of services for the benefit of the physical environment, for example greenery or water. More importantly on the planet side are often the savings, the negative environmental consequences that are avoided, which mean that (later) there is no need for expensive clean-up or compensation measures. At the top of the 'steps' are people: the services and facilities are geared towards them and it is they who determine the value, the importance they attach to them, their usefulness and the choices to be made.

A well-functioning combination of functions always calls for cooperation and development. The users of an area play a key role. Physical combinations are often initiated and realized by public and private parties, and increasingly by users or residents themselves. The people-effects of multifunctionality are expressed by an increase in social cohesion, more pleasant living and working situations, improved health and increased happiness. With multifunctionality, there is always evidence of a mixed earning model. By saving on set-up costs as a result of combining functions, you simultaneously avoid nuisance and clean-up costs for the protection of nature and the environment, and social cohesion increases. Often, this acts as a flywheel, because it forms a breeding ground for even smarter services, as a result of which it becomes an even more attractive place to live, work and undertake all kinds of activities.

3.4 Business case

When combining goals, the costs fall by sharing the same land, infrastructure and equipment or using the same building for two or more goals. When setting up a centre for housing, learning and care, the costs for the design, construction, financing and management of school, homes and care institution are shared. The BaLaDe building is a good example of this, and sharing costs is continued during the operation of the centre. The Province of Noord-Holland has saved 34% by using dredged material for the construction of road embankments instead of storing it in a special depot. The Soil department takes care of recycling the dredged material and the Roads department uses it for road building. Dredged material can also be used to raise a noise barrier: saving 37.5%.

GOUDA, SOUTH-WESTERN RING ROAD IS A DIKE ALSO

In 2008 the Province of South Holland presented the design for the new South-Western Ring Road of the city of Gouda that was realized in 2012. Part of the embankment of this new part of the ring road originally was planned outside the dike and parallel there with the river Hollandsche IJssel. In the same area, the Water Board of Schieland and the Krimpenerwaard manages the primary flood defences, and they no longer met the standards.

The new ring road and improvements to the dike came together when a policy official from the Water Board wondered how it could be explained to the public that an embankment without a flood defence function will be built in front of the dike whilst the existing flood defence structure will shortly be rejected. The Province and the Water Board then decided to investigate the possibility of building the South-Western Ring Road as a primary flood defence.

Design and execution

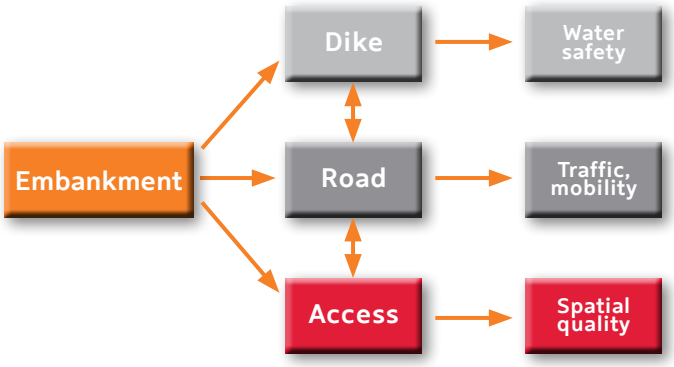
The embankment of a road is usually made of sand, but it can also be of clay, which is commonly used as flood defence. That makes the embankment suitable for two functions: both a road function as well as a flood defence function. With a view to operations, a dilemma did arise at this stage: who is charged with the maintenance work, the Province or the Water Board? If the road becomes a dike, the whole structure is primarily a dike. As a result, the Water Board should bear the most responsibility, whilst the Province is the major investor. This was solved cleverly by making the service road next to the secondary road the actual flood defence structure. The upkeep of this service road is also the responsibility of the Water Board, whilst the secondary road on the same embankment remains within the jurisdiction of the Province.

Costs and profits

The Water Board handed responsibility for the design and construction of the dike fully to the Province. The discussion about where exactly the boundary lies between service road and road was still ongoing when the parties reached agreement. No calculation was ever made of precisely which costs and benefits would go to each party, because the advantages are more than clear. The starting point that the combination is fundamentally the right thing to do is enough.

The explanation for this is the patently obvious benefit and the confidence that the parties will not let this advantage go to waste. The half a kilometre along which the road forms a combination with the dike requires an investment of around €800,000. This involves replacing half a kilometre of dike that does not pass inspection. The costs of the separate construction of a new dike would be in the region of €5,000,000. The combination means a saving of €4,200,000; 84%!

The relocation of the flood defence structure will turn the old dike into a dead end, thereby giving rise to a residential area with restricted traffic on a stretch which used to have a maximum speed limit of 60 kph. The flow of traffic on the new ring road will also improve, which will



improve safety and reduce delays. Furthermore, less land is needed for infrastructure and, the ring road can be integrated better into the landscape. The area that is bound by (outside-the-dike) water safety rules will move towards the river and, as a result, more will be possible in part of the area, for example house building. The main benefit for the surrounding area, however, lies in the decision not to carry out the original, unavoidable dike reinforcement. The homes on the old dike would have suffered a lot of inconvenience from this in the form of noise nuisance and reduced accessibility.

Involved parties

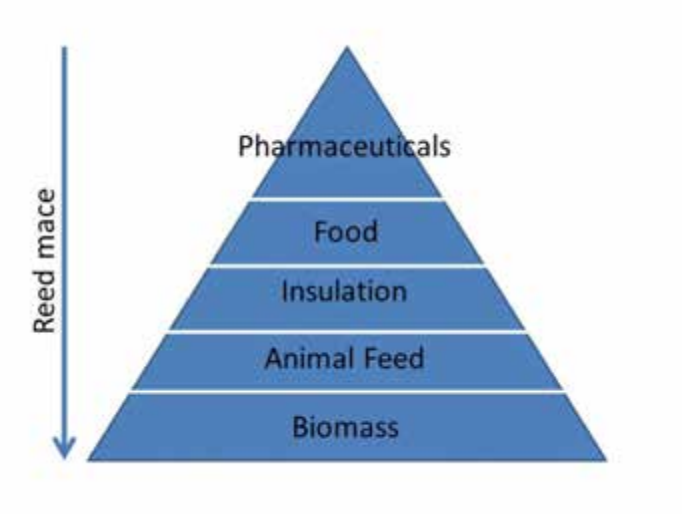
Province of South Holland, Municipality of Gouda, Water Board of Schieland and the Krimpenerwaard (HHSK)

Photo: Jeroen Mul www.flickr.com|photos|windwalkernld

	Standard raising with sand	Variant raising with dredged material	Saving	Percentage
Road – Groundwork	€ 432,642.58	€ 286,517.58	€ 146,125	34%
Noise barrier – Groundwork	€ 1,295,474.43	€ 794,474.43	€ 501,000	37.5%

A road on a dyke saves costs. In Gouda, the reverse is the case and costs are saved by building a road that also serves as a dyke; a saving of 84%. At the same time the road, which is also a dyke, yields extra returns: access to the area is better than without the road cum dyke, so existing and new homes are more easily accessible. Beside cost savings multifunctionality is also about creating new qualities, which can lead to profits. To reduce the turbity of the water in the Kromme Rijn river, and thereby make it more suitable for nature, a silt catcher was designed. The costs are at least 8 million for an area of 6 hectares that can no longer serve any other function. Instead, the decision was made to build 2.5 kilometres of nature-friendly banking, in addition to the existing 7.5 km. These banks already serve as an alternative to silt catching and, at the same time, have functions for nature, the landscape and bank reinforcement. The cost of the extra 2.5 kilometres is estimated at 850,000. This not only means a saving of millions, but also extra returns for nature, the landscape and bank reinforcement.

Landschap Noord-Holland has worked out the business case for 'wet' farming in the Westelijk Veenweidegebied (western peat meadow area). There, the average annual proceeds for a dairy farmer are € 965 per hectare. This can rise to € 1450 if combined with water management that leads to more water storage and more nature, and to less subsidence. An alternative to dairy farming is reed mace cultivation with financial returns of € 1630, due to a high yield of raw materials for numerous uses, including food and medicines, the biobased economy. As in the examples of the Kromme Rijn and Gouda, here too extra returns go hand-in-hand with cost savings: subsidence leads to heavy costs and is associated with the escape of greenhouse gases. Furthermore, wet farming is in keeping with water level management and can certainly save considerable energy costs for pumping stations in the western part of the Netherlands. This produces a strong business case.



The search for crops which are competitive is an important issue when it comes to making farming on wet land economically viable. Growing crops which can be used as animal feed, such as reed mace, peat and azolla, seems to be an attractive option. It is even more interesting to look for crops which serve several purposes and can be used in different layers of the product pyramid. For example, a certain substance from reed mace can be used in the pharmaceutical industry and the residual product can serve as insulation material, animal feed and biomass.

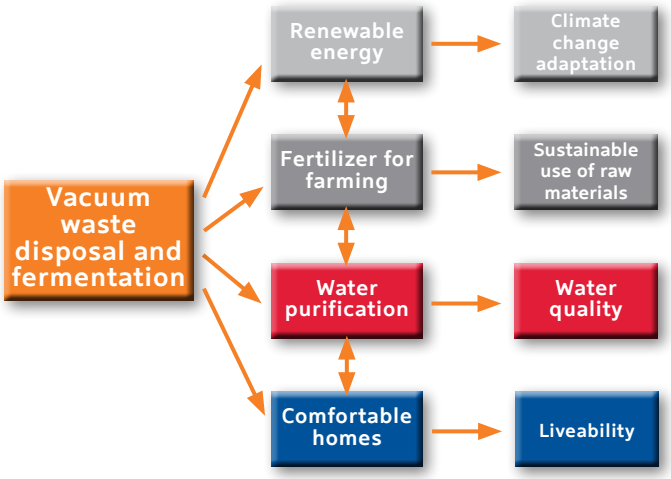
The figures look promising, financially speaking, particularly as milk prices are under pressure at the moment and because the current subsidies, among other things to protect meadow birds, are superfluous with wet farming. Dairy farming yields about €1,000 per hectare for farmers. If a farmer starts to grow crops partially on wet land, the other land can be used for organic production, which can yield €1,500 per hectare. If a farmer cultivates peat moss, this can even yield as much as €2,500 per hectare.

Wet farming would be even more interesting financially if carbon emissions were capitalized. Draining leads to the oxidization of peat, resulting in carbon emissions (and subsidence). Wet farming, by contrast, reduces carbon emissions and nature can even capture carbon in wet conditions. A financial

DECENTRALISED SANITATION, NOORDERHOEK SNEEK

NEW SANITATION

In the Netherlands, there is an increasing surplus of nutrients: phosphorus, nitrogen and potassium compounds. Because of import in the form of food, animal feed and ores, this surplus is increasing every year. It is very expensive to purify the waste, sewage and surface water and to process manure. Elsewhere in the world, there is actually a need for nutrients (fertilizers) due to the increasing world population and emerging economies. In order to be able to meet the demand for raw materials, now and in the future, it is necessary to use raw materials more sustainably. That can be done, on the one hand, by ensuring that fewer raw materials are used and, on the other hand, by recycling what is used as much as possible. This starting point is one of the key elements of 'DeSaH' (decentralised sanitation and recycling).



Noorderhoek is a demolition/newbuild project in the town of Sneek. In total, 280 homes are being demolished and replaced with 207 new ones. The domestic waste water from these homes and a care centre will be collected separately as toilet wastewater (black) combined with kitchen waste and the remaining wastewater (grey water), and purified locally. All of the homes will therefore be fitted with a system for vacuum waste disposal: vacuum toilets and a system for vacuum disposal of fruit and vegetable waste. A central fermenter converts this into biogas, renewable energy which is used to heat the homes. The fermentation of the black water produces gas and also sludge and liquid. The nutrients in the liquid part are purified and made into fertilizer, which can be used in farming. Depending on legislation also the sludge of the fermenter can be used in farming. What you are ultimately left with is purified water, the quality of which is good enough to be discharged into the surface water.

Comfortable living goes hand in hand with environmental return

In Sneek, they already had some experience with decentralised sanitation on a small scale. At the time, this involved 32 homes, the toilet water from which was treated separately. The results of this project prompted to roll out the concept in Noorderhoek on a larger and broader scale. This project provides the opportunity to gain experience with and insight into the costs and the environmental return of New Sanitation. Experience in Noorderhoek thereby forms an important assessment framework for its further application. The environmental return is made up of a large number of elements. For example, households can make 25-50% savings on water. Another important advantage is the removal of harmful substances from the waste water before it is discharged. These include nitrogen and phosphate (more than 90% removed). There is also a reduction in (contaminated) residual flows such as sewage sludge and carbon emissions. Heat is recovered from waste water, whilst the use of organic kitchen waste in the fermentation process generates more biogas.

The conversion of raw materials like nitrogen and phosphate into fertilizer means that there is a closed cycle for energy, raw materials and water. The DeSaH concept has a modular structure, as a result of which the investments which are needed for transport and sewage treatment run parallel with the phasing in the residential development. There are also advantages for residents. Water and energy costs are cut. There is more flexibility regarding the location of the bathroom and the toilet, due to the use of a vacuum toilet. The home is more comfortable. And there are no unpleasant smells in the kitchen now, because the kitchen disposal grinder obviates the need for a separate bin for fruit and vegetable waste.

Involved parties

Housing foundation Elkien, municipality of Súdwest Fryslân , DeSaH BV, province of Fryslân, Wetterskip Fryslân and STOWA

More information

www.wetsus.nl/demonstration-and-pilot-projects/desah-sneek

incentive for farmers to limit carbon emissions, for example by funding carbon reduction with carbon credits, would make wet farming even more attractive. Conversely, the introduction of charges for carbon emissions would currently mean bankruptcy for many farmers so a transition period is needed. In this period they can learn to combining goals, and share means. This sharing, is that part of the sharing economy?

3.5 The sharing economy is much bigger than we think

Making combinations brings about the fundamental change of the coordination of goals, so that a single means can be deployed. It gives rise to a sort of sharing economy, but one that goes further and deeper than we normally understand by the sharing economy. It is well known from the sharing of cars, tools and, for example, holiday homes or parking spaces. The principle is that of time sharing by users who share end products after one another. In the case of carpooling, for instance, this can be simultaneous, as is also the case with the shopping bus in Bellingwedde. This takes people in a 'shrinking area' to and from the shops and, in this way, helps to strengthen social bonds at the same time. Producers can also share means of production. Examples include caterers who use restaurant kitchens in the mornings. Here, kitchens are shared after one another, and that is also the case with a local restaurant that uses a school's kitchen in the evenings. Time sharing can be consecutive but also simultaneous, as with carpooling and the shopping bus.

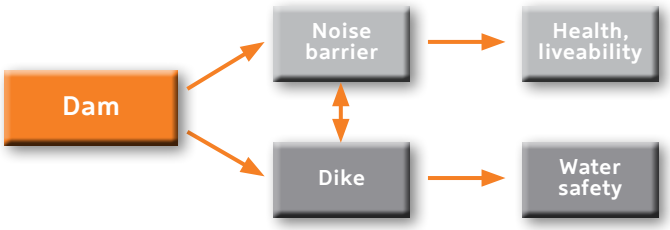
This shopping bus is a means to several ends, as are all of the examples in this book. In the case of the Smart Polder (see page 54) the pump of a pumping station used for water level management can also serve as a pump for storing heat and cold. In the case of Desah Sneek, a sewer can also generate electricity. In this case, producers share resources to achieve two or more goals. Another example is the noise barrier near Zwolle, which will also serve as a dike. The users have shared protection against noise and water, and the producers share too. On the one hand, that is the municipality, which must provide the noise barrier, and on the other the water board, which must provide a dike. They share the space, the land for the barrier and the building, management and maintenance costs. In addition, both receive returns in the form of protection against noise and high water. Although this is not known to be part of the sharing economy, the sharing of means to various purposes can be considered as such.

Another example of consecutive sharing that is unknown in the current understanding of the sharing economy is temporary alternative usage. Examples include an empty office building that will serve as accommodation for students or asylum seekers for five years. Temporary use can also involve nature, such as the creation of temporary nature on derelict building land or the use of this land for urban farming. Here we see space being shared consecutively, but that can also be simultaneously, as in the case of high-rise and building underground. The phenomenon of 'combining work with work' can be seen as part of the sharing economy. An example of this is replacing the gas mains at the same time as laying a new sewer; construction capacity is then shared. Finally, waste as raw material forms the basis of the circular economy. This revolves around maximising the recyclability of products and raw materials. Can this also be seen as part of the sharing economy because two products share the same raw material after one another?

Recycling is a type of time sharing of raw materials and can

INNOVATIVE NOISE BARRIER PROTECTS AGAINST FLOODING

A noise barrier is to be built around the Zwolle neighbourhood of Stadshagen near the Mastenbroek polder. On the outside, this noise barrier looks like a dike, but it is not a dike: Stadshagen will be the first place in the Netherlands to have a noise barrier that also serves as a dam that will restrict effects in case of an emergency. The emergency dam will provide extra safety for thousands of residents of Stadshagen.



Noise barrier

The noise barrier will be stronger than normal, will be finished off with clay and planted with special dike grass. The Mastenbroek polder is vulnerable, but if the polder dike was to be breached, chances are higher that the residents of Stadshagen would remain dry. If necessary, the noise barrier can hold back water for several weeks.
The dam-cum-noise barrier will form part of the total water safety regime in the Mastenbroek polder. If the Mastenbroek polder, which covers over 8,000 hectares, was to flood as a result of a breach in the dam, it would cause massive damage. Stadshagen (approx. 600 ha) currently has 8,000 homes and a population of more than 20,000. Investments in the area have a total value well in excess of €1 billion. Through subdividing, creating an emergency dam, the direct damage can be restricted substantially, as can greater consequential damage in the period following the floods. This creates a sense of safety.

Costs

The extra work related to water safety can be incorporated relatively cheaply into that for the noise barrier. That is because the municipality (together with the province) is investing millions in the noise barrier that has to be realised anyway. The additional costs for an extra function relating to water safety are relatively low: about €500,000. There are also, for example, costs for connecting to the existing dikes; these sums are relatively manageable. Such measures are only affordable if they can be combined with a project that is already planned. It concerns extra safety that can be achieved relatively easily and cheaply.

Added value

Not only will added value be generated in terms of cost savings, safety and reduced noise nuisance, but the traffic burden will also be reduced. The barrier will form part of the main structure of Stadshagen, as a result traffic will no longer travel through the neighbourhood, but around it.
This innovative concept in the IJssel-Vecht delta, a first in the Netherlands, serves as an example for the National Delta Programme, designed to protect the Netherlands against flooding.

Involved parties

Municipality of Zwolle, Municipality of Kampen, Municipality of Zwartewaterland, Province of Overijssel, Water Board Drents Overijsselse Delta

De Stentor – Photo Frans Paalman - http://www.destentor.nl/regio/zwolle/water4daagse-start-op-dijk-1.4407198

therefore be considered as an element of the sharing economy. A picture emerges of this economy in which this is much more than simply time sharing end products. The sharing economy also covers means of production such as raw materials and space, and sharing can be both simultaneous and consecutive. Then this economy encompasses all stages of production and use and can develop into an alternative to the economy as we know it and in which sharing plays only a small role. That is the economy that throws away waste, that focuses on individual clients who all have an end product instead of sharing this, and that invests separately in, for example, a noise barrier and a dike. This is less sustainable and means that it is necessary to seek a serious alternative – the sharing economy. Sharing means to several ends, the subject of this book, is an element of this.

3.6 Conclusion

By looking carefully at what a place has to offer, it is possible to make combinations, such as the combination of a noise barrier and a dike. Many different parties are already making use of this: water boards, care providers, school boards, farmers, nature managers, carriers, food producers, energy companies. They save on resources, and thus on raw materials, and generally speaking cause a lot less damage to the environment, meaning that no or little money has to be paid in compensation. The fundamental change is in the coordination of goals, so that a single means can be deployed; multifunctionality in this book. This concerns sharing means, and deepens thinking about the sharing economy. The coordination of goals calls for knowledge of the place and the resources available there, and of the goals people on the spot consider important. What if people consider a goal important on the one spot and think it a good idea to combine it whit a goal on another spot. Is that possible, or in other words is multifunctionality perceivable on two or more places, and with transport between these places? Or can the means of transport be the single means that people share for two or more goals? These are the kind of questions in the next chapter on transport.

Circular economy

3D Print Canal House

Canal houses can be up to 400 years old. Today, in 2015, they are used as homes, businesses, offices, shops, restaurants and hotels. In contrast to many modern premises, their dimensions and layout are such that they have been able to serve numerous functions for hundreds of years. In other words, their design and build are excellently attuned for maintenance and operation. Using the latest construction technology, 3Dprinting, a new canal house is currently being built in Amsterdam. A unique feature of 3Dprinting is the customisation; based on their ideas about maintenance and operation in particular, the user can have a very direct influence on the design. With a few clicks on the button, this design is sent to the printer, the first stage in the building process.

The build can proceed very quickly and the number of parties involved is small, whilst the most interested party, the user, plays a prominent role. Will this give rise to a canal house that will last for the next 400 years? It is also important nowadays to consider the building materials well, and for example the extent to which they can be recycled. Whereas traditional building projects often simply require certain materials, with 3D printing this can be controlled better by the choice of material to be printed. Thus 3D printing fits quite well with the principles of the circular economy; see http://3dprintcanalhouse.com.

FAIRPHONE

Fairphone is a social enterprise that is building a movement for fairer electronics. The phone serves to uncover production systems, address challenging problems and stimulate discussions about what is truly fair. The initiative started in 2010, is 100% independently financed to preserve the social values, and has sold over 80,000 phones since 2013. Fairphone is tackling issues within its supply chain by focusing on four core areas: Mining, Design, Manufacturing and Life Cycle.

Mining

Every smartphone contains over 30 different minerals. All minerals and metals enter the supply chain from the mining sector. From pollution and extremely dangerous working conditions to child labor, many mining-related practices desperately require improvement. Conflict minerals fund rebel groups, contributing to political and economic instability while neglecting workers' rights, safety and their ability to earn a fair wage. Fairphone wants to source responsibly mined minerals and metals that support local economies, not militias.

Design

With design Fairphone is able to influence the supply chain as well as the lifecycle of the product, and empower buyers to have more control and ownership over their phone:

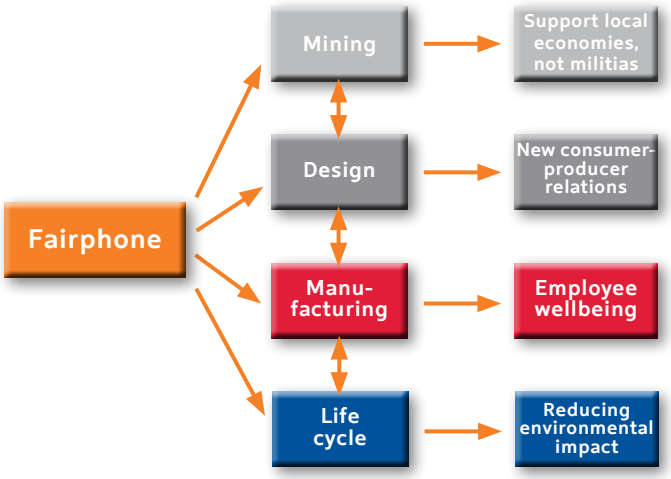
- The Fairphone 2 is built around a modular architecture, making it easy for owners to repair their phones by themselves. This repair model will lead to a longer lasting device and give owners more responsibility for the functioning of their phone.
- Creating a Developer-friendly Software Environment focused on openness, transparency and ownership to achieve greater product longevity.
- 3D-Printed accessories is an experiment in distributed production – eliminating the need for longdistance shipping and producing excess stock.
- A Life Cycle Assessment (LCA) helps identify hotspots for reducing environmental impact, and will help shape future decisions regarding the production and supply chain.

Manufacturing

Manufacturing in the consumer electronics industry is demanding and involves labor-intensive production processes. Workers are often not paid a living wage and lack employee representation, while working long hours in conditions that infringe upon health and safety. These systemic issues are multifaceted and cannot be instantly rectified. To begin creating positive change, the Fairphone organization is establishing collaborative, mutually beneficial and transparent relationships with manufacturers who are willing to invest in employee wellbeing.

Life cycle & Circular Economy

Every year, consumers throw away millions of mobile phones, contributing to the world's e-waste crisis. This is occurring because most phones are not built to last and we constantly want to upgrade our devices. With others Fairphone works to address the full lifespan of the mobile phone, including use, reuse and safe recycling:



- Spare Parts and Self Repair; selling of spare parts online to allow users to repair their own phone. Partnering with iFixit to create open source repair guides.
- Responsible E-waste Recycling; about 34% of the copper used in the printed circuit board of Fairphone 2 comes from recycled sources. Partnering with Closing the Loop to help provide solutions for e-waste in countries without a formal electronics recycling sector.
- Phone Recycling Program; encourage the public to donate their old phone by sending it in to be safely recycled to ensure it stays out of the landfill. An example is Fairphone Recycling Program in Europe with Teqcycle.

Why an ethical phone?

There are literally thousands of social and ecological standards that can be improved in the production of smartphones. They cannot be overcome all at once and with the Fairphone a range of interventions is defined to gradually address some of them. It is a tool to open up the supply chain and build a movement towards fairer electronics. Consumers deserve to know the whole story, including where their money is spent. Fairphone publishes a Cost Breakdown to give a detailed overview of where their customers' money goes, and publishes a list of suppliers to reveal where all components come from. The Fairphone is a storytelling device that provides a useful metaphor for complex, interconnected supply chains. This symbolic product changes the relationship that people have with their products and contribute to an economy based on different values.

Involved parties

Fairphone, and amongst many others: iFixit, Closing the Loop, Teqcycle

More information

http://fairphone.com/blog
https://www.fairphone.com/roadmap/mining/
https://www.fairphone.com/resources/

Circular economy

Alliander HQ

The largest Dutch Grid Operator 'Alliander' developed highly sustainable premises at an existing location with approximately ten (old) buildings. Alliander had set ambitious goals with respect to the sustainability of the building, in terms of raw material use and energy consumption. The complexity of the project required close collaboration between disciplines in order to allow for a successful and financially viable bid. The reference point for the financial bid was a "Total Cost of Ownership" (TCO) of the previous real estate situation. The selection phase focused on challenging market players to create collaborative teams composed of architects, engineers and contractors. The winning design surpassed the expectations of the organization and the financial bid was comfortably within the TCO framework.

It was decided not to develop a new building, but to remodel existing buildings to form one new generic workspace. The new workspace is energy positive, it generates more energy than it consumes. One of the key contributing factors is the roof, the shape of which enables perfect climate control with a minimum of technical equipment. Also, the building process was designed to be circular, minimizing waste: 85% of existing structures were repurposed and 90% of the waste streams recycled.

Provided that collaboration is sought and integrated into all processes, and secured within the business model, high-level sustainability need not be more expensive. Tender processes can be an excellent method for encouraging collaboration between disciplines to reach these sustainable breakthroughs. The new office of the Dutch Grid Operator 'Alliander' provides an excellent example.

Parties involved

Alliander, RAU, Copper8.

More information

http://www.rau.eu/liander/

http://www.copper8.com/en/projects/sustainable-redevelopment/#more-483

ROETZ-BIKES

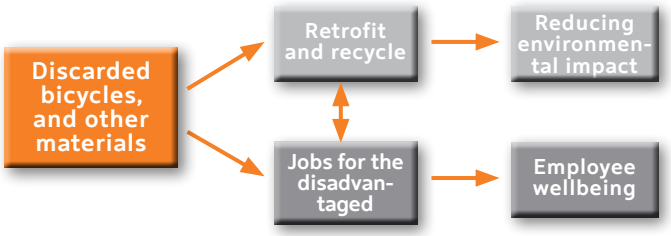
MORE THAN A BIKE

The almost 17 million Dutchmen together own almost 23 million bicycles. They buy around one million new ones each year, but also discard around one million. Roetz-Bikes is a bicycle manufacturer with the mission to re-use materials from discarded bikes to make new ones. All the frames used by Roetz-Bikes are recycled steel frames with a history and ready for a second life. The bikes are produced by men with a disadvantage on the job market. They're trained to be experienced bicycle makers with extended knowledge. Those who produce Roetz-Bikes are given both the time and space they need, so they can devote all their attention to making bikes.

Design and durability

After they have been used, worn out and discarded old frames are re-used to make new ones. Roetz-Bikes sets high standards for the components and materials used. The quality and look are definitely important, but also durability and the sourcing of raw materials. If unable to find parts that meet the standards, the factory self will design them, like the wooden fenders and cork grips. For Roetz this prudent approach to materials has become a starting point for even more products and processes: dress guards are made from discarded industrial conveyor belts, wooden crates are made from Amsterdam trees that are saved from the shredder.

Also the bikes' transport boxes are as many as possible returned to the factory, so they can be used again. Regarding inner tubes, saddles, wheels and chains there are many possibilities still untapped. Last but not least, Roetz-Bikes has an even bigger impact when it comes to handling larger series of bikes used by, for example, cycle rental companies. These bikes are usually in better shape technically, but still have to be rejected. They are usually the bike fleets of larger companies or rental firms. The best example we can give is the OV-Fiets (public transportation bike) from NS, the Dutch national railway company.



Involved parties

Roetz-Bikes, OV-Fiets, NS

More information

https://roetz-bikes.com/page/homepage

Photo retrieved from website Roetz Bikes

Chapter 4

Transport and mobility

The added value of IT in mobility and traffic management

The smartphone combines telephone, web browser and GPS tracker. From a technical perspective, it is now possible to provide every road user carrying a smartphone with the individual travel information he or she needs at that moment – both pre-trip and on-trip. In the northern city of Assen the Traffic Management System Assen (VMSA) from Heijmans makes it possible to improve the monitoring of traffic movement and traffic load on the road network. The VMSA translates data into high quality, real time information a traffic centre, and up-to-date travel information for the road user. By means of various route information panels, parking route information systems and the traffic management system TrafficLink, this is achieved via the fibre optic network of Sensor City. In the future, the system could also be predictive, so that travellers can take account of expected travelling times and traffic congestion.

The GPS tracker determines the location accurately and the telephone, combined with the web browser, neatly presents the necessary travel information. In terms of traffic management, this means that advice provided up to now on signs above and along the road can also be displayed in the car. Smartphones also make it possible to personalise this information, because you can take account of the relevant traveller's location, destination and preferences. That brings together traffic management and mobility management, and the first tentative steps are already being taken in various initiatives in the Netherlands. Precondition for this is a good customer relationship with the road user. A close customer relationship between road manager and road user would be a world first.

Stichting Sensor City

4.1 Introduction

A care institution in Amsterdam has a minibus to transport its clients. This minibus is maintained by students as part of their vocational training as car mechanics. In return for their services, the students are allowed to use the minibus at the weekend for their sport club activities. A similar example of the multifunctional use of transport is the shopping bus in Bellingwedde in eastern Groningen. Instead of delivering items to people, it takes groups of residents to do their shopping. In a shrinking economy like that of eastern Groningen, transport is a way to reduce the degree to which the loss of retail outlets is accompanied by the disappearance of residents and their social connections. Both of these examples illustrate how transport can be a means of achieving two or more goals, thus making it multifunctional in the context of this book.

In recent years, the idea that a means may serve two or more ends has become part of current practice in the Netherlands in sectors including water safety, nature conservation, education and healthcare. In the traffic and transport sectors, examples of means, transfer points and mobility services illustrate how a measure may serve two goals in this area too. This chapter will provide further elaboration on that topic. The first step, however, is to gain a better oversight of the means themselves. Clearly, minibuses are not the only examples. Physical transfer hubs are available, as well as software apps that help people make informed transportation choices involving a combination of means: a bus ride followed by train travel, for example. Does such an app serve a single purpose, i.e. to improve the functionality of bus and train networks, or does it help achieve multiple goals, such as increasing the functionality of an area in general? Demonstrating the app's multifunctionality is the next logical step. Particularly where apps are

MOBILITY MANAGEMENT

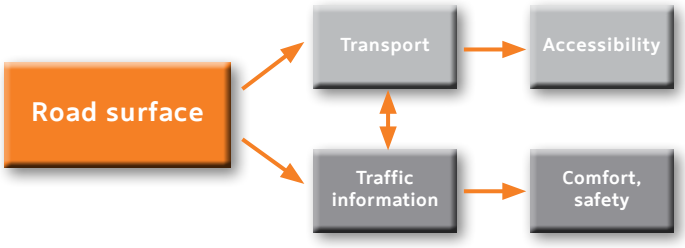
The places where and times at which people work have changed, partly as a result of flexible working hours, flexible workplaces and working from home. In the project Smart Working, Smart Travelling (SWSR), this goes hand in hand with mobility management, influencing a traveller pre-trip to choose an alternative to the car or to travel at a different time. Within the context of SWSR, this mainly involves measures to enable workers to avoid rush hour when commuting or travelling for business. They can choose between the car, cycle or public transport, facilitated by the provision of covered cycle parking facilities, allowances for cycles and public transport season tickets, among other things. An integrated approach to smart working and smart travelling leads, for example, to teleworking, which reduces commuter traffic. It makes extra savings on workplaces possible, because fewer are needed. That, in turn, has consequences for office premises, but none of this results in savings unless the corporate culture and ICT are in order, as well as the terms of employment: rewards for desired behaviour.

A smart working/ smart travelling policy has contributed to the relocation of energy company Nuon to Amsterdam Zuidoost. The new location is more easily accessible by car and public transport, and travelling time is expected to increase less in the future than at the previous locations. A severe reduction in the number of parking spaces, combined with promoting the use of cycles and public transport and smart working, is leading to an improvement in the mobility of staff and the accessibility of Nuon. With the relocation and the smart working / smart travelling policy, Nuon can make substantial savings on accommodation, reduce carbon emissions and choose to have far fewer parking spaces. This last choice shows how parking influences mobility management. That is also the starting point for an initial experiment by the Bronovo Hospital in The Hague.

Bronovo Hospital

Parking can reinforce mobility management in the pursuit of accessible and liveable cities. As one of the largest hospitals in The Hague, the Bronovo Hospital has taken part in two experiments concerning

Photo retrieved from http://www.vexpan.nl/nieuws/parkeerplaats-ziekenhuis-in-gebruik-als-pr-voorziening



parking and mobility in recent years. If patients are unable to find a parking space on busy days and at busy times, they arrive too late and that is bad for the hospital's logistics as a whole. One solution is to encourage staff to avoid parking, for example by cycling to work. Another incentive is having to pay for parking spaces, which is organised via payroll administration. Having to pay more at peak times is an incentive to leave the car at home. This is also referred to as Peak Shaving: charges and rewards are differentiated according to the day of the week, time of day, parking location, distance between home and work and staff sector. In other words: with a smart HR arrangement, employees can help optimise the logistics. The driving force here is the Dutch company Montefeltro, which is also behind a second experiment.

The second experiment also concerns parking, but this time during quiet periods. Every year more than 1,500,000 people visit The Hague for major events. 27% of them travel by car: 160,000 cars on a limited number of days of the year. The dual use of parking spaces can be advantageous for the user. Based on this idea, the first parking spaces were made available at the Bronovo Hospital on Friday 20 February 2015. The UIT-JE AUTO (out of your car) service yields extra revenue for the hospital. The parking spaces are made available to visitors outside peak hours; they can reserve a space via a website or app. They are then sure of a place when it is busy. The app provides navigation to the destination point. Visitors can book an HTM (public transport in The Hague) day ticket online or reserve a taxi in advance with discount.

Involved parties

Heijmans, Beter Benutten, Nuon, Bronovo, Montefeltro, Municipality of The Hague

More information

www.beterbenutten.nl/en
www.Montefeltro.nl/vm/

concerned, IT is a component that can expand the possibilities by which transport can be a means to serve two or more ends.

4.2 Means of transport

Walking, bicycles, cars, trains, boats and airplanes are means of transport. Transport is optimal when passengers and goods are transported using the proper means, or the proper combination of means. That means: when the passenger or package arrives at the destination in the most sustainable way possible. In other words, it's best to avoid transporting cargo containers by road when a ship could have done the job, and done it more sustainably too. Optimal in this instance means choosing the mode of transport that will maximise accessibility in the most sustainable fashion. Cars and bicycles are examples of means, the goal is transportation and the underlying concern is sustainable accessibility. Accessibility not only means getting from A to B as quickly as possible, but doing so in the greatest comfort while minimising the environmental impact. With regard to the latter, CO_2 emissions are an important indicator.

Choosing the means of transport that will maximise accessibility in the most sustainable fashion may involve substituting one mode of transport for another: people who no longer drive to work but take the train or drive only part of the way before getting on a train, for example. For this reason, it is important to create hubs where commuters can easily transfer from one type of transport to another. Picture a train and bus station with parking facilities readily available for cars and bicycles. Along with the means of transport themselves, a transfer hub is a measure that contributes to effective transportation. An additional measure that can reinforce the functions means and hubs is mobility management.

Mobility management means influencing travellers pre-trip to choose between the alternatives to travel or to travel at a different moment in time. The aforementioned apps, in particular, often involve mobility management – like a mobile app on your phone that plots your trip from A to B. There is also traffic management, which involves measures for regulating traffic during the trip (on-trip). Real-time traffic information that alerts you of traffic congestion and alternate routes, for example. It is important to consider how mobility management can increase the pleasure and comfort of travel for passengers, as well as limiting the impact on the environment by reducing the number of cars on the road. Traffic management contributes to the latter by minimising the number of traffic jams; the environmental impact of backed-up traffic is much greater than that of traffic moving in a normal flow. While other measures could be envisioned, the scope of this chapter will be limited to means of transport, hubs and mobility and traffic management. These themes should prove sufficient to explore whether these measures can serve additional purposes besides transport and are therefore multifunctional.

Cycling

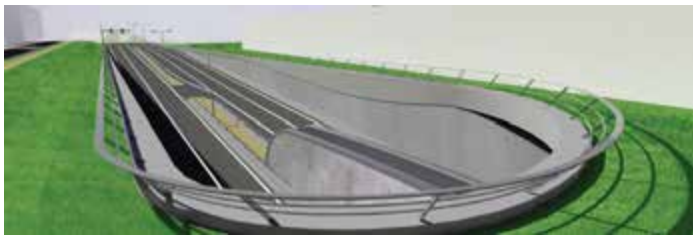
In recent years, a lot of innovative projects have been launched to encourage the use of the bicycle. The Light Companion system enables cyclists to plan quite a way ahead when approaching traffic lights, via a dynamic, green light. Sometimes the green light will flash more quickly and the cyclist will have to cycle faster to get through, another time it will flash more slowly. This system means that cyclists do not need to stand still. The aim of another concept, the Go Light Avenue, developed by Heijmans and Forenzo, is to enable more people to cycle more often and further. On this rapid cycle route, there are few stops, cyclists always have right of way on the route and there is a direct connection from town to town. On the Go Light Avenue, the focus is not only on modifications to the infrastructure, but cycling is also made appealing through active communication, smart price incentives and the ForenZo Cycle Reward programme for which an App is also available.

In the province of Brabant cyclists are encouraged to get on their bikes by a points system: the kilometres are recorded via the smartphone App and they collect points which they can exchange for up to €700 worth of gifts. 2300 B-riders, people from Brabant who leave their car at home and cycle to work, have together cycled more than 6.5 million kilo-

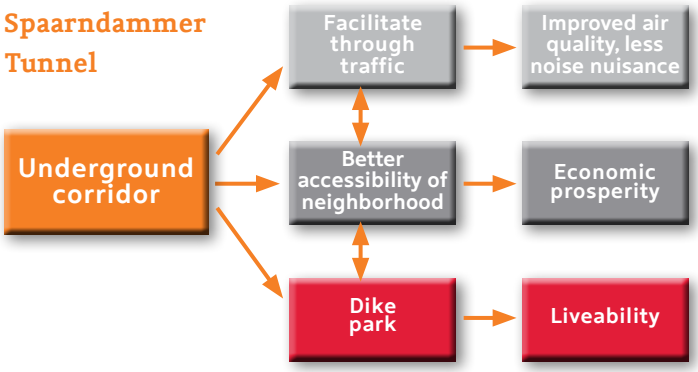
AMSTERDAM TUNNELS

The district of Houthavens in Amsterdam-West is to be transformed into a climate-neutral residential neighbourhood. Following a long history of industrial activity, the area will undergo a radical metamorphosis in the period ahead. The construction of the Spaarndammer Tunnel will connect the new neighborhood with the existing Spaarndammerbuurt.

The tunnel will serve as an underground corridor for through traffic. For access traffic, a 'dike park' will be created on top of the tunnel. The underground section of the Spaarndammer Tunnel will therefore function on the one hand as the roof of the tunnel, but on the other as the base of the park. Via this park, residents will be able to cross the busy Spaarndammerdijk safely and the tunnel and urban park will form an important link between the new district of Houthavens and the existing Spaarndammerbuurt. The dike park on top of the tunnel will be the size of four football pitches. Shortly, when local residents walk, cycle or drive over the dike, they will have a wonderful view over grass and water towards the new section of the district.
The Spaarndammer Tunnel will generate added value for the area, partly as a result of the improved accessibility. This improvement could contribute towards the prosperity of the region. Thanks to the tunnel, the Houthavens will be well connected with the centre. In addition, construction work will provide an economic boost for the Spaarndammerbuurt, as a result of which businesses too will benefit from the newbuildings in the Houthavens.
In addition to the added value created by the accessibility, this link will also help to improve the air quality and to reduce noise nuisance for residents. Whereas through traffic used to drive over the Spaarndammerdijk, this will now only be used for access traffic.

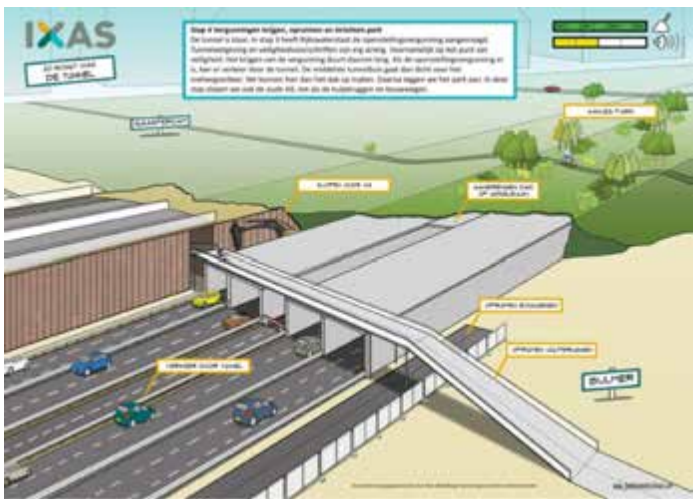


A park will also be created on top of a tunnel in Amsterdam-Zuidoost. A tunnel will be built on Gaasperdammerweg, between the Amsterdam-Utrecht railway line and the river Gaasp. The construction of this tunnel will substantially increase the road capacity on the Schiphol-Amsterdam-Almere stretch. On top of this new tunnel, there will be a park twice the size of Vondelpark, the central park in Amsterdam's old city centre. As with the Spaarndammer Tunnel, one of the main purposes of the park is to connect neighbourhoods. The park on the Gaasperdammer Tunnel will link parts of the Bijlmer district on the two sides of the tunnel, which were first separated by the A9 highway. In addition to this physical connection, the neighbourhoods around Gaasperdammerweg will benefit from cleaner air and less noise nuisance as a result. In the longer term too, more future value can be created, for example by putting effort into recreational amenities which are in keeping with the current hotels, office and conference facilities and Amsterdam's biggest campsite.



Involved parties
Municipality of Amsterdam, Amsterdam Zuidoost city district, Directorate-General for Public Works and Water Management

More information
www.bartels-global.com/projects/spaarndammertunnel-amsterdam
http://en.vshanab.nl/en/projects/detail/a9-gaasperdammerweg



metres to and from work since 2013. For many cyclists, a journey involves cycling as well as using the train, or bus. This requires good parking facilities. In the new cycle parking facility Jaarbeursplein in Utrecht, cyclists can park their bikes next to the station using their smart card for public transport. They can see directly at the entrance to the facility where there are any free spaces, and there is also a cycle shop with repair service. Such good amenities make the combination between cycling and public transport even stronger.

The cycle highway is a new kind of infrastructure in the Netherlands. The F35 in Twente is an example of this: a fast, safe, non-stop cycle link stretching 62 kilometres. The cycle path is wide, the asphalt is of a high quality and there are few junctions. The Province of Noord-Holland combines cycling with generating electricity. The solar cycle path SolaRoad is about 70 metres long and consists of concrete modules, 2.5 by 3.5 metres. Solar cells have been fitted under a top layer of reinforced glass. Since it opened in 2014, the cycle path has generated in the space of six months enough electricity to supply a one-person household for a year. The solar energy generated is supplied to the grid and can be used, for example, for road lighting, traffic systems, and households.

More information
http://en.solaroad.nl/
http://www.fietssnelwegf35.nl/home/english

4.3 Goals besides transport

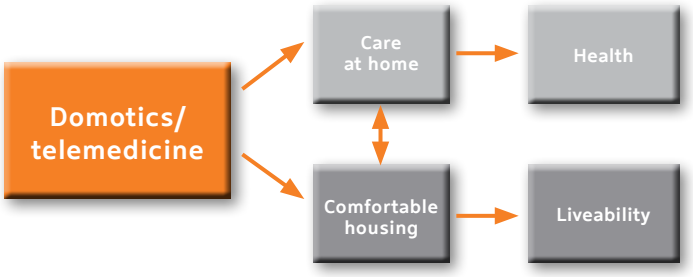
Means of transport, hubs and mobility and traffic management are measures that contribute to effective transportation. This goal, in turn, serves the interest of sustainable accessibility. Other goals and interests may be considered too. Two examples of means of transport that serve two or more ends were given at the start of this chapter: the minibus belonging to the care institution in Amsterdam and the shopping bus in Bellingwedde. These means promote a wide array of interests like education, sport and wellness, as well as the higher goal of spatial quality, due to their role in providing accessibility for these facilities in a given area. Transfer hubs may also serve these purposes when facilities for education, sport and wellness are present at the location. For example, at least three stations in Rotterdam are next door to faculties of major educational institutions.

Station Schiphol primarily enhances the quality of the transport network through its role as a transfer hub. However, the station has additional functions with regard to work, retail and the hospitality industry. It is a multimodal hub that allows all of these functions to achieve added value. Thus working or shopping at Schiphol becomes more attractive because it is so highly accessible, while waiting to transfer to another means of transport becomes more enjoyable due to the shops, restaurants and cafés. A transfer hub like Schiphol serves multiple ends as well as the higher interest of any effectively functioning area – spatial quality. Is it also possible for mobility and traffic management to serve both similar ends and the higher interest?

With a view to mobility management, some businesses are offering their employees so-called ‘mobility packages’: the employee may select their own means or combination of transport within a given budget. Such measures can reduce the number of single-occupant car commuters by 5 or as much as 20 percent. This not only reduces the amount of traffic on the road but also the costs per employee, parking expenses and the cost of work delays resulting from employees arriving late. As a tool of government policy, mobility management can focus on reducing the number of car movements, especially during rush hour, by offering travellers incentives to travel at another moment in time, or to choose a different means of travel. As such, the intended result of mobility management is sustainable accessibility. Reduced traffic enhances spatial quality because it allows the area to function more effectively. IT, and certainly the advent of mobile apps, has greatly improved the effectiveness of mobility management and traffic management as well.

DOMOTICS & TELEMEDICINE - THE FUTURE CHALLENGE POSED BY CARE

Care institutions are currently experiencing a great deal of change, such as the increasing ageing of the population and scarcity of resources and staff. Housing and care form a strong combination, which can play a part in meeting future challenges. Care could be improved in the home environment, because it is not necessary to incur the costs of a separate place for a nursing or care home. Care at home can make life more enjoyable, because care clients can remain in their familiar surroundings. ICT aids can reinforce the advantages referred to, by facilitating care from a distance. Innovations such as Domotics and Telemedicine are part of this development.



Domotics form the integration of technology and services to improve the quality of life. An example is a personal alarm by means of which the elderly can call for help remotely, or a leave-the-room report, which allows nursing staff to monitor clients remotely. New means of digital communication with a doctor or nurse, for example via a smartphone, are also part of this development. Telemedicine is an e-health application whereby a care provider has contact with the client via telecommunications and ICT. In addition to advice or supervision from a distance, Telemonitoring makes it possible to measure certain body data (such as weight, heart rate, pulse and blood sugar levels) remotely via ICT. Components of Telemedicine are also automated, thereby relieving the care provider, and the client answers the initial questions via a multiple choice system. Finally, developments are conceivable whereby it is not the care provider who has contact with the client via Domotics or Telemedicine, but others assist the person in need. Via an online neighbourhood platform, the client could, for example, easily call in local residents to perform light domestic duties.

Domotics are also used beyond the healthcare sector, for instance to provide extra comfort in the home. An example is an automated vacuum cleaner that moves around the house itself, or the Philips Hue connected lighting system for the home developed by Philips Lighting. Philips Hue wirelessly controls lighting across a home both when at home and away via the Hue app and third-party apps, allowing light to be adapted to the needs and lifestyle of the occupant.

Involved parties

Smart Homes, the expert centre on home automation & smart living, Philips

More information

http://www.smart-homes.nl/default.aspx?lang=en-US
http://www2.meethue.com/en-GB/

Traffic management does not reduce traffic, but it does contribute to a more efficient flow of traffic, which in turn improves the functioning of a given area. Another precondition of an efficient flow of traffic is the presence of separate infrastructures for pedestrians, cyclists and cars. Together with strong transfer hubs, these infrastructures allow the transportation system to function more effectively. For their part, mobility and traffic management ensure that all infrastructures and transfer hubs are operating properly. This improves accessibility, which contributes to the good functioning of regions and cities. Means of transport, hubs and mobility and traffic management have historically served as instruments for that purpose. Their effectiveness can be increased by exploring what other ends they might serve, such as education, wellness or work. That extra effectiveness enables these instruments to contribute to multifunctionality.

In conclusion, it is interesting to ask ourselves whether there is a link between transport and combinations of means and ends described in other sections of this book. For example, what factors are at play in the combination of housing and care? The strength of combining housing and care in residential care facilities lies in that shared space, makes them more affordable as well as reinforcing their efficiency. The quality of care improves (because it is administered in the living environment) and the quality of life is increased (because residents know they will not need to leave their home if they require care). What part of this mutual benefit can be maintained if housing and care are physically separate, yet effectively connected by good transport? One aspect lost would be the cost effectiveness of sharing physical space, although the feeling of quality can be maintained in the continued connection between care and the individual's home. The quality of care and the quality of the living environment are increased as a result.

Increasingly, in order to maintain the quality of care and the living environment, residents are working together within care cooperatives. They might establish a daycare, for example, to which care clients are transported. This could potentially offer solutions for the future, especially in shrinkage areas. This might be a reason to maintain traffic and transport as well as possible in those areas. This brings us to another purpose of means of transport: if a minibus is already providing transport for care patients, for example, could it transport students—or even goods—at the same time? Through their cooperatives, local communities are increasingly using minibuses and car services to serve two or more ends at once. Based on the example of combined housing and care, it is possible to assume that transport can help promote the mutual reinforcement of functionality within an area, and thus its multifunctionality.

4.4 Conclusion

As a conclusion to this chapter, it is an interesting exercise to reverse the order of operations here. We might view transport not as a measure to be implemented in order to exert influence on goals and interests, but as the object of the implementation of other measures. In this view, transport is subject to the effects of other aspects. Take the ability to work from home, for example, which is certainly useful for businesses operating from an office. One might imagine a workday consisting of a few hours' work at home, followed by a trip to the office for some meetings, then heading off before rush hour to pick up the kids from school or do some shopping. This will reduce the amount of office space required as well as distributing traffic volume more evenly throughout the day. If employees are able to work from home for entire days, organisations will be able to achieve substantial savings to their transportation budgets. Traffic will also be reduced, resulting in more effective use of both traffic junctions and the spaces at the traveller's destination. Businesses requiring an office would be able to rent less floor space if not all employees were present during working hours, for example.

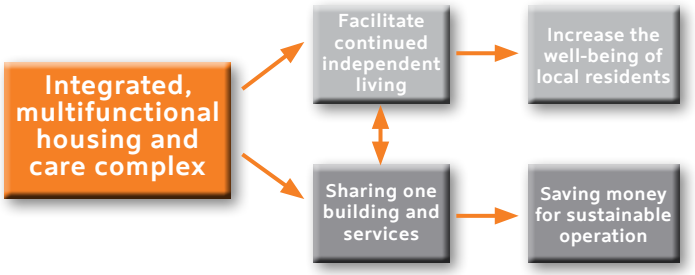
Such an organisation might choose to promote working from home among its employees, which would affect traffic in the surrounding area. The area would suffer less from traffic to and from the workplace, and more importantly, the environmental impact would be reduced. This organisation might also implement mobility management, with apps being particularly useful for this purpose. Local councils could also take steps to manage mobility, through measures aimed at avoiding traffic congestion during rush hour, for example. Together, working from home and mobility management by businesses and local councils can have an effect on more than transportation alone. They can also improve the proper operation of the area as a whole. This chapter, and its position in the book, is intended to

SMART COMBINATIONS OF HOUSING, CARE AND FACILITIES IN DE LAAK

Housing corporation Portaal wanted to set up a more differentiated house-building programme in neighbourhood De Laak, including for example care, than the original brief with just social rented housing. The St. Pieters and Bloklands Gasthuis (St. PBG) in Amersfoort was looking for a new location because the old care home was no longer fit for its purpose. The municipality brought them together. They were also joined by a senior citizens' initiative for group living and a large number of care providers. For the senior citizens, a housing complex that is as normal as possible was created. The comfortable 'life-cycle appropriate' apartments measuring approx. 80 m² do have specific domotics applications and modifications, however, so that good care can be provided. Of the 98 units for assisted living, 79 are currently let to St. PBG as care home places, and the other 19 are used for (intensive) extramural care. Residents from the former care home now live in very spacious conditions compared to their old situation.

Following consultation, a special rent structure was agreed upon. In the initial years, the rent is high, but it falls every year. That makes it possible for St. PBG to run the building. Portaal's investment is not cost effective. The unprofitable part remains at an acceptable level, however, one of the reasons being that the adjacent medical centre is let commercially. The complex also has 24 places for psychogeriatric nursing care and 6 places for short-term admissions. In addition, there is a day centre for elderly people from the area. Near to the care home, Portaal has also created group living facilities for the over 55s. For them, the presence of the care home has added value in terms of possible future care needs. In addition, a few of them work as volunteers in the care home.

The care home collaborates with the adjacent health centre, which accommodates general practitioners, a pharmacy and a physiotherapy practice, among other things. In the medical centre, a number of treatments can be given for which people would normally have to visit hospital. As fourteen disciplines can be found under one roof here, the various care providers can quickly contact each other and refer clients more easily.



The brasserie, the grand café and the multifunctional areas of the care home were designed partly as a somewhere to meet and do activities with local residents and for letting to third parties. This generates extra revenue and provides added value for the residents and the neighbourhood. Other examples of combined functions are the hairdresser's and the beautifully designed shop at the entrance to the care home, which also serves as reception.

More information
http://www.wonenzorg.nl/english

make clear to the reader how transport fits into the argument that a means can serve two or more ends. This clears the way for us to discuss the issue further in the next chapter. How are areas developing now that they are subject to the influence of increasing multifunctionality, in which transport plays a part?

Combinations with roads

Numerous combinations are being put into practice around and with roads:

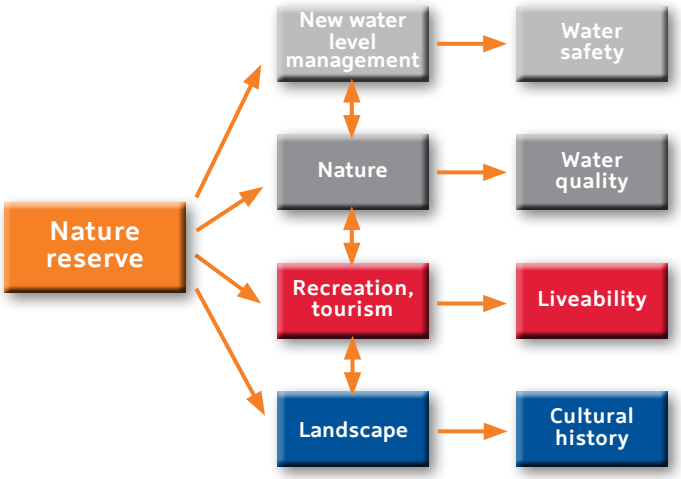
- Motorway asphalt: asphalt as heat exchanger for heat and cold storage
- Rapeseed: exhaust gas purification and diesel production along the motorway
- Interstate energy farming on the central reservation
- Wind energy near motorway
- Wind turbine alongside motorway that provides lighting on the spot
- Parking in the shadow of solar panels and simultaneous charging
- Sound barrier with solar panels
- Sound abatement and building, for example DCRM office
- Sound abatement and housing
- Sound abatement with greenery
- Air-purifying acoustic barrier
- Sound abatement, greenery and capture of fine dust
- Noise-reducing road surface
- Air-purifying asphalt surfacing
- Air-purifying structures along the road
- Self-cleansing verge (road construction, storage and cleansing dredged material)
- Drainage through porous motorway: separate drainage systems no longer needed
- SMART tunnel: combination of tunnel and water exit in event of flooding
- Motorway junction combined with shopping centre
- Use of space under motorway
- Road corridor in combination with other corridors (train, tram, cycle, water, energy)
- Rest stops along the motorway in combination with regional culture

KOOPMANSPOLDER PROJECT

In the Koopmanspolder near Medemblik, the Province of North Holland created a sixteen-hectare nature reserve. It involves wet nature with reed-land, scrub and wet grassland as part of the Ecological Main Structure. In the design, landscape, nature, water, cultural history and recreation are combined with a pilot for new water management. By experimenting with different water levels, the Directorate-General for Public Works and Water Management can learn more about water safety and that is important in connection with rising sea levels. The water managers measure the effects on nature, water quality and the surrounding area. It is interesting to see which combinations are possible in such an area that is enclosed by flood defences.

The unique design for the Koopmanspolder, as a landmark, also enhances the cultural historical landscape of the greater region. In this way, the province and region want to make this area more attractive for recreation and tourism. The differences in height and the variation in wet and drier areas make the polder an excellent habitat for various species of flora and fauna. To allow water in and out, a fish-friendly inlet is being created on the north-west side of the polder. It concerns an innovative tubular auger driven by a small wind turbine. This not only allows fish to enter the polder, but also return to the IJsselmeer, the large inland lake in the middle of the northern part of the Netherlands after spawning. A good flow and fish stock are also essential to limit insect populations, for example mosquitoes.

There is restricted public access to the polder. In the western part you can walk over the 'rings of the whirlpool' via small dams or plank bridges. There is also a plan to use the polder as an ice rink during the skating season. The eastern section of the polder will retain an agricultural function, in part. Here, sheep can continue to graze, for example.



The footpaths on the dikes around the polder will remain accessible. By realizing the many functions of this project simultaneously, it is certainly a constructional combination. If, following completion, these functions are mutually reinforcing, it will also be an operational combination.

Involved parties

Province of North-Holland, Hoogheemraadschap Hollands Noorderkwartier, Rijkswaterstaat, Deltares, Municipality of Medemblik, Staatsbosbeheer

More information

https://www.youtube.com/watch?v=ILX0SpBe-I4
http://fishflowinnovations.nl/en/news/news

Foto: http://www.noord-holland.nl/web/Themas/Groen/Groenprojecten/Koopmanspolder.htm door Kwint van den Berg

Chapter 5

Multifunctional area development

5.1 Introduction

An area is nearly always multifunctional because a wide variety of functions occur within it: for example, living, working, water and nature. The previous chapter made it clear that transport connects all these functions, but do they reinforce each other as well? For the purposes of this book, multifunctional means that mutual reinforcement occurs because parties have combined goals and are sharing means. A closer look tells us that many areas are lacking in this regard. The functions in these areas are often separated so that they do not impede one another. Transport is then required to move people and goods from one function to another, which does not improve the mutual reinforcement of the functions. However, change is underway: many examples in this book demonstrate how more and more people are embracing health as an intersectional theme. In their efforts to build healthy cities, they examine how elements such as housing, greenery, water and transport can contribute to this goal.

In this book, climate is another example of an intersectional theme that connects functions in a given area. Parks, public gardens, green roofs, surface water and many other elements are ways to make a city climate resistant. The fact that this promotes good health is obvious. In other words, the intersectional themes of health and climate continue to intersect each other, resulting in multifunctionality. The previous chapter provided a number of additional examples, such as the connection between living and working that transport helps to support. An example of an area in which cohesion between divergent functions has been given priority is the Zuidas area in Amsterdam, see page 51.

The previous chapter recognised the importance of IT as a tool for mobility and traffic management. These two instruments help to connect the functions within a given area and designate a role for IT in the management and development of areas. That applies not only to the transport of people and goods by road, the central issue of the previous chapter, but to other types of infrastructures as well. For example, the efficient distribution of energy over a smart grid, supported by IT, can add significant value to an area. What is now taking shape is a view of functions, and of the cleverly arranged flow of transport between them, that allows an increasing number of functions to reinforce each other. At that point, all aspects of the area are brought together, drawing attention to area development as a subject that certainly deserves to be included in this book on multifunctionality.

This chapter will focus on area development, in particular on arranging areas to achieve multifunctionality. The first step focuses on area development. The second step will add new ideas to existing ones by indicating how area development can be guided by ideas for achieving multifunctionality. The principle behind this approach is that multifunctional area planning will achieve better economic and sustainability outcomes than the older, more mono-functional forms of area planning. This could inspire the creation of an area-specific fund, in which revenue resulting from multifunctional area planning is deposited before then being available for re-investment in the subsequent step of the area planning process. This sometimes involves investment in temporary functions, while more and more frequently, IT and smart grids are playing a role in coordinating the functions within a given area. All in all, a vision is emerging: a future of multifunctional areas in which temporary and permanent functions together form a cohesive whole and are connected by intelligent transport and smart grids. This chapter outlines this future.

5.2 Views on area development

During the final decades of the last century, 'planning by permission' was dominant. This means that an initiator is granted permission for a project that is profitable for him. This is not only a permit to build, but also permission to burden the area with negative side effects, for example noise pollution. Positive side effects also occur, which produce benefits for others, for example improved social safety due to homes being positioned so well that the public space can be monitored.

Historic defences form breeding ground for multifunctionality

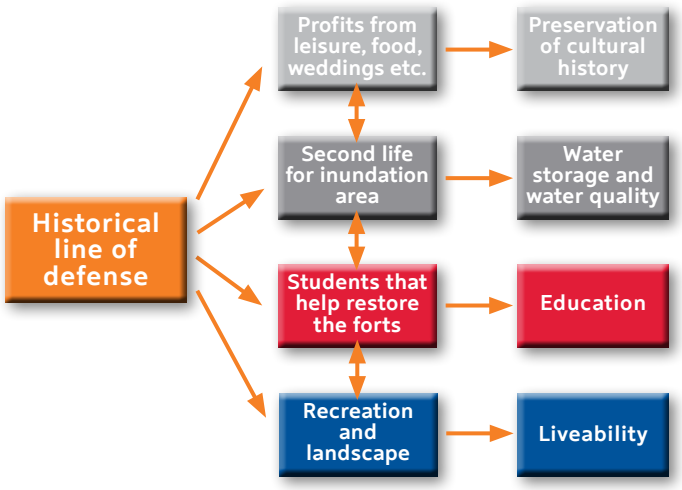
CULTURAL HISTORY AS STARTING POINT FOR COMBINATIONS

The Nieuwe Hollandse Waterlinie (New Dutch Waterline) runs from Muiden (to the east of Amsterdam) to the Biesbosch, a national park that lies east of Rotterdam. It consists of forts, inundation areas and other elements such as locks and bunkers. From 1815 to about 1940, the Nieuwe Hollandse Waterlinie served as a line of defence. If the enemy reached it, strips of grazing land could be flooded. After the Second World War, the area lost its function. Most of the elements of this old defence system do not produce returns, but are running costs. Despite this, their preservation is considered important from a cultural-historical perspective. The loss incurred by managing these elements will therefore have to be compensated for as much as possible by profit. For example, forts are used as wedding and conference venues, for overnight stays, as museums, art venues or offices, or an inundation area is leased to a farmer. Very valuable contributions, because the 'Waterlinie' benefits financially.

More drastic combinations are also conceivable. For example, a second life for an inundation area by using it for water storage and water treatment. The costs are reduced by sharing the construction and management costs with the water board, and the profits increase by earning from storage and treatment. In another combination, students help with the maintenance and restoration of a fort. This reduces costs for the Nieuwe Hollandse Waterlinie and improves the quality of both the fort and the education. There is a comparable project around the 'Stelling van Amsterdam' (Defence Line of Amsterdam). Fruitful combinations with recreation authorities and landscape managers are also conceivable, whereby costs would be shared and it would help improve the quality of the Nieuwe Hollandse Waterlinie, recreation and landscape, perhaps even in a trilateral arrangement.

Involved parties

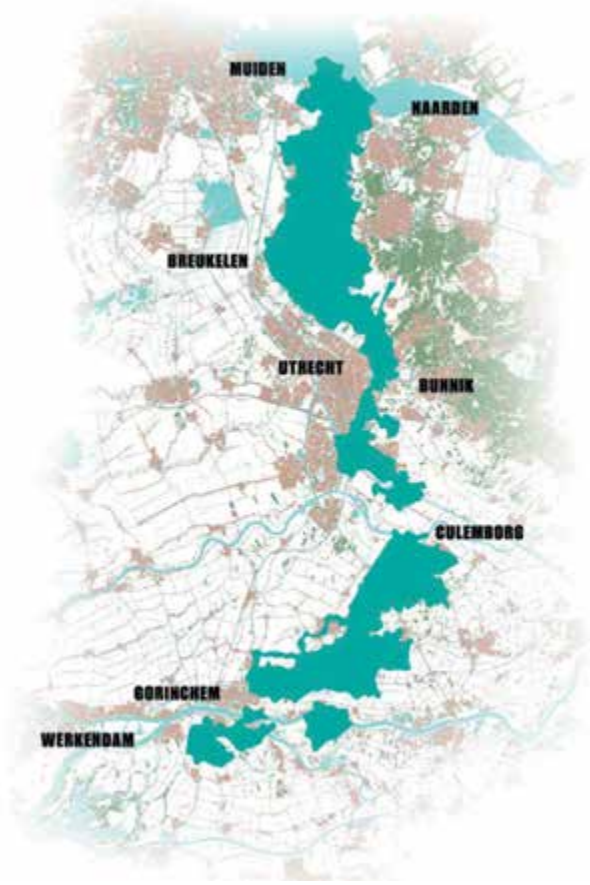
NHW planning office, four ministries (Education, Culture & Science, Economic Affairs, Agriculture & Innovation, Infrastructure & the Environment and Defence), five provinces, municipalities, water boards,



organisations and entrepreneurs in the field of cultural history, recreation and agriculture, among others.

More information

https://en.wikipedia.org/wiki/Hollandic_Water_Line
http://pho.home.xs4all.nl/Dutchwaterline/dutchwaterl.htm
http://www.herstelling.nl/english/ (a project involving the Stelling van Amsterdam, comparable to the Nieuwe Hollandse Waterlinie).



Within the practice of planning by permission, little attention was paid, however, to positive side effects, because the profit comes from realizing the permitted project as quickly as possible and not from side-effects which only yield a profit once the project is up and running.

When, some twenty-five years ago, the term development planning made its breakthrough, a link was made between the significance of a project for the area as it was previously, is now and will be in the future. Underlying idea is that the value of an area develops steadily through the projects and activities which occur there. In this way, using what is already there is an economic motor of area development. With development planning both negative and positive side-effects matter. Every project is an integral part of the environment and is assessed and evaluated as such. Simply building a residential neighbourhood without thinking about social safety proves to be expensive in the long run, because an unsafe neighbourhood falls in value. A failure to take into account such facilities as schools, shopping centres or infrastructure is less sustainable than if you do so.

Taking into account means that side-effects are coordinated with each other: for example, can the shopping centre withstand and absorb the noise from the infrastructure, can schools be made accessible easily by means of this infrastructure? This integrated approach, whereby a project adds value to the area, is an important feature of the original view of development planning. With the introduction thereof, people worked on the basis of the idea that an area combines functions, such as housing, work, recreation, water, nature and culture. However, they still thought in much the same way as old-fashioned planners, who could oversee these functions from above and attribute them to an area from the drawing board. Nowadays, when the use of an area is the motor for developing it, the integration increasingly comes from below. It is mainly the users who see which functions can reinforce one another in an area.

Many parents and teachers have worked to set up community schools, because they as users realised that this would better enable them to retain such functions as education, library, childcare and a music school for their area. Area development where the focus is on the user calls for accompanying spatial policy. The government no longer decides what is desirable, because it is unable to realize these desires. The funding must come from the area, through the intervention of users and local residents. They are the motor for development, in accordance with the old triad: interest, payment and say. If you, as government and market, want to take part in area developments, this is only possible on the basis of participation. A precondition for this is that you provide added value, for example if you help the users have their say. That calls for a following step in planning, as the government (and market) must actively seek partners in the area development: 'planning by invitation'.

With planning by invitation, governments roughly set out where spatial changes are and are not wanted with a view to long-term forecasts and the values to be protected. They do not impose these outlines on the area, however, because that would make the government itself an uninvited guest. It is a question of what the area itself seems to be asking for, on the grounds of the existing values and users. The government would be well advised to listen carefully to the existing and future users of the area. The desired direction of the development is then set down in an appropriate vision that is inviting to users. This fits with the basis of development planning to make a link between the significance of a project for the area as it was previously, is now and will be in the future. Initiators to whom this appeals see opportunities for realizing their ideas and dare to take risks. With their initiative, they develop the appeal of the area further and it subsequently increases in value. The cash released can be reinvested in new projects in the area, but will this create multifunctionality?

5.3 Developing multifunctionality in the district

Integrating greenery and water across the Zuidas area and their function with regard to a pleasant living environment are examples of multifunctionality in the area. The noise barrier near Stadhagen is being constructed to simultaneously function as an emergency flood defence, much like the Kristalbad example where construction serves five functions at once: water storage, water purification, nature, recreation and im-

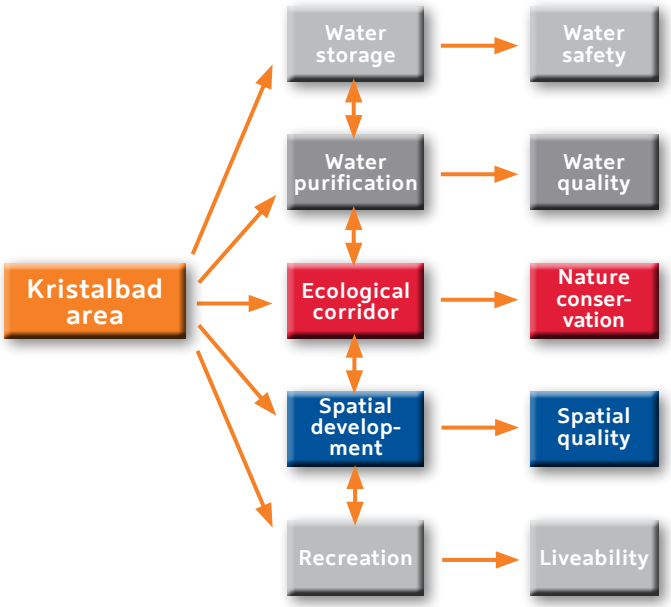
KRISTALBAD, CRYSTAL BATH, WATER STORAGE AREA

Enschede, the most eastern city in the Netherlands, lies higher than nearby Hengelo, the second most eastern city. Heavy rains on the paved surface of Enschede create the risk of flooding Hengelo. Kristalbad is an investment enhancing the resilience of both cities and of the area itself. It's a water storage area that mitigates the risk of flooding, and creates the option for the next investment, turning this area also into a nature reserve. This second investment creates the option for another next investment, turning the soil into a means to purify water. At the same time this second investment improves the quality of the first investment, since nature helps to store more water in the soil. Thus in total five goals have been combined:

1. Water storage
There is too little room in Enschede and Hengelo to store excess rainwater. Furthermore, there is a considerable difference in height between Hengelo and Enschede. During heavy rainfall, the water runs too quickly, as it were, towards Hengelo. To guarantee dry feet in Hengelo, the water from Enschede has to be collected temporarily. Following the construction of the Kristalbad retention area, the water board will be able to store 187,000 cubic metres of water in times of excessive precipitation.

2. Post-treating water and making it biologically active
Some of the water in the Kristalbad comes from the Enschede sewage treatment plant. The Vechtstromen Water Board therefore came up with a design for the further treatment of this water. The Kristalbad is made up of compartments, which are filled, empty and run dry by turns. Under the influence of light, air and vegetation, the water bed does its purifying work: it breaks down and converts matter.

Photo thanks to Water board Vechtstromen



3. Ecological corridor
In the new situation, the whole Kristalbad project area serves as an ecological corridor. There is great variation in biotopes for numerous species of flora and fauna. The biotopes vary from dry to wet and from woody via shrubs, reeds and scrub to open water.

4. Spatial quality
The area between Hengelo and Enschede is at its narrowest on a level with the project area. By bundling road, rail and canal, a fragmented landscape of residual spaces with limited value in terms of nature emerged. The construction of the Kristalbad provides the opportunity to preserve the scenic quality and reinforce it with its own identity. The Kristalbad forms a permanent green buffer between the two cities.

5. Recreational use
The Kristalbad offers extensive recreational possibilities. This mainly involves walking and cycling. Observation towers provide excellent views of the nature reserve between both eastern cities.

The water-storage function of Kristalbad not only involves treating water, but also keeping people's feet dry. Although there is no direct relationship with a flood defence structure, by storing water the Kristalbad does serve a damming function. Furthermore, this example, like the Koopmanspolder (see page 46), shows what is possible within an area: the Kristalbad project achieves five different functions simultaneously, these functions reinforce one another.

Involved parties
Water board Vechtstromen, Municipality of Enschede, Municipality of Hengelo, The Landschap Overijssel Foundation, Province of Overijssel

Amsterdam South Axis District in 2030, Zuidas

In 2030, people in and around Zuidas, South Axis Amsterdam, will be able to look back on a profound transition of their district. The ambition is that Zuidas will continue to develop as the international business centre of the Netherlands. However, Zuidas will stand apart from other such districts due to a mix of functions: commercial and office space, hotels, shops, bars and restaurants, sports facilities, public spaces, leisure, VU University, VU University Medical Centre, the RAI conference and exhibition complex, and last but not least: housing. Zuidas will be a multifunctional and lively place to work, to live and to reside.

An Amsterdam neighbourhood

Zuidas will eventually have around 7,000 residential units of various types, meeting the housing needs of some 15,000 people. One of the goals is to achieve balance between rental and owner-occupied property, as well as variation in size and price. Zuidas will not only attract first-time buyers, students and people who are merely 'passing through', but also those who intend to stay indefinitely and are more inclined to invest in a home and its setting. The aim is to make a popular neighbourhood with greenery in the design of public space and essential services and leisure facilities matching the needs of the users.

Connected to greenery and water

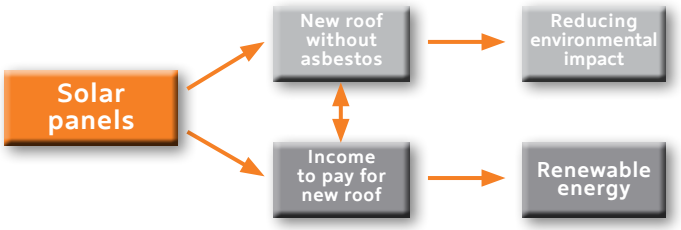
In 2030 Zuidas will have a network of green areas, large and small, new and established, at ground level and elsewhere, public and private. Greenery and water elements are essential to the human dimension of Zuidas. There will be:

- Sports fields
- Playgrounds
- Pocket parks
- Greenery on buildings and the rooftops and
- A 'Daklaan', a green path at a high level to walk and cycle

Besides the leisure benefits, greenery and water have an important functional goal. Plants play an essential part in regulating the microclimate and in water management. Water also plays a significant role, not only as a buffer providing extra storage capacity but in relation to spatial balance and user perception. Adequate measures will be taken to

REPLACE ASBESTOS ON ROOFS WITH SOLAR PANELS

Asbestos roofs are common on farm buildings, commercial premises and homes. From 2024 onwards, there will be a ban on asbestos roofs in the Netherlands. However, the financial viability of asbestos removal is a major obstacle in implementing the ban. One way of maximising the incentive to invest in this process is to install solar panels. With solar panels, you can cover your own energy costs, but also feed electricity back into the national grid, thereby generating income. This could mean that asbestos removal not only costs money, but also makes money. In order to encourage the replacement of asbestos roofs with solar panels, the Dutch Ministry of Infrastructure and the Environment is going to combine the existing tax regulations for the removal of asbestos roofs and the installation of solar panels.



There are a number of reasons why the installation of solar panels to replace asbestos roofs is still not a feasible solution. Four sticking points make the financing of asbestos replacement with solar panels problematic:

- Technical issues, as a result of which not all energy generated can be fed back to the national grid
- Changes in energy prices, as a result of which the revenues do not counterbalance the costs
- The fiscal schemes and subsidies, which are inadequate
- Increasing charges for removal and new roofs due to the shortage on the market.

Due to the high investment costs and the low returns, there does not seem to be a viable business case for the individual entrepreneur at the moment. One way of removing financial obstacles could be large-scale replacement. As soon as the solution becomes financially viable, it will be possible to create added value through the smart combination of replacement of asbestos by solar panels.

Involved parties

The Dutch farmers' association LTO, the Dutch Ministry of Infrastructure and Environment, AT Osborne.

Source: Asbest van het dak. Energie in het bedrijf, LTO Noord rapport 300pb10|WV|LA

manage groundwater, surface water and rainwater. Zuidas will be 'rainproof' even in times of extreme precipitation. Examples -partly already realized- are:

- More energy neutral buildings, like The Edge, the Valley and the new pavilion of ABN AMRO
- Run-off storage below building and paved areas, like the new bicycle parking underground 'Mahlerplein' with water storage capacity
- Extension of 'De Boelegracht', a canal

Zuidas and accessibility: space for the bicycle and public transportation

Due to the particularly intensive use of space, the balance between accessibility and quality is under increasing pressure. The central area must not be a barrier but a hub at which various connections converge. There will be more space for cyclists, pedestrians and public transport users, especially in the central zone. This will entail prioritizing these transport modalities along certain routes: they will be given 'right of way'. The key ambitions for both the short and longer terms are therefore:

- Realization of a better, more complete cycle network, with new routes to and from Zuidas, broader dedicated cycle paths, a more tightly knit network, safe road crossings and a 30 km/h speed limit for other traffic.
- Realization of parking and storage facilities for bicycles, mopeds and scooters.
- A compact and renewed public transportation station Amsterdam Zuid.

The Zuidasdok project involves a major upgrade to Amsterdam Zuid station. There will be shorter and more convenient connections between rail, bus, tram and metro services. Beginning in 2017, a six-kilometre section of the A10 motorway is to be widened, with part of the road moved underground through two parallel tunnels. The space created above ground will be used to expand and upgrade Amsterdam Zuid station. The Zuidasdok project is scheduled to take ten years.

More information

file:///C:/Users/JHEI/Downloads/building_blocks_vision_zuidas_2015%20(1).pdf

proving spatial quality. Arranging for construction projects to coincide with one another reduces total costs, this is known as a 'win-win situation'. That is happening now across the Zuidas area as well, with the construction of the Zuidasdok project for example.

A multifunctional project frequently involves adding a second function at a later date, some time after the first function has been taken into use. Take the use of solar panels instead of asbestos, for example, where new roofing is installed on top of the existing structure of an old barn. The Orlyplein case is another good example: a decades old station square was refurbished to create a space with green value. The square also collects rainwater and is still a place for relaxing and enjoying the shops, cafés and restaurants. In fact, it's entirely possible that the renovation work has created potential for adding yet another function to the station square in the future: urban agriculture, for example.

Multifunctionality, combining goals and sharing means, can be an ongoing activity. New goals may be added along the way, which will need to share the means that were already being divided among two or more goals. One example is a green roof that, in addition to water storage and insulation, serves the purposes of urban agriculture and efforts to increase biodiversity as well. If the amount of greenery at ground level increases later on as well, the water authority may decide to disconnect rooftops from the public sewer system. The capacity of the sewer system may be sufficient at that time, saving the investment costs required to successfully collect and store large quantities of water. The pattern that emerges is an upward trend in investments that stimulate and reinforce each other, whilst reducing costs due to their multifunctional nature. The investments therefore build on each other. This is 'planning by invitation', in which one function invites and enhances the other. An example of this is the Nieuwe Hollandse Waterlinie, a 19th century defence line of waterways.

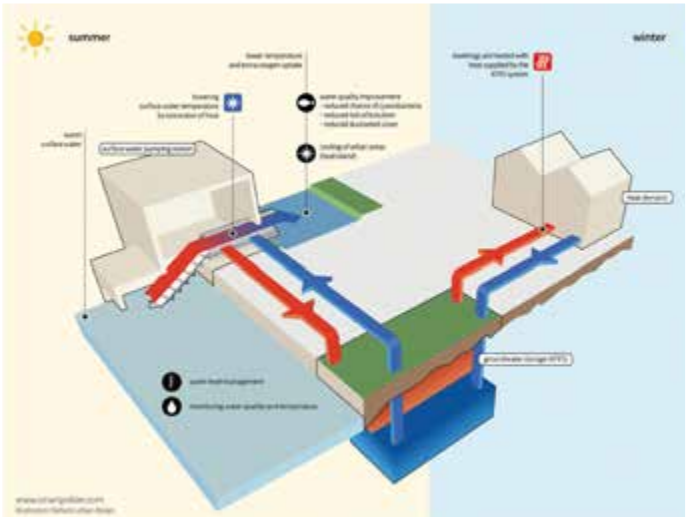
SMART POLDER

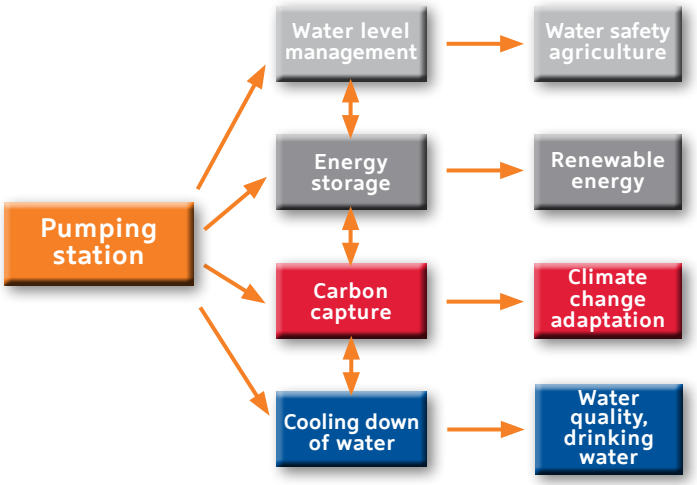
The technology at the basis of the Smart Polder concept involves generating energy from surface water. Heat and cold are extracted from surface water with the aid of heat exchangers, and used to heat or cool buildings or processes. It becomes interesting when you combine this with improving the water quality and the supply of freshwater. Interesting also is the use of pumping plants that are there already for water level management. They can also pump hot and cold water up and down for an ATES, Aquifer Thermal Energy Storage (see page 60). The Smart Polder is still at the experimental stage; several small systems are currently operational.

Pumping plant as thermal energy plant

The heat available in surface water that is pumped by means of a pumping plant can be converted into high-grade heat with a heat pump to heat buildings or prepare warm tap water. The great potential lies in the combination of heat or cold extraction with seasonal storage such as ATES. Here, use is made of the natural difference in temperature between the surface water in the summer and the winter and the temperature of the groundwater (approx. 12°C). In the summer, using the pumping plant, the heat can be extracted from the surface water and stored in an ATES. This heat can then be pumped back up in the winter to serve as a source of heat for the heat pump. This can be used to produce heat in a highly sustainable way.

Another result is that the surface water that is pumped around in the summer cools a few degrees, which has a positive effect on the quality of the surface water. Particularly in the urban environment, where the urban heat island effect has a negative impact on the temperature of the surface water, local issues arise in terms of the water quality, such as blue algae, scum and botulism as a result of dying fish. That is often the consequence of an excess of nutrients (eutrophication) in combination with too warm surface water, as a result of which the natural processes are speeded up. By brining movement into the water, it can absorb more oxygen. This effect is heightened by cooling the water a few degrees. Colder water also inhibits a number of negative processes. In this way, the Smart Polder can contribute towards climate adaptation and future-proof water management.





Pumping plant as cold power plant

In the winter, cold can also be extracted from surface water and stored for use during the summer. In this way, it is possible to provide highly sustainable cooling with low temperatures (7 to 9 °C) without additional technologies. Here too, cold can be supplied directly if the temperature of the surface water is low enough. Since the pumping plants are meant for water level management, they have a high capacity, and therefore even a limited change in temperature makes very high heat or cold output possible. With the use of ATES, no cooling water is discharged in the summer.

In the smart polder, water level management, freshwater provision and improvements in the water quality are coupled with generating sustainable energy. By linking the water and energy sector, added value is generated, which can be translated into energy savings, reductions in carbon emissions, costs savings and improvements in the water quality and the “urban” climate.

Involved parties

IF Technology, Valorisation programme Delta technology & Water, Ministry of Infrastructure and the Environment, Association of Water Boards, Higher Water Board of Delfland, Alliander, Rivierland Water Board, Province of Gelderland, Zuiderzeeland Water Board

More information

http://www.cleantechdelta.nl/project/smart-polder/

In a fort that forms part of the Nieuwe Hollandse Waterlinie, a group of people manage a museum together. They run a small catering venture, which helps to keep the museum going. The museum and catering facility add to the recreational value of the surrounding area. This provides the motivation for a farmer to run a small campsite on his farm. It is in keeping with this to maintain a lot of greenery around the farm. In this way, the chain extends from the fort, to the farm, to nature and it can perhaps be extended even further by, for example, bringing in care clients to work on the farm and around the fort. Such activities add value to the area and make it more sustainable. This is an alternative to the old policy, in which a lot of money was spent on buying sustainability in the form of new nature. Now that those days seem to have gone, managers are looking eagerly in rural areas for alternative earning models so that they continue to have access to funds for maintaining the quality of water, nature, scenery and things of cultural value.

Sustainability increases when, in an existing area, people come together to undertake new activities together and, in this way, create added value on the basis of what is already there. This kind of area development provides solutions for creating value even with less money. In urban areas, people are increasingly getting together in this way. In rural areas, the point of departure is different. Less money is available there and, in addition, people often ask if there will be over-cropping or too many trees felled, too many houses built in the rural area and too much space devoted to recreation. All justified questions, which can be traced back to whether or not a sustainable balance is possible between earning from an area and maintaining the area on the basis of these earnings. The challenge is to 'harvest' (sustainably) from an area, generating sufficient returns to further develop the area, also in the long term. In other words: to make the area self-supporting or, even better, self-sustaining. An area-specific fund could help meet that challenge.

5.4 Area-specific fund

The 'Smart Polder' concept is based on that of a pumping station, whose original function was water level management. In many cases, investment in the pumping station took place long ago and has long since been amortised. This kind of investment is also known as sunk costs: investments dictated by past decision-making. When that decision was made, however, no one predicted that the pumping station would also be used for heat and cold storage in the deep layers of the soil. The Smart Polder case demonstrates that investments in the past may sometimes lead to unforeseen yields in the future. Previous investments may be utilised in order to achieve these new yields, resulting in significant savings. Using a pumping station for energy storage breathes new life into a past investment, which retains its previous function at the same time. The Smart Polder concept provides a series of examples of functions that may then ensue, such as surface water purification. The surface water is cooled as its warmth (heat energy) is stored in the soil.

In the preceding case, the pumping station is a means that becomes the lynchpin anchoring subsequent investment by attracting other investors to join in. For example, these investors might make use of either the stored energy or the clean water present at the pumping station. Area development then resembles a kind of 'hopping procession of Echternach', taking two steps forward and one step back. A step in reverse is the revaluation of a past investment and the maintenance of this investment for its current function. The first step forward is the innovation that bestows a new function on the old investment object. In the case of the Smart Polder, this is the subterranean heat and cold storage. The next step forward is the future value that is being created; with the Smart Polder, this value is water purification. The procession continues when this realisation of future value eases and encourages the next round of investment. This method of area development is particularly efficient, in economic terms, as it brings new value to old investments while minimising the cost of new investments. That can make this type of investment attractive to financial supporters.

Such 'clearing the way' for new investments has been intentionally put into practice in the SSRS (Self-Supporting River Systems) project. The maintenance contract of the project provides for a 'Self-Supporting River Systems Learning Space'. Acknowledgement of each other's separate and overlapping interests forms the starting point for the Learning Space SSRS; fundamental understanding of each other facilitates the shared responsibility for the innovations and involved risks.

SELF SUPPORTING RIVER SYSTEMS

Dutch river management has become quite dynamic and complex over the past decades. Floodplains were traditionally used for agriculture, clay and sand mining. Management measures focused on levee construction, maintaining the water discharge capacity and optimizing the dimensions of the fairway. Due to an increasing number of societal stakeholders in the river landscape, functions like nature restoration and recreation have been added (to the traditional land uses).
The situation has become even more complex after the implementation of programs like 'Room for the River' and the European Water Framework Directive which made the river system more natural and dynamic.

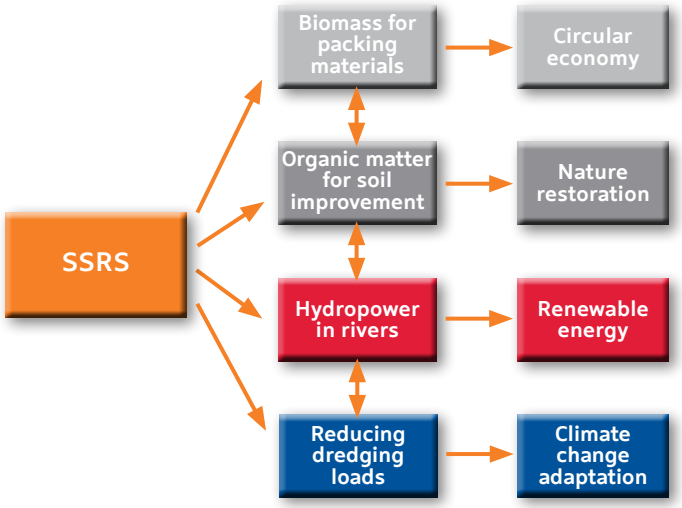
The programme SSRS (Self Supporting River Systems) is addressing the quest for technological innovations and the fierce organisational challenges that come along with these new developments. SSRS strives to use the natural dynamics of the river system in order to make river management more affordable, reliable and sustainable. SSRS is achieving this by embracing concepts like ecosystem services, natural capital, nature based solutions and building/maintaining with nature. SSRS is focusing on themes like:

- Using residual biomass from floodplains as fibers for packing materials
- Organic matter for soil improvement
- Hydropower in rivers
- Reducing dredging loads by efficient sediment management

Co-creation in the IJsseldelta

There is an ever growing pressure on all public service organisations to become more efficient, market oriented, transparent and collaborative. This is no different for floodplain and river management organisations. These pressures resulted in management strategies based on co-creation and a more cost-efficient maintenance program. Co-creation implies a fundamental change in the traditional principal-contractor relationship.

For the SSRS program, this resulted in the 'Learning Space Self Supporting River Systems', which is a part of the maintenance contract IJsseldelta – Twentekanalen. The contract for the Learning Space is signed by the 'Golden Triangle' of a business (contracters consortium BAM – Van den Herik), government (water management authority Rijkswaterstaat) and researchers (independent institute Deltares). The three partners have been awarded the second prize at the European Public Procurement of Innovation (PPI) Award in October 2015 for introducing the Learning Space into the maintenance contract. The



Learning Space SSRS offers the possibility to cooperate on an equal level within the golden triangle. This cooperation facilitates the joint development of innovative ideas within the IJsseldelta. The Learning Space SSRS started in 2015 and is now preparing a number of business cases for pilots to start in 2016. The current cases are:

- ***The aquabot***

Students of the RDM Campus in Rotterdam are developing an Aquabot. This is a small self-floating boat that can perform detailed measurements of the riverbed.

- ***Sediment measurements***

The Jumbomat plans to fill the erosion pit at the tip of a groyne with sand and then cover them with an strong woven mattress to prevent erosion of the riverbed. The X-blocks pilot plans to replace a conventional groyne by an open construction consisting of interlocking concrete blocks. This type of groyne will be more permeable resulting in less concentrated currents and less scour.

- ***Submerged trees***

Whole trees will be submerged and anchored in the riverbed to offer a natural environment for small fish and macrofauna. This will also have an effect on sediment transport.

- ***Sheep as vegetation managers***

The vegetation of riverbanks could be cut naturally using sheep, this should be safer and more sustainable than mechanical maintenance. First pilot started in 2015.

- ***Biomass***

Biomass from the river plains could be used in nearby farmlands to improve the quality of the topsoil. Other pilots are focusing on high-valued use of biomass for paper or other products.

Involved parties

The Directorate General for PublicWorks and Water Management in alliance with the different parties in the river and canal acreage.

More information

www.ssrs.info (online in March 2016)

This way, innovations that contribute to each party's interests can be enhanced and an innovation process based on equality is achieved. The project team of the Learning Space assesses innovative ideas for sediment and biomass, consults specialists, makes business cases and starts pilots. The Learning Space aims to process a continuous stream of innovations during the five-year period of the maintenance contract.

When the future value of an investment is clear, it is not necessary to have a party lined up to make an immediate investment. Take for example the relocation of a dike in order to give a river more room to rise, or the creation of space for water storage. Moving the dike further back would make a harbour possible, while the facilities for water storage could potentially take on water purification as well. Imagine that certain parties are interested in developing the harbour and the water purification facility, but are unable to invest at the same time as the initiators. In that case, funding from a public or even private financier could help to bridge the gap. Such a financier could weigh the opportunities that might present themselves in the area if a series of investments are made because they create good conditions for each other. The financier might establish an area-specific fund and receive income from such a fund. These investments could yield a profit because they will continue to gain new functions in the future. When the revenues from these investments find their way back into the area-specific fund, the fund can grow and continue to support subsequent investments. Sometimes these investments are made in temporary zoning designations.

Temporary redesignation

Temporary redesignation means temporarily making use of a building or area for a function other than that for which it was originally intended. This can involve all manner of situations, including using an existing building for a different purpose for a time or erecting a temporary structure. It might additionally mean the short term use of areas for purposes of nature, energy, recreation, water and events, cultural or otherwise. Naturally, a temporary redesignation is not the same thing as combining functions. But flexible use does broaden the basis for combinations, certainly if various uses are permitted, as is the case with the Marconi Freezone in the harbour of Rotterdam. This former emplacement was temporarily designated for use as a free zone: port storage warehouses and temporary architecture offered space for establishing studios and hosting exhibitions, as well as housing the work of experimental makers and restaurants and/or cafés. Two other examples are the Strijp-S area in Eindhoven and the ACTA building in Amsterdam.

Strijp S

Strijp S is a former office park of some 27 hectares in the Eindhoven neighbourhood known as Strijp that was formerly home to the Philips company. The neighbourhood has been in the process of redevelopment into an urban residential area since 2000, see www.strijp-s.nl/en/home. Due to the vast size of the office park, the redevelopment project is expected to continue for some years. Temporary functions have been authorised within a 2,500 m2 space known as Plug-In-City, www.plugincity.nl/en/home. There is plenty of room for creativity, providing it meets the single condition that it is safe. Plug-In-City has developed rapidly over 2015 into a place of collaboration and creative diversity. It will continue to grow over the next coming years as a bottom-up creative community. The possibilities are endless, from studio to gallery, from temporary events to a pavilion or unique hotel room. New life grows in this former sterile area, leftover materials are reborn into new objects and temporary buildings; plants are slowly invading roofs and open spaces. The circular principle promotes warmth and respectful interaction.

The ACTA building

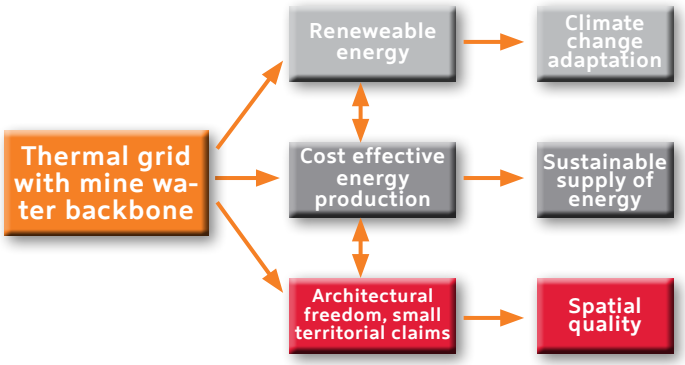
The ACTA building was an empty office building in Amsterdam, which was converted into temporary accommodation for students. The owner, housing corporation De Alliantie, did put the building in the hands of two managers: the foundation 'Temporary Wonen Amsterdam' (TW-A) and Urban Resort. TW-A is responsible for the creation and manage-

MINE WATER, STARTING POINT FOR SUSTAINABLE ENERGY IN HEERLEN

A hybrid sustainable thermal smart grid for heating and cooling
Some buildings, like older dwellings, require almost constant heating, whereas others, such as data centres, need cooling. If the two were connected by a thermal grid, the surplus heat from the data centre could serve its neighbour's demand for heat, with the latter producing cold for the centre. In Heerlen, the thermal smart grid is organized in clusters linked to a mine-water backbone. The cluster grids are designed as a two-pipe system with ultra-low heat (26-28 °C) and high temperature cooling (16-18 °C). Each building -or building complex- is connected to a decentralized energy plant with heat pumps, additional renewable energy support and/or energy buffers. The purpose of these energy plants is to satisfy demand from the buildings and also maintain the temperature conditions in the grid. The backbone serves to exchange energy between the cluster grids and is linked to an underground mine-water reservoir. Production wells supply the missing heat and cold to the mine-water backbone. Surplus heat and cold will be stored in the reservoir through injection wells. In the future, all wells will become bidirectional for synchronous production and injection of mine water, as well as for capacity enlargement.

Low losses and high efficiencies due to the low exergy principles within the system

With the mine-water reservoir, a huge (geo)thermal storage capacity is available. More than two million m^3 of water can be stored with a temperature variation of 10 - 15 °C, which gives a capacity of over two million Tesla powerwalls; one such powerwall is able to store 10 kWh, the average daily electricity consumption of one dwelling. Moreover, the thermal mass in the buildings and the grid can be utilized and additional buffers at building and cluster level are used. With this storage capacity, a shift of energy exchange is possible in time. Through long-term seasonal buffering, summer heat (from cooling or solar collectors) can be stored for the winter. With mid-term buffering, peaks (weeks/month) can be significantly reduced within cluster grids to increase the capacity. Following from the thermal mass connected to a large cloud of heat pumps, the hydraulic grid is able to stabilize fluctuations in the electricity grid caused by green electricity generation (e.g. solar/wind power). Important for advanced energy management is a high level of intelligence. Optimized monitoring and control strategies enable high efficiencies at lower investment and operating costs. Heerlen is partner in the Horizon2020 project



STORM, which is developing a top-level control framework for thermal grids.

Sound business case

Mijnwater B.V. offers commercial services for sustainable energy support to building owners. The building owner pays a standing charge for the mine-water connection and runs his own heat pumps from the mine-water source. Alternatively, Mijnwater also owns and operates the energy plant (heat pumps included). In that case, advanced energy savings and further improvement of the hybrid sustainable energy structure are within reach with a very low CO2 burden. The fees for the heat and cold supply are based on the costs avoided by using gas boilers, electrical chillers and unnecessary additional measures for meeting the strict Heerlen energy performance regulations.

Carbon emissions reduced by 65% for the connected buildings

In the road map to energy neutral (in 2040 as a local ambition), a distinction can be made between measures at the building, area and national level. At each level, the most cost effective measures can be taken, with Mijnwater covering the area level. As such, the design of buildings is less costly and there is more architectural freedom. Moreover, territorial claims relating to sustainability are reduced (e.g. wind turbine planning, large biomass cultivation, increased electrical infrastructure, etc.). By establishing a thermal grid, Mijnwater is investing in the reduction of energy consumption and improvements to the efficiency of green support. Based on the energy bill - 50% of conventional energy costs due to saving measures in the buildings - expenditure on internal comfort shifts from the import of fossil fuels to investments in green infrastructure. For the Heerlen region, this adds up to savings of € 360 million a year, while carbon emissions are reduced by 65 % for the connected buildings.

Involved parties

Municipality of Heerlen, Mijnwater BV

More information

www.mijnwater.com/?lang=en
http://storm-dhc.eu

ment of 460 student rooms on the second to eighth floors. Urban Resort created a cultural breeding ground in the form of business units with a café-restaurant, a reception hall and studios on the ground floor and first floor. A unique aspect of the approach is the self-motivation of the residents. Management is in their hands and active 'handymen' will get discount on their rent. That made the conversion of offices into living accommodation on the basis of temporary redesignation feasible.

More flexibility when designating buildings or areas for a particular use means that they can grow with the times. An area can then develop on the basis of the needs which exist within the area, and maybe become more multifunctional. With temporary redesignation municipalities seek to maximise the elasticity by allowing flexible use. This gives the initiator a lot of freedom, relatively speaking, which increases the feasibility of projects. The municipality hands over part of the control to private parties. This has many potential advantages, such as less chance of buildings being permanently unoccupied and deteriorating, the prospect of new investments, more rapid response to market demand, better chances of funding due to greater sales opportunities, more possibilities for temporary (living) accommodation and freedom for the end user to use the area as he wishes. A feature of ploughing social profits back into urban renewal is that at least one party earns (or saves) something from it, this being the one who also invests in the project. This can also be in kind.

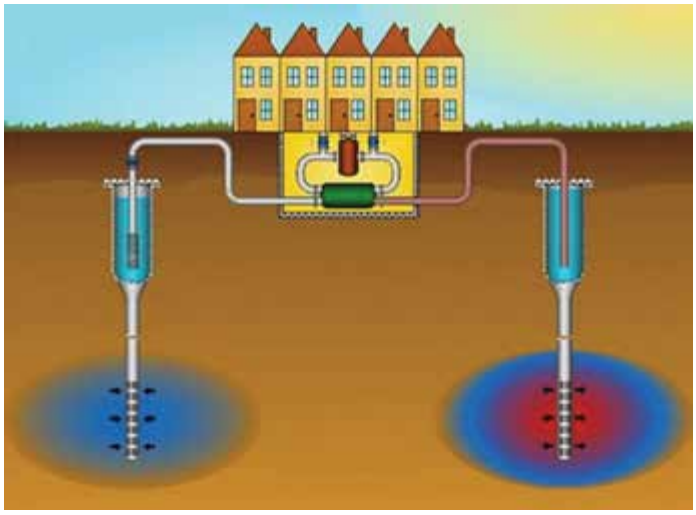
5.5 Conclusion

Particularly for market parties and for government bodies, investment is among the primary instruments used to achieve virtually any goal. Although this has been the case for many years, the message of this book is that things are changing. It is not that the act of investing is disappearing: on the contrary, it is that investments will increasingly take the form of co-investment in the future. Of course co-investment has been around forever as well, assuming co-investment means that multiple parties put their money towards a common goal. Take stock market investors who purchase shares in the same company, or municipal authorities who coordinate their waste management. They invest money and other means towards achieving the same objective, while this book is about parties who invest money in the same means in order to reach their different individual goals. They must then combine their goals. This obviously means that each investor provides funds to support his own goal, but also that he throws in his lot with one or more other investors and their respective goals. Together they can achieve more: because they share the costs of the means and because they reinforce each other's efficacy in reaching their objective. Co-investment is therefore investing in a means together with other parties, so that one's own goal becomes more affordable and easier to achieve in combination with other goals. An area-specific fund can allocate financial means for just that purpose. Sometimes co-investments are made in temporary zoning designations.

A quick glance at urban and rural areas is enough to be certain that these areas have seen a long term pattern of investment in goals that exist independently and have not been combined with each other. Often there's an office park right next to a residential neighbourhood, yet the two share little to nothing in common. They do not balance their energy usage, their traffic flows are at odds with each other and they are not integrated into natural surroundings that could otherwise, given sufficient size and proper connections, ensure the retention of water and a cooling effect. There may also be grasslands and forested areas present that do not actively benefit each other, the neighbourhood or office park, despite the potential benefits to be had. For example, grasslands and forests together can enhance the quality of natural areas around businesses and homes and thus strengthen the natural environment around the grasslands and in the forests themselves. The same principle applies to water quality, both in terms of water purity and water level management. Mutual reinforcement can be achieved by sharing means and combining goals before pursuing joint investments (co-investing).

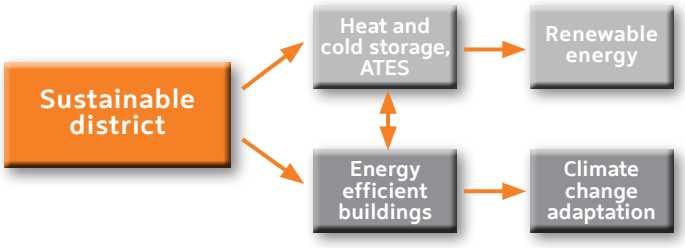
OOSTERDOKSEILAND, RENEWABLE ENERGY IN THE HEART OF AMSTERDAM

Aquifer Thermal Energy Storage (ATES)
The principle behind an ATES with an open groundwater system is that a building is heated during the winter using summer heat and is cooled in the summer using winter cold. The heat and cold are stored seasonally in underground reservoirs by means of open sources.



The cold and heat are added to the water by means of a heat exchanger. That could be, for example, the roof of a building under which water pipes run, absorbing the heat and cold. If the cold water is not at the right temperature in the summer, and if the warm water is not at the right temperature in the winter this can be rectified with the aid of a heat pump.

The OosterDoksEiland (ODE) sustainable district consists of 220,000 m² of modern, energy-efficient office space, as well as areas for living, leisure and culture. A low-temperature, renewable Aquifer Thermal



Energy Storage (ATES) system provides the district with sustainable heating and cooling, allowing a maximum reduction in the carbon footprint, running fully electrically on Green Power. The ATES system uses 3 cold and 3 hot underground water "wells" in the shallow aquifer and it reduces carbon exhaust by 65% compared to conventional gas heating. By using green certified electricity (Hydro & Wind) to power the heat pumps, the system can claim a close to zero carbon footprint. During peak demand, the district can use an incorporated biofuel heater to add extra heat, but the biofuel system is rarely used. The ATES system provides 35,000 GJ of heat and 18.000 GJ of cooling per year. It can provide maximum heating of 9.5 MW and cooling of 8.5 MW. At max power it can transfer 750 m² of water to transport energy from the wells. The energy plant is well hidden in the basement.

Involved parties
Cofely Energy Solutions (Engie), City of Amsterdam, www.dutch-ates.com

More information
www.oosterdokseiland.nl/pages/home-en.aspx

A well informed observer of urban and rural areas will note that goals are being coordinated with each other with increasing frequency and that areas are gaining a more multifunctional aspect. As many of the examples in this book illustrate, a dike is not just a dike: it is nearly always a road as well, and with increasing frequency, a part of nature too. In most cases, energy is still delivered by cable or pipeline from a distant country. Yet more and more, it is being generated in the cleverest of ways in our own backyards - take the case of Minewater in Heerlen, for example. Care has long been a separate function involving care homes (residential care facilities) to which individuals go when they are elderly or ill. Residential care is slowly being integrated into the living environment, while a number of transport solutions have been created to bring care to individuals in their own homes. Transport and the road infrastructure are also being integrated into the total environment. Despite detracting from the harmony in an area, a noise barrier may be necessary. However, such a noise barrier can also be well integrated, for example by installing solar panels on top or by turning it into an emergency flood defence, like in Stadshagen.

In order to generate energy from an area and to distribute the energy among users, smart grids are vital. Smart grids are control systems that make it possible, in combination with IT, to optimally coordinate goals. Take the Oosterdok island for example, where the ingenious use of various energy sources ensures the lowest possible energy consumption. Control systems are also necessary to coordinate flows of traffic. These are equipped with IT and increasingly make use of Big Data in order to understand traffic flows and thereby manage them more efficiently. Or think of domotics, home automation, that helps make it possible to receive care at home. Big Data from a great many residents and their home automation systems can help organise the traffic flows of caregivers on their way to clients' homes. This will reduce the burden on healthcare and the area. A well informed review of areas will show that this process has already begun and the multifunctional character of the areas is increasing. The creation of the Oosterdok island as a sustainable area would have been impossible without the coordinated investment in buildings, energy systems and control systems: in other words, without co-investment.

'Co-creation' is a more apt term than 'cooperation' for indicating that individuals are not only pursuing the same objective, but are combining means and goals as well. This term, co-creation, is generally used in the context of methods aimed at improving collaborative ability, such as in the field of area development. In search of a method for using multifunctionality as an instrument for area development, the question is which approach is most appropriate to help the parties involved realise that together they can take advantage of an unmissable opportunity. How can the parties acknowledge and capitalize on the (potential) benefits by entering into new coalitions? We will get into these in the next chapter, but there we will not focus any longer on area development only, but on multifunctionality in general and how to make the transition from sectoral to integrated working methods.

International Test and Simulation Facility *Big Data example*

More renewables. Greater demand. The rise of the 'prosumer'. There is no doubt that future electricity systems need to be smarter with intelligence distributed throughout the network. But there isn't yet a consensus on how that intelligence will look. This makes it difficult for network operators, regulators and energy suppliers to make informed decisions on new products, services, solutions and business models. The Netherlands' International Test and Simulation Facility (ITSF) for future energy systems helps to mitigate the risks around deploying energy systems including smart grids. It offers a complete test cycle that can be customized to meet specific needs. This enables to test and validate new technologies at the unit, integration and complete energy system level.

A key component of the ITSF is its unique large-scale simulation environment for modelling complete energy systems including the grid and energy market. It helps to assess the

REGIONAL FOOD COOPERATIVE 'OREGIONAL'

Regional produce is available in farm shops, restaurants, supermarkets and at the market, but is increasingly being served in businesses and institutions.

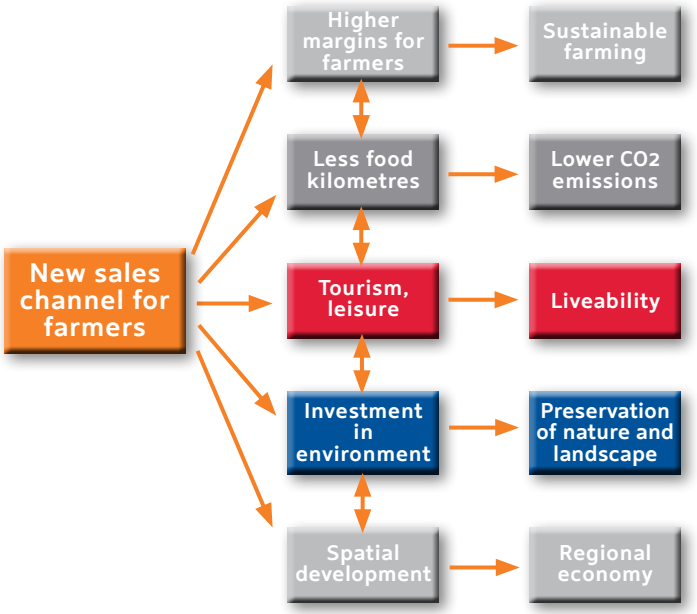
Farmers seek new sales channels

In the region of the city of Nijmegen, a group of farmers took the initiative, in 2009, to set up the area cooperative 'Oregional'. Oregional stands for original, regional and sustainable. The mission of the cooperative is to establish connections between producers and consumers, farmers and the public, town and countryside. This is done in order to contribute towards a sustainable and valuable countryside and offer sustainable prospects for farmers. The aim of the cooperative is to promote the regional, cross-boundary sale of products and services in a sustainable and economic way, under the brand name 'Oregional'. Vital to the area cooperative are fair prices for the farmers taking part and the involvement of consumers and the public.

The area cooperative Oregional is a new sales channel, aimed at achieving at least 15% higher margins, on a structural basis, for its members' products (rural businesses) compared to regular sales (auction, dairy cooperative, etc.). The area cooperative handles the purchase and sale of products, the processing and transport by farmers and third parties, quality development, monitoring and certification, obtaining subsidies, approaching new market parties, developing new product and market combinations, marketing and PR, and the finances and internal organisation.

Regional produce boosts own region

Because the products are produced, processed and consumed in the region, little transport is needed to get the products to the right place. This means, among other things, less food kilometres and thus lower CO_2 emissions. Moreover, the farmers get a fair price, so that they can continue to make their products whilst showing concern for the environment. Often, the public are allowed to visit the farm, so that they can see for themselves how the products come into being. In addition to the sale of produce to care institutions, the catering trade, schools,



caterers and consumers, the cooperative puts a great emphasis on the development and promotion of (tourist) activities on and around farms. Both the producers and customers are within a 40-50 kilometre radius of Nijmegen. In this way, the money that the consumers spend on products from the region also remains in the region. The money goes into the preservation and development of nature and the landscape, among other things.

Involved parties

Oregional, the 'Landwaard' Foundation

More information

www.landwaard.eu/nl/home/over-landwaard/information-in-english

behavior and impact of potential products, technologies, services and business models – such as demand-response or load-shedding solutions – in a realistic energy system, based on a wide range of future scenarios. The ITSF is a multiyear project funded by the Netherlands Enterprise Agency that has the intention of developing the capability to simulate and test emerging smart grid technologies at scale. ITSF has three main capabilities:

1. Unit testing of individual (hardware) components, including protocol compliance and interaction with the grid
2. Integration testing of (hardware) devices using simulated or small-scale hardware smart grid systems
3. Scalability/performance testing using software simulations of a single medium-voltage distribution grid with a focus on demand-response approaches.

The first two capabilities are partially covered by existing test labs among consortium members, so the primary focus has been on the software-based scalability/performance test capability. The primary stated objective of the ITSF is to help manage the risk of large-scale implementation of smart grid technologies…by offering realistic simulation environments.

In order to help parties like municipalities, utility companies, and project developers to implement these technologies the ITSF offers "integral testing of the system, not just the parts" that fills a gap by "connect[ing] three complex systems…electricity, gas, and (district) heat".

The ITSF has been developed by a consortium of commercial and academic partners. The consortium offers a wide range of expertise in testing and smart grid projects, and offers specialised, state-of-the-art facilities for the physical testing of smart energy components. In addition, all the modelling and analysis tools at the heart of its simulation environment have been developed and thoroughly validated as part of smart energy system field trials such as PowerMatching City.

The consortium is led by DNV-GL (formerly DNV-Kema) with close cooperation from TNO. Other members of the consortium include the Eindhoven University of Technology, ICT Automatisering, VITO, and the Energy Academy Europe's Energy Transition Center (EnTranCe). More information: www.dnvgl.com/services/international-test-and-simulation-facility-33375

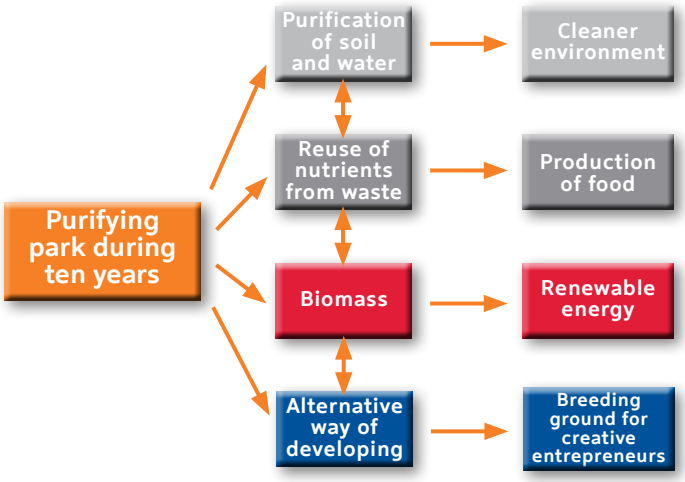
FORMER SHIP WHARF 'CEUVEL VOLHARDING'

The area of 'Ceuvel Volharding' is a former ship wharf in Amsterdam. An abandoned and polluted site in the industrial and harbour area of Buiksloterham, in the north of Amsterdam. The current era, during which planned urban development has come to a halt and many areas await development, provides opportunities for an alternative, less capital-intensive way of developing. For the next ten years, the site will be used as a breeding ground for creative entrepreneurs.
A thorough analysis led to a selection of purifying plants to achieve an attractive and purifying park.

Purification
The site is heavily polluted with organic as well as inorganic pollutants. Current techniques that are used for the purification of soil and water are costly, unsustainable and are often limited to hiding the pollution or moving it to another site. The technique of phytoremediation, in which plants are used to stabilize, absorb or extract contamination from the soil, offers an alternative. After ten years, the entire site will be returned to the municipality of Amsterdam cleaner than at the original outset.

Houseboats
Houseboats are brought on land and transformed into 17 sustainable ateliers. The boats are insulated and equipped with a sustainable heating system, green roofs and solar cells. Wastewater from the site is purified in bio-filters and nutrients from the waste are re-used for the production of food. Organic waste (from toilets) produced by visitors and residents of the boats is converted into energy.

Design
The purifying park consists of an undulating green plain of grasses, perennials, short rotation coppice and mature trees for the uptake and degradation of pollution. The plant species are specifically selected for this area; plants that suit the rugged nature of the industrial terrain of Buiksloterham. A raised wooden boardwalk ensures that there is no direct contact with the polluted soil. The trail winds through the planting and connects the different houseboats. The results of pruning



in the park are not transported elsewhere but remain on the premises and are used to create products from biomass. A biomass digester converts biomass into energy that is used in the area.

Opportunities
Soil contamination is no longer the problem of this place, but is now the catalyst for innovative concepts and initiatives in the field of (cultural) sustainability. Purification of soil and water, education, biomass production, innovation, research, ecology, art and culture come together. The innovative form of redevelopment applied to the Ceuvel can serve as an example for many abandoned, derelict and contaminated areas. Through the right interventions, wastelands can be valuable for nature, recreation, housing and industry. Activation leads to the creation of financial and social value. Not designs for temporary use, but the right mix of temporary and permanent, intensive and extensive use makes a place fascinating and versatile. By using time as a tool, a resilient and suitable plan can be developed. This results in an area that provides solutions instantly and can easily cope with changes in the future.

Involved parties
DELVA landscape architects, Space and Matter architects, Metabolic, Municipality of Amsterdam

More information
http://deceuvel.nl
http://www.spaceandmatter.nl/index.php/architecture/ceuvel-volharding/

Chapter 6

Instruments for multifunctionality and perspectives for action

6.1 Introduction

Multifunctionality means crossing sectoral boundaries and making connections. It means being curious about the other party, willing to learn each other's language, and compromising to optimise other functions. It calls for courage to leave your own safe, compartmentalised cocoon and step over that boundary. But it is necessary, because only then can you take the step from 'simply' fitting in and tweaking to actively seeking and finding synergy, co-creation. The users of the area always play a key role here, because it is in their back yard that all of the functions come together. They have the necessary knowledge of the area. Only if they realise the advantages do combinations get off the ground. But it also works the other way round: because the users are aware of the advantages, sectoral contrasts are overcome and new combinations are created.

Successful multifunctionality is usually characterised by simplicity; the combined goals seem to have a sort of natural coherence. Despite this, it is often a long process to set up a new combination. That is related to the transition from a sectoral to an integrated working method. The challenge lies in the process, in bringing together people who are willing to put effort into a combination and the accompanying area development. How do you achieve multifunctionality? That's the question in this chapter, but in order to come to an answer it's important to first look at obstacles, because achieving multifunctionality means overcoming these also. After the obstacles focus will be on how to win over stakeholders to become shareholders in a project and add to the multifunctionality of a project.

6.2 Obstacles

For multifunctionality, the budgets for two or more projects are often combined. An initial obstacle occurs if the budgets are inadequate to fund the investment. A second obstacle can be that a budget has been earmarked, for example for dike reinforcement, and then cannot be used for other purposes such as water storage or the development of nature. A third obstacle can be that the advantage of the combination is not clear enough. For instance, it might not have been demonstrated convincingly that a climate buffer will strengthen the flood defences. A fourth obstacle can arise from the risks that can accompany multifunctionality, for example because a competent administrative body is unwilling to accept responsibility for a combination. Joining together in a multiple solution is not something that every organisation dares to do, or may do legally.

Often mentioned as maybe the foremost obstacle to combining goals is the split incentive. That is when parties who basically can combine do not have the incentive to do so because the advantages of the combination do not accrue to the party that has to bear the costs. As a result, the combination does not go ahead and the parties which did have the incentive do not benefit either. Just think of a water board that, unlike a nature manager, does not feel any incentive to develop a dike in an environmentally friendly way. If there is an advantage to be gained from both the construction and operation, that helps a lot in preventing the split incentive. A party that only benefits from the construction or only from the operation will be less inclined to combine due to the split incentive.

In the case of water safety, a dike manager cannot and may not make concessions regarding the stability of flood defences in order to make things fit together better. For reasons of safety it can be hard to give a permit to combine flood defences with other functions. Obstacle to multifunctionality is the lack of scope for policy-making on the part of the dike manager. Particularly when a large organisation with a strict division of responsibilities is involved, there seems to be a good chance that an individual employee will feel no incentive to combine. There is a good chance that he will act only in accordance with the authority vested in him and choose a separation of functions. Without the backing of his superiors, he will never choose a combination. The Gouda case study, on the other hand, shows

CULTURAL HISTORY AND ARCHAEOLOGY

There is a lot of cultural history to be found around flood defences in the Netherlands. Features of flood defences with cultural-historical value often form characteristic elements of the landscape. Typical examples of this are mills and locks. These and other elements influence the visual quality and scenic quality of an area.

Kampen and Dordrecht

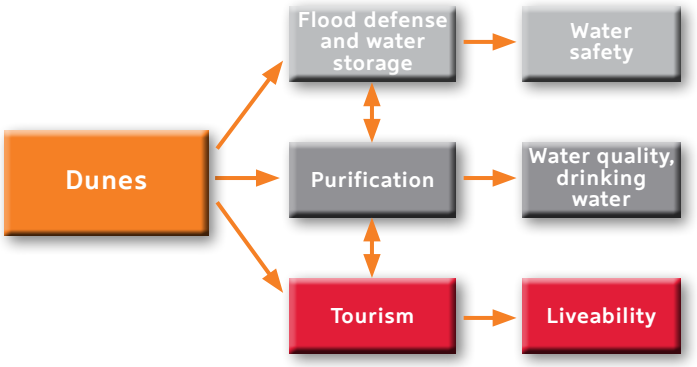
Nowadays the old city wall of Kampen forms a large part of the flood defences (over 1.5 km). However, the city wall and homes on it were never built as flood defences. Due to building activities to retrofit the wall and homes the quality of the flood defences increases and, the other way round, the flood defences ensure that Kampen can retain its character and quality as a historic town. Right in the old city centre of Dordrecht a historic street, the Voorstraat, forms a primary flood defence which, as such, comes under the jurisdiction of the water board. As in Kampen, measures have been taken in this street which can reinforce the flood defence function.

Landscape and nature

River areas and the areas of dune land have high scenic value and are home to a lot of flora and fauna. All 'line infrastructure' functions longitudinally as an ecological corridor and this applies equally to dikes and dunes.

Dunes

Dunes serve an important function for nature, are very important in water purification and also retain water. For instance the cities of The Hague and Amsterdam both profit from dunes as places to produce drinking water, and to provide a place for recreation. From way back, numerous opportunities involving dunes have been utilised to combine these flood defences with tourism, for example in the form of footpaths. Many structures, such as beach cafes, hotels and restaurants are reinforced by the dunes. The same applies to specific facilities created for recreational purposes, such as car parks, viewpoints, works of art, picnic areas, special planting or cycle paths and footpaths.



Dike rerouting, Westenholte

The rerouting of the dike near Westenholte is one of the three measures to improve the safety of the city of Zwolle and surrounding area. By rerouting a dike, the river is given more room by moving the flood defence structure inland. This means that land that was originally inside the dike ends up outside the dike and the winter bed of the river is given some extra space. Due to the open connection with the river IJssel, nature will have the chance to develop in the transition zone between wet and dry. On the country estate, there will be 'boot paths' so that people can enjoy this new nature.

Promenades

Promenades are a unique form of road over a flood defence structure because they do not simply provide access to an area, but link an urban area directly with coastal tourism. In order to guarantee safety for the coming fifty years, the coast at Scheveningen is reinforced with an (invisible) dike in the promenade, which should be able to withstand water levels which are only exceeded, on average, once every ten thousand years. On the beach in front of the dike and under water, extra sand is being brought in. That will break the force of the waves, so the dike behind does not need to be high and the sea views are not lost. This latter point is important in terms of spatial quality. As the flood defences were being reinforced, the Municipality did grasp the opportunity to improve the spatial quality at the same time and redesign the promenade.

how an employee can be successful by taking a risk. Achieving multifunctionality calls for a willingness and the leeway for those involved to look beyond these limits.

Nonsynchronous money flows of various parties can form a major stumbling block. Funds have a planning cycle and it is possible that a golden opportunity to combine cannot be funded simply because no money was set aside. For this reason, the Water Board in the Gouda case advanced a sum that had to come from the Province at some point. The Water Board showed courage here, because there was no certainty that this sum would ever be paid. In addition to a shaky planning cycle, the fact that various decision-making processes do not link up with each other can be a further obstacle to multifunctionality. If such processes fail to connect with each other, no window of opportunity can be found to realize the combination of goals.

6.3 Stakeholders become shareholders

During the past decades, numerous methods have emerged, enabling people to co-create, and find out what they can expect from one another when it comes to making joint social and economic profits. Since area development has such a profound significance for society and economy, many methods have evolved within that practice. The preconditions have changed, however, due to the shift in area development from money that is looking for projects to projects which are looking for money. Parties with plenty of money, who want to develop and get a return quickly, approach the environment differently to parties who combine their funds to retain and gradually build up value. Virtually every method capable of involving stakeholders was developed to facilitate capital-intensive project development that is linked with powerful public and private investors who want to implement big, often very big, projects. In such processes, stakeholders tend to play a subordinate role; they have no interest in the project (in either sense) and merely wish to safeguard their own interests with respect to the project.

That is not the case with multifunctionality. The disappearance of money from project development has changed the relationship between initiators and stakeholders. The stakeholders not only include people who reject the initiators' project, but also people who represent an interest that can combine well with the interests of the initiators. However, the initiators often have no inclination to combine, due to the high transaction costs associated with this, and certainly if simply realizing their project quickly yields an adequate return. The advantages of combining are often only achieved once a project is up and running, whereas the initiator wants to restrict himself to the construction phase, and is often under pressure to complete this quickly.

Interest in multifunctionality increases when less capital is available to simply push through a project. It then becomes interesting to combine. The mutual gains approach, which Lawrence Susskind introduced in 1987, is a method that can help in outlining multifunctionality as an instrument. Mutual gain is a feature that is also strongly associated with area development, and with multifunctionality. After all, the social functions which are combined cost less and produce greater returns together. Despite this, the origins of the two concepts are very different. The mutual gains approach was part of the tradition of instruments devised for settling conflicts between the initiators of a project and the stakeholders with an interest that was affected by the project in question. The interesting thing about this approach is that it broke away from this tradition and focuses nowadays on the development of projects by a wide variety of involved parties.

The business case of multifunctionality (Chapter 3) gives substance to a process that involves a search for mutual gains. The underlying principles of the returns and savings on the social, ecological and economic front help in determining what these mutual gains are. By taking the business case as starting point, the conflict is not negated, because there will naturally always be disagreements with stakeholders. The change lies in the fact that the disadvantages and the conflict no longer form the starting point, but the advantages and the joint business case do. This places the disadvantages in a different light and some are also easier to resolve. The mutual gains approach made this switch and, in its wake, a diverse set of instruments has emerged, based on this approach. The key element is always to look for shareholders among the stakeholders. With them, you then seek mutual gains. If these do not exist and conflict threatens, attempts are made to resolve this. Stakeholders in the

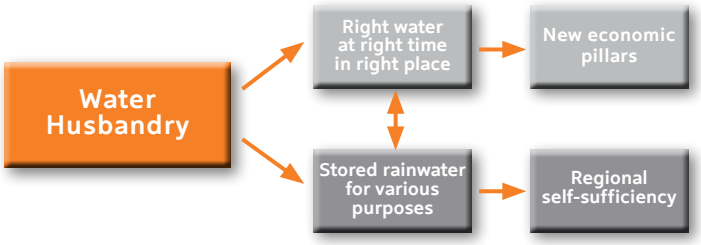
WATER HUSBANDRY WATERHOUDERIJ

In the future, it will no longer be possible to take the unlimited availability of good quality fresh water, whether it be groundwater or surface water for granted. In wet periods there will be surpluses, but in dry periods we will be faced with ever greater shortages. Demand will increase further, for agricultural production but also for cooling and generating energy. It is therefore becoming increasingly important to get the right water at the right time in the right place. In addition, there is a growing need for regional self-sufficiency. Area-specific, independent fresh water supplies are becoming more and more important throughout the Netherlands.

This calls for a different, integrated way of thinking: actively seeking possibilities for linking the water supply with projects in other policy fields, such as flooding, nature, the environment, spatial quality, energy, industry, food provision, drinking water, housing and recreation. It also calls for a reconsideration of the role played by the different actors. Farmers and other landowners must start to play a part in the independence of the fresh water supply in the Netherlands.

A concept that is based on this new approach is Water Husbandry in a water management area. In such an area functions and economic pillars (flooding, nature, the environment, spatial quality, energy, industry, food provision, drinking water, housing and recreation) are linked together. The land users store rainwater and make it available for various purposes. With this area-oriented approach, diverse aims are achieved and new economic pillars can emerge. Water boards, municipalities, estate managers, water companies, provinces, nature managers and (agricultural) interest groups are showing an interest and want to investigate the concept in their own patch.

On the former island of Walcheren, the Water Husbandry concept is



being looked at in practice. In the triangle of the villages Vrouwenpolder, Oostkapelle and Serooskerke, twelve farmers are investigating whether or not Water Husbandry could be the solution for their future water supply. Every summer, the crops are damaged by a shortage of (fresh) water. But flooding is also a reason to take part. The farmers get an idea of the state of the soil, the situation with respect to filtration and hydration and what the sprinkling and irrigation needs, water damage and drought damage are. The farm's crops and where fresh water can be obtained, as well as the watercourses, the environmental factors and the different ways of applying water are also taken into account. In this way, a good overview of the availability of and the need for water emerges, which possible applications exist and what investment would be cost effective. At the request of the farmers, the water board makes modifications to groundwater levels, dams and watercourses. More radical modifications are included in the policy. The farmers have looked at level-controlled drainage in some depth. They spend more and more time together and can see the advantages of cooperating in the area.

Involved parties

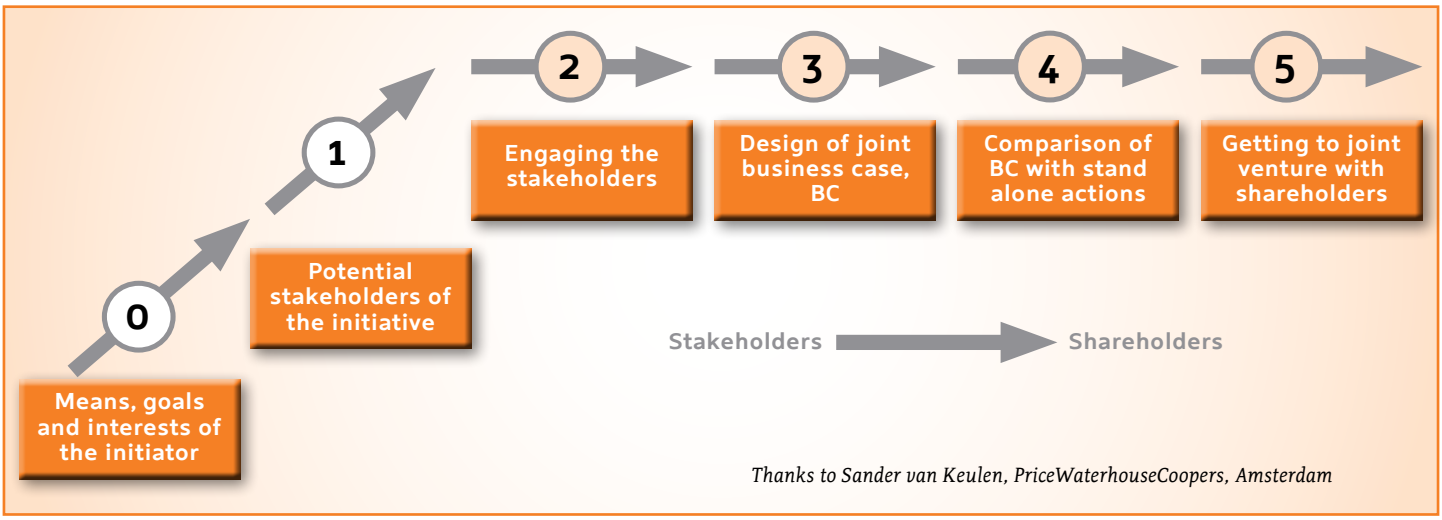
Aequator Groen&Ruimte, Innovatie Agro & Natuur, Deltares, Water Board De Zeeuwse Eilanden and the ZLTO.

traditional sense do not seek mutual gains because, although they can exercise an influence, they are not usually invited to take part in a project.

In area development the search for multifunctionality begins by bringing together stakeholders in an open process with plenty of space. With the potential shareholders among these stakeholders, good, practical solutions for uniting diverse interests within the project are sought. Every interested party has a share in at least one (but usually several) function(s) within the area. If the shareholders are also the residents and/or users of the area, you have positive involvement in the sense of mental ownership. The group of shareholders organises itself with the aim of realizing concrete area investments which generate (social) added value. Instruments inspired by mutual gains facilitate a coming together, provide the space for co-creation, creativity, experimentation and risk, make adjustments and correct, and finally produce sustainable area investments. Many of these instruments can also inspire to achieve multifunctionality outside the practice of area development.

6.4 How to achieve multifunctionality

In order to successfully identify stakeholders, an initiator must first be present. After all, if a primary party fails to take initiative, it remains unclear which other parties might benefit from participation. Who these parties are will be determined by examining the interest of the initiator, the goal that he or she is pursuing in service of this interest and the means that the initiator intends to implement to reach said goal (0). Potential stakeholders can be recognised by their desire to put the same means to use, in order to achieve their own goals and the interests behind the goals (1). Engaging them in an initial discussion may serve to confirm whether they are indeed eager to participate in the initiative (2). If signs are positive, they can develop a business case together, in which they combine their goals and share the same means (3). To what extent the business case is beneficial to all parties must be demonstrated through a comparison. This is the comparison of the costs and revenue of each individual party in a potential joint venture with the costs and revenue that each party would achieve if they were to act independently (4). If the results of the comparison are favourable for the joint venture, the parties can then reach agreement on how best to proceed together. At that point the initiator and stakeholders involved all become shareholders in the new joint venture (5).

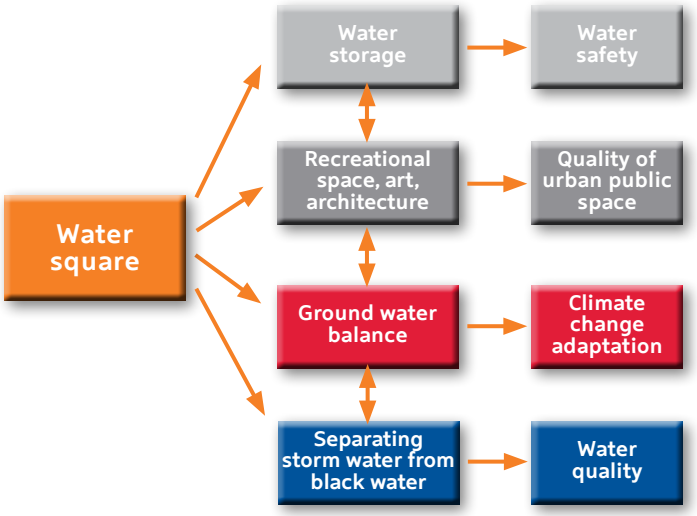


Thanks to Sander van Keulen, PriceWaterhouseCoopers, Amsterdam

Step 4 is crucial: the comparison of the costs and revenue of each individual party in a potential joint venture with the costs and revenue that each party would achieve if they were to act independently. The diagram below illustrates the benefits of the joint venture, and may help compare the costs and revenues of each individual party. The latter is not shown here. In principle, the costs and revenues are already known quantities when making the comparison. The additional costs and revenue involved in the joint venture are listed below. The extra revenue consists of shared savings achieved by dividing the costs, as well as new revenues resulting from more effective achievement of goals due to the combining of objectives.

WATER SQUARE BENTHEMPLEIN

On the Benthemplein (square) in the middle of Rotterdam the first water square has been realized in 2013. This square combines water storage with the improvement of the quality of urban public space. The water square can be understood as a twofold strategy. It makes money invested in water storage facilities visible and enjoyable. It also generates opportunities to create environmental quality and identity to central spaces in neighborhoods. Most of the time the water square will be dry and in use as a recreational space.



Three basins collect rain water: two shallow basins for the immediate surroundings will receive water whenever it rains, one deeper basin receives water only when it consistently keeps raining. Here the water is collected from the larger area around the square. Rainwater is transported via large stainless steel gutters into the basins. The gutters are special features, they are oversized steel elements fit for skaters. Two other special features bring storm water on to the square: a water wall and a rain well. Both dramatically gush the rain water visibly onto the square.

After the rain, the water of the two shallow basins flows into an underground infiltration device and from here gradually seeps back into ground water. Thereby the ground water balance is kept at level and can also cope with dry periods. This helps to keep the city trees and plants in good condition which helps to reduce urban heat island effect. The water of the deep basin flows back into the open water system of the city after a maximum of 36 hours to ensure public health: all the storm water that has been buffered does not flow into the mixed sewage system anymore. Like this the conventional mixed sewage system is relieved and lowers the frequency of relatively dirty water to overflow in the open water whenever it reaches its buffering capacity. By separating storm water gradually from the black water system with each intervention, the entire system step by step moves towards an improvement of the overall quality of the open water in the city.

When its dry, the square is a feast for active youth to sport, play and linger. The first shallow basin is fit for everybody on wheels and whoever wants to watch them doing their thing. The second shallow basin contains an island with a smooth "so you think you can dance" floor. The deep (third) basin is a true sports pit fit for football, volleyball and basketball, and is set up like a grand theatre to sit, see and be seen. The planting plan emphasizes the beautiful existing trees.

The color scheme emphasizes the function of the water square: all that can flood is painted in shades of blue, and all that transports water is shiny stainless steel. This means gutters receive extra attention and are made beautiful. And the floors of the three basins are painted in blue colors that match with the colors of the surrounding. The space is gently defined and subdivided by a green structure that makes a difference in planting colors between the entrances and the centre of the square. The water square creates a new context for the great modern building of the architect Maaskant and allows the fantastic artwork of Karel Appel to receive more attention.

Involved parties
City of Rotterdam, de Urbanisten, the local community

More information
www.urbanisten.nl/wp/?portfolio=waterplein-benthemplein

Photos thanks to Jeroen Musch

Photos thanks to Jeroen Musch

	Extra costs	Shared savings	New revenues
A. Buying or renting space together	X	Two or more to bear the costs	X
B. (Re)building together	More complexity of the building	Two or more to bear the costs	X
C. Joint exploitation	More complexity of the maintenance, management and exploitation	Two or more to bear the costs	X
D. Joint venture	X	X	Mutual reinforcement of goals
E. Future value	More complexity of adding extra goals	Extra parties to bear the costs	More mutual reinforcement

Reducing costs starts with the joint purchase of space (A) and organising construction (or renovation) together (B). Making joint use of space ensures savings, as the costs of maintenance, management and usage are all shared (C). Reducing costs together means increased yields and extra yields as a result of the joint venture itself. This results in more effective realisation of goals through the mutual reinforcement of goals, and therefore higher yield in terms of money or societal benefit (D). In Chapter 5, we explained the concept of future value: more parties are able to join in by combining their goals and sharing their means. This allows the costs to be divided among a greater number of participants and further strengthens the mutual reinforcement of goals (E).

6.5 Conclusion

It is not easy to just impose multifunctionality from above. A statement such as 'we must get that community school' is even dangerous and can actually result in the failure to achieve clever combinations. It is only possible to combine in the right place, with a good knowledge of the physical surroundings and with a support base of shareholders. Integrated thinking and action are abstract concepts, whilst successful projects tend to have a concrete starting point. A farmer who starts to produce organically and to cooperate with nature and water managers no longer utilises his freedom to continually produce more, ever faster, but trades this in for a new freedom: the freedom to work with partners. The water manager trades in his freedom to take increasingly technical measures for the freedom to cooperate with other parties who contribute towards making the system climate proof, and profit from that. It is growth, but growth that takes the preconditions set by those involved in the collaboration into account. It means a different way of working, very much attuned to the other party and designed on the basis of the situation of cooperation, resulting in better quality in the area for lower costs.

Within one sector, everyone speaks the same language and production is optimised. There is a straightforward, closed system. You could say that the transaction costs between supplier and customer are low. With a combination of functions, different sectors are involved and there is virtually always a question of customisation. For this reason, some free space is needed at the start of the process. Freedom in which individuals can get to know one another so that they can better understand each other's products and activities. Freedom so that they can work out the practices and the areas within which these will take place. Freedom so that innovative ideas can arise on the interface between sectors. Free space is important. It is necessary for there be an exchange without this involving a negotiation situation. All of this means that a relatively long process is needed. The parties involved are all required to invest a lot of time. One could say that the transaction costs are relatively high during this phase. They might well be recouped at a later stage, when the combination starts to bear fruit, but, because these costs always precede the benefits, tenacity and patience are required.

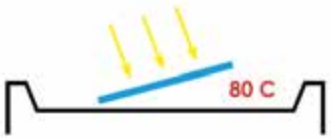
MULTIFUNCTIONAL ROOFS

Multifunctional roofs are perhaps the best example of innovative water management to create rainproof cities. In Amsterdam there is an enormous potential of 12km² of flat rooftops and with a basic green roof this would account for an estimated 240 million litres of rainwater storage. Amsterdam Rooftop Solutions develops business cases for green, yellow and blue rooftop-solutions:

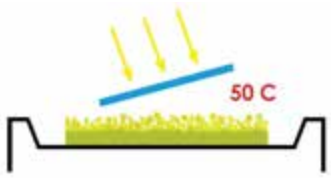
- Green: from a simple sedum roof to an accessible rooftop vegetable garden (with for example eatable crops and herbs)
- Yellow: solutions that reduce CO2 emission levels, e.g. solar panels or plants that generate electricity
- Blue: solutions to cool buildings and solutions with a water buffering capacity to resist heavy flooding

Most interesting are the synergies between the solutions. For instance: what happens to the efficiency of solar panels when combined with a sedum roof? Or, what happens when we lay out a Blue-Green roof below an air-conditioning unit? The Blue-Green roof will cool the air that is sucked in by the airco unit and is thus expected to lower energy consumption. The company Solar Sedum provides combinations of solar panels and Blue-Green roofs: Blue-Green roofs cool the environment, especially when permanently moist. Solar panels yield most energy and have the longest lifespan at low temperatures. In the shade of solar panels biodiversity increases because of extra atmosphere underneath the panels.

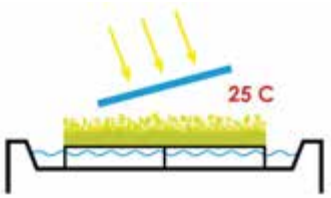
- **Traditional Solar Roof**
  - High temperature
  - Standard energy yield
  - High degradation
  - No biodiversity



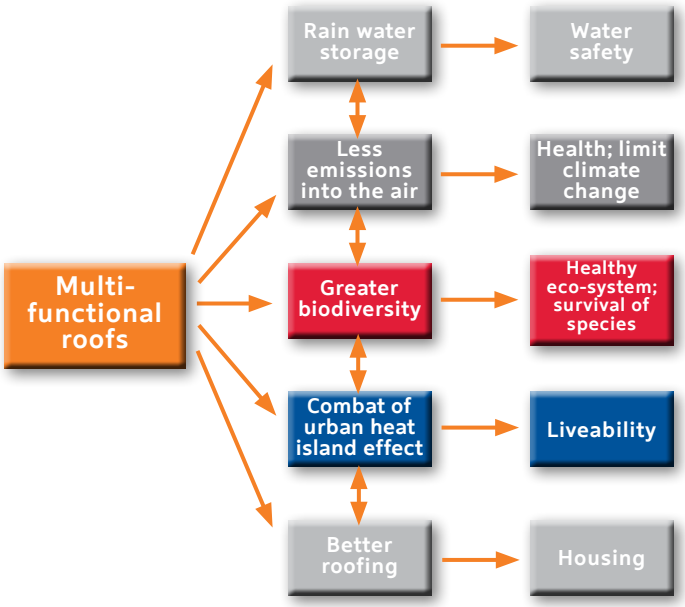
Solar Sedum Roof
- Lower temperature
- 8% more energy yield
- Longer lifespan
- More biodiversity



Solar Sedum 'Polder' Roof
- Combining Blue and Green
- Lowest temperature
- 13% more energy yield
- Longest lifespan
- Most biodiversity



Property owners and tenants: a Blue-Green rooftop provides extra insulation for a building, which helps to make the building cool and comfortable in summer and warm in winter. It will therefore lower the energy bill. The roofing will be less exposed to temperature changes, thereby doubling the lifetime of the roofing. The evaporation of water will help to cool the building in summer. The value of the property increases when it overlooks a green area. The rooftops can add many square metres of living space to the houses.



- City: Multifunctional rooftops make a positive contribution to the urban environment. The vegetation of green roofs absorbs rainwater and combats the urban heat island effect. Green roofs contribute to biodiversity and air quality. Blue water-buffering solutions will help cope with urban flooding caused by extreme rainfall. Green and yellow rooftops will contribute to lower CO2 emissions.

GrownDownTown is a company developing ways to provide the city with fresh vegetables, herbs and fruit. It helps to place smart growing systems on roofs and balconies, makes it possible to grow inside homes or schools, restaurants and offices, and on the roof. GrownDownTown also provides a water retention system that makes use of excess rainfall: crops are placed in special crates, which make it possible to retain rainwater. By means of a string protruding from the bottom of the crates, the crops can absorb water whenever they need it. These so-called blue-green roofs are also supplied by the company Permavoid, which established the Old School project in Amsterdam. These roofs can help cities restore the cycle of catching rainfall, using it for growing green and evaporation that provides cooling. It is interesting how the water management of these roofs is performed by remote control using weather data.

Involved parties

Municipality of Amsterdam, Amsterdam Rooftop Solutions, Growndowntown, Permavoid, Solar Sedum

More information

http://www.growndowntown.com/en/home-2/
http://amsterdamrooftopsolutions.com/
www.solarsedum.nl
www.permavoid.co.uk

Amsterdam rainproof

Blue-Green system on Orly square

Sloterdijk Station is Amsterdam's second largest station. Train, metro, bus and tram converge at this public transport hub. Tens of thousands of passengers, staff and local residents pass through here on a daily basis. Until 2012, Orly square served as its bus station, located above two car parks and the rails of the train station. The redeveloped Orly square was officially opened on 18 June 2015. The human dimension has returned among the large-scale infrastructure of a commercial centre consisting mainly of offices and industry. This innovative roof park creates room for biodiversity, flowering plants and opportunities for people to relax in pleasant, green surroundings, with bars and restaurants. Orly squares' Blue-Green roof park collects, stores, distributes and recycles rainwater for irrigation. In this way, rainwater is kept out of the sewers and off the streets, and a contribution is made to climate change adaptation.

To prevent flooding caused by extreme rainfall, particularly in the cities, action is required from the local council, as well as all residents, businesses and other parties accommodated in the area. In Rotterdam, the city council has taken the lead and devoted a substantial budget to creating, among other things, green roofs and water squares. On 1 January 2014, Amsterdam Rainproof was launched. This is a network of interested parties. Under the motto 'Every drop counts', the aim is to use the whole city, wherever possible, as a sponge in the event of heavy rainfall, in order to slow down water drainage to the sewers as much as possible. The idea is that by creating more awareness, attention will be paid to water when investing in roofs, gardens or parks, for example.

An important advantage when encouraging greater awareness is that it has many positive side effects. An Amsterdam Rainproof publication lists almost forty. Too many to discuss here, but the categories are:

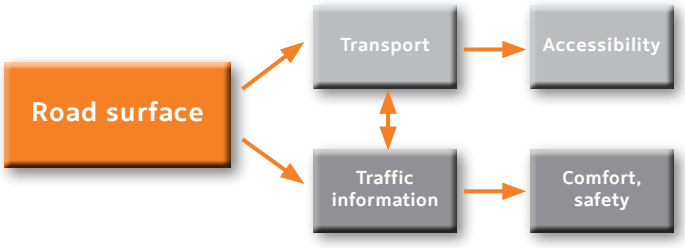
1. Temperature control
2. Water quality and quantity
3. Air quality
4. Increase in aesthetic quality and improvements in well-being
5. Climate adaptation
6. Sound-insulting capacity
7. Extending life of roof
8. Contribution to sustainable goals set by politicians
9. Extra opportunities for inner-city recreation
10. Increase in value of property with accompanying reimbursement in the form of property tax to the city
11. Roofs for urban farming
12. Extra shadow due to vegetation on roofs
13. More urban greenery
14. Advantages for the owners and/or users of buildings

Orly square before

Orly square after

LUMINOUS ROADS AND CYCLE PATHS

The function of a road surface is to enable cyclists, motorists, motorcyclists and other road users to move from place to place. In addition to this key function, there are a variety of other functions associated with roads, such as traffic information via signs and lighting via lampposts. Innovations such as 'Dynamic Paint' and 'Interactive Light' integrate these functions into the road surface and are interesting steps towards a 'Smart Highway'.



The 'Glowing Lines' is an advanced innovation. These lines charge during the day by means of sunlight, so that they produce light at night and the road markings are therefore clearly visible. As a result, the glowing lines not only yield light, but also information for motorists. The road markings can also be used dynamically: at one moment a continuous stripe and the next moment a broken line, depending for example on how busy the road is. This innovation benefits visibility, and with it safety, on the road.

Comparable technology is applied on a cycle path in Nuenen – the Van Gogh cycle path, developed by the social design lab Studio Roosengaarde and construction firm Heijmans. Inspired by the famous painting 'The Starry Night' by Vincent van Gogh, a cycle path is illuminated via thousands of luminous stones. Another development is 'Dynamic Paint', whereby the road surface responds to the temperature. This means that the motorist, for example, can easily see that the road is slippery.

In all of these examples, innovations are a means of combining and reinforcing interests such as accessibility, comfort and safety. Various Dutch and foreign companies are currently experimenting with these innovations. There are already working prototypes and pilot projects, such as the glowing lines on the N329 near Oss (Province of Noord-Brabant), the so-called 'highway of the future'.

Involved parties
Heijmans, Studio Roosengaarde, SolaRoad

More information
www.studioroosegaarde.net

Photos: www.studioroosegaarde.net

Chapter 7
Conclusion

7.1 Introduction

Universities have been sharing premises and personnel for educational and research purposes for almost a thousand years. This saves costs by reducing the need for separate buildings and separate people for education and research. In addition, the teaching staff provide better education, because conducting research leads to a better understanding of the subject matter. Furthermore, by also teaching this, the staff perform better research. An even older example is the road on top of a dyke; it is not necessary to build a separate road, and a dyke provides access to areas which would otherwise be difficult to reach.

Apart from the examples of universities and dykes, there are few other historical examples of combining goals and sharing means, but if we look at the recent past, we can see a rapid increase of cases starting about thirty years ago. That is what this book is about, as well as the massive social and economic potential that exists if we utilise the combination of goals and sharing of means. We present this with the aid of a large number of examples and an explanation of the phenomenon multifunctionality. This chapter is the place to draw a number of conclusions. First step is to extract a number of main points from the examples and case studies. This is followed by some ideas for further discussion.

7.2 Lessons from the examples and case studies

Use one measure for more purposes and thus reduce costs with better results. That is what this publication is about. By combining measures and purposes in this way you give rise to a new earning model, the essence of which is that it costs less whilst at the same time yielding a greater social return. By unlocking the value of what already exists, unexpected business cases suddenly become highly promising. It is a question of how we work with such social functions as housing, health or education. By putting the focus on the user, it is possible to keep the flows of funds in the area and reinvest available euros in further quality improvements. Working 'mono-measure-multi-purpose' leads to new partnerships, which help in achieving ambitions faster, more simply and more cheaply.

On the basis of most examples multifunctionality is usually a question of building and then operating. To begin with, the involved parties create for themselves the advantage of the constructional combination, including the lower costs for raw materials. Above to that, if the building process and the usage phase are bound together, then nothing is built without thinking about its use. In this way, raw materials are used in a careful and sustainable way that fits with ideas about the circular economy. Beside this the involved parties also benefit in the operational stage. Just take the Gouda case study, where the constructional combination yields a substantial financial advantage and then its operation offers numerous further opportunities for earning money. Examples of just a constructional combination are conceivable, as are examples of just an operational combination; the overall conclusion is that making combinations is usually a question of building and operating together.

Even though multifunctionality is not seldom the result of coincidence, there are also examples of successful planned combinations: Kristalbad is a combination that was consciously sought. It is therefore definitely possible to bring area partners together in a planned way, to let them feel the tension in a planned way and, in this way, to make combinations. In order to couple area partners in this way, you must use the right method for organizing the process of involving stakeholders and turning them in to shareholders of a joint venture. This can help in enabling area partners to discover from each other how they can be mutually reinforcing. If area partners discover, in this way or coincidentally, that they can come up with wonderful combinations together, the insights in this book will help them further.

Multifunctionality is a way of working for people who want to go beyond the boundaries of their sector, resulting in good,

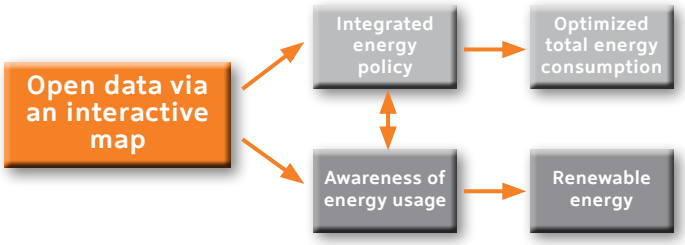
ENERGY ATLAS

An example of how IT can facilitate the combination and reinforcement of interests is the interactive Energy Atlas for Amsterdam. This online atlas provides information about, for example, energy consumption in neighbourhoods, the heat produced in industrial parks, the opportunities for using solar or wind energy and the possibilities of matching the demand for energy with the (renewable) energy supply. By providing this information, the energy atlas can support (local) governments to make and comply with energy policy. The Energy Atlas makes it possible to look beyond certain specific sectors or chains, and work towards an integrated energy policy that enables the public and private sector, as well as citizens, to optimize total energy consumption.

Amsterdam faces tremendous challenges, because the city expects an increase in its population of between 100,000 and 150,000. For Amsterdam, therefore, the Energy Atlas is an instrument for stimulating the use of renewable energy, as citizens will become more aware of their own energy usage and realise that there are gains to be made. Companies will be able to determine their own usage and that of others and find out where renewable sources of energy and the energy infrastructure are located. The data is available as open data via an interactive map. Different partners have contributed data. Businesses and organizations can develop products and services independently, based on this data for energy efficiency and renewable generation.

Energiek Zuidoost

Amsterdam Zuidoost (Southeast) is an interesting mixed use area. In the project Energiek Zuidoost (Energetic Southeast), energy is the connecting factor; the focus lies on energy consumption, the possibilities to produce energy locally and the reuse of sources like waste heat.
In preparation for Energiek Zuidoost, the energy situation in Amsterdam has been mapped and collated in the Energy Atlas. The opportunities for generating energy and the mutual exchange of energy



in Southeast was thus imaged and analyzed. The methodology that produced this body of information can be used to map other areas. The Atlas shows that there are many opportunities for using local waste heat, such as offices, data centres and the Amsterdam Medical Centre. Also other Dutch cities, network operators and regions are mapping data which will lead like The Hague to a national Energy Atlas.

Involved parties

Municipality of Amsterdam

More information

http://amsterdamsmartcity.com/projects/detail/id/71/slug/energy-atlas?lang=en

sustainable solutions. It is a question of logical combinations. This logic seems easy, but does not come about quickly. It is the result of a development process, which incorporates adequate quality in terms of people and areas. People, authorities and businesses come together in new constellations and partnerships. They save money and improve the quality of their own environment by looking for more intensive and more efficient forms of use, and through local production under their own management. New forms of area development emerge in this way. Area development that still has growth as its aim, but no longer at the expense of space and resilience. It is a question of sustainable, inner growth, of intensification and adding new qualities to the existing ones, like in the Westelijke Veenweiden region.

Westelijke Veenweiden region

Dairy farming has traditionally been an important source of income in the Westelijke Veenweiden region, located to the south east of Amsterdam. The typical Dutch landscape that emerged as a result of this production function has considerable cultural-historical value for many people. For various reasons, agriculture is looking for other, additional revenues. Other parties have their ambitions also. Water boards want to combat (the consequences of) climate change and subsidence. Governments feel responsible for different aspects, such as agriculture, scenic quality, topsoil and (ground)water quality, and biodiversity. Nature managers are faced with dryer periods and reduced water quality. Local residents have an interest in the quality of the area in which they live. However, no single party is able to achieve all its ambitions. The parties need each other, and sometimes there are interests which are difficult to reconcile.

A lot is already going on in the Westelijke Veenweiden area. An inventory brought more than a hundred projects to light. As these are often implemented on the basis of sectoral interests and using sectoral funds, the lessons learned are largely 'left hanging' with those who carried out the project and they are not put to new use in the area. Thinking in terms of ecosystem services gave rise to new insights. New opportunities were identified for adding value to the area. Drinking water collection, water storage and reed cultivation are among the most important. It transpires that 30% of Amsterdam's drinking water comes from the Bethune polder in the Westelijke Veenweiden. If we take the price of 1 m3 of drinking water to be €1, the value of these services can be calculated at €25 million a year. Because the quality of the water is good, the purification costs are lower than in an urban area.

The area also provides ecosystem services which are paid for, although they are not referred to as such. Farmers receive a one-off € 5-7 per m2 from the water board for ditch widening. The purpose of this is to increase water storage in the area. For the water board, this solution is evidently more attractive than increasing the pump capacity. Submerging a whole hectare under water would supposedly yield a one-off € 50,000 - 70,000. This inspired Frans Lenssinck from trial farm Zegveld to think about other water services. "If I get paid for increasing the area of water on my farm, what else can I then do in, on, next to, with and over the water?" he has been wondering since. A possible service is, for example, reed cultivation.

THE ECOSYSTEM SERVICES OF REED

Production services

Production of biomass reed for fermentation or as a substitute for straw in cowsheds and stables. Straw is expensive nowadays. Good quality reed can also be used for house roofs.

Regulatory services

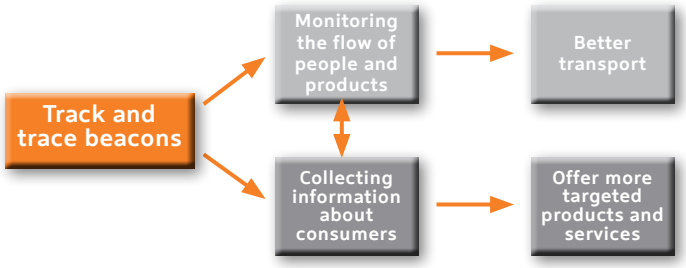
The capacity of reed to extract nutrients from the surface water is appropriate in a wet area. It reduces the need for water level drawdown and thereby reinforces the regulatory services (water storage and carbon capture).

INTERNET OF THINGS – THE USE OF IT FOR CONVENIENCE

Nowadays people are ordering more and more products via web shops and online marketplaces. Parcel firms deliver these to consumers, but often do not know if there will be anyone at home. Conversely, the consumer does not know when to expect the delivery. An IT system that simplifies this process is 'Track and Trace', whereby a parcel is monitored during transport. As a result, the consumer can see when the delivery firm will be calling and take account of this or even request a specific time. Such a Track and Trace system is an example of the Internet of Things, whereby everyday objects are connected to the network and can therefore exchange data.

Another example is the supermarket that can monitor the outflow of products on the basis of a personal card, using the barcode on the card. How many products are sold, when and in what combinations? This information can help the supermarket with its stock management and control, but also assists in collecting information about purchasing behaviour. It also has advantages for consumers; with the aid of the data acquired, they can make use of personal special offers and discounts. Some stores go even further to acquire this data. Consumers' telephones are linked to the network via WiFi. This enables the store to gain an even better understanding of the client's behaviour, so that it can offer even more targeted products and services.

ItoM is a Dutch design service and IP provider that facilitates the Internet of Things. ItoM does this by developing transceivers and receivers, by means of which everyday objects are connected to a network. Glimworm Beacons is an organization that develops beacons: small devices with sensors, which can transmit signals, for example to a nearby smartphone. In The Netherlands, the largest grocery store chain introduced iBeacon technology to help customers get better and faster service in their flagship concept store of the future. IoT is a fast growing service.



Involved parties
ItoM, Glimworm

More information
http://www.itom.nl/index.php?page=home
https://glimwormbeacons.com

Cultural services

From a cultural perspective, reed as a crop is in keeping with the 'veenweide' (peat meadows) area. Depending on how reed fits into the landscape, it can make it more attractive to visitors. In this way, reed can contribute towards the diversity of the landscape.

Support services

Provides a habitat for birds and other organisms.

More information

http://www.klimaatbuffers.nl/projects/peat-areas

7.3 Food for discussion

A number of points are apt for a future agenda. Multifunctionality is more topical than ever. But it's still a long way from being generally accepted and can still use plenty of support. Multifunctionality is an established, but at the same time, a relatively unknown phenomenon. There are plenty of examples, but many people do not recognise them as such. They only form the tip of the iceberg of possibilities. Which points spring out for inclusion now in the agenda for multifunctionality? Which topics would be good ones for theoreticians and practitioners to tackle, and to reinvent multifunctionality?

Paradigm chance

Flood defence structures are there to keep water out and protect the area behind the structure from flooding. Yet the presence of water can also yield added value for such functions as living and working. It is therefore important with flood defences to look for opportunities to benefit from the presence of water. Water is no longer an enemy that has to be kept out, but the opposite: the water actually yields added value. That is possible through combinations with nature, roads, housing, energy, tourism and much more. This turn is the inspiration in this book to speak of a paradigm change, and not only regarding water safety. The change is to turn away from concentrating on one goal, and using all available means to reach this goal, and turn to others who work on their goals, and have means to share. The result is multifunctionality since the means will be used for more goals at the same time, and these goals are aligned. Reinventing multifunctionality is to distinguish this from multifunctionality that only concerns using the same space, without alignment of the goals.

To further strengthen multifunctionality, it is a good idea to look in more depth at the terms finiteness and inexhaustibility. The finiteness of the planet seems fairly evident, but the notion of inexhaustibility is still firmly anchored in our actions when we use all available means to reach a goal. What is the reason for this, what does it signify that this is so deeply ingrained, what can we do about it? The idea of inexhaustibility is also deeply rooted in our legal system. To us, thinking about this in more depth seems relevant for the debate on sustainable area development, as is the question of whether there is more to consider than just natural resources and resilience. Are these two the right phenomena to look at in relation to (in) finiteness, or are there more relevant phenomena?

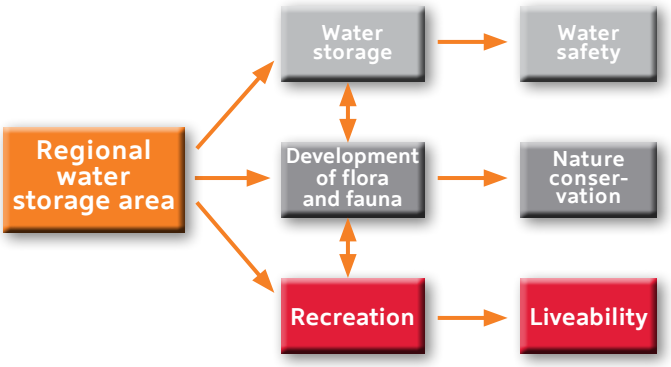
Good spatial planning

The ideology of planning by invitation might well have been embraced now, but its implementation often meets with resistance. Precursors in the field of multifunctionality are faced with a barrage of sectoral laws and regulations, all of which are well intended but miss the mark because they make an integrated approach impossible. Also, vested interests often make it difficult to get new coalitions off the ground. A compelling Dutch example is the energy transition. The system of laws and regulations at the local/rural level contains a number of important obstacles which make it difficult for consumers to produce energy themselves. It is also difficult to supply others or return energy to the system. Yet it transpires from the examples presented here that this failed to discourage a number of parties from setting up new trans-sector and sector-cutting combinations.

Environmental law is currently under fundamental revision. It could be in keeping with this review to allow the original idea behind planning by invitation to provide the lead. This means re-establishing the requirement that a new development takes account of the integrated character of the environment. The

HOWABO, A PARKING PLACE FOR WATER

In 1993 and 1995 large areas flooded as a result of high water levels in the river Maas. In order to prevent such inundations, the Maas Project was implemented in the south of the country. This might well prevent the risk of the Maas flooding, but the Maas Project has negative consequences for the regional water system up north near the city of Den Bosch. Calculations suggested that about 4.5 million m3 of extra water storage would be needed by 2015. In order to cater for this massive need, the Aa and Maas Water Board made an area of 750 ha to the west of Den Bosch into a regional water storage area. The project soon took on the name HoWaBo, or the High Water Approach Den Bosch. This new water storage area will be allowed to fill up once every 150 years.



At the same time as setting out the area for water storage, the nature-related values in the area have been restored also, so that rare flora and fauna will be able to thrive. This will enhance the beauty of the area and make it more accessible for the public. The new water storage area even overlaps the Ecological Main Structure for a large extent. This structure is the robust network of nature reserves where priority is given to the development of flora and fauna. Residential safety is improved due to the protection against flooding, and people's enjoyment of where they live increases due to the proximity of nature and recreational opportunities. An increase in recreational use will generate more revenues in this sector.

Design and execution

The whole project is completed in 2015. Levees were built around the whole area, which spare the existing farms. Due to the relatively low, gently sloping levees, the open lines of vision in the area will be preserved. Furthermore, nature can develop on the low levees. There was hardly any need to purchase land, and claim settlements also proved unnecessary. This is because the area is largely owned by nature organizations, which cooperated in redeveloping the area for temporary water storage. The advantage for them is that the nature-related objectives in the area will be achieved, planned levees will also be given a nature-related function and the use of the area for nature is guaranteed. After all, incidental water storage does not clash with nature-related objectives. The majority of the remaining land had already been bought up by the Province in connection with the Ecological Main Structure.

The total costs were estimated at around €20 million. The costs of the project will be covered, according to agreements, by the Maas Project, because, after all, it is because of this latter project that water storage is needed at Den Bosch. Compensation for water storage within the planning area of the Maas Project would have cost around €500,000,000, twenty five times as much! The combination of goals and sharing of means also yields various other cost savings. Using the excavated soil for the nature reserves meant substantial savings in the soil balance. The construction of the levees required 100,000 cubic metres of soil. By using material from the area for this, a saving of around €12.50 per cubic metre, or
€1.25 million, was made. Furthermore, the fact that the excavated soil didn't need to be carried away and no newly purchased soil brought in saved a lot of money and carbon emissions. Given good coordination between the development of nature and levee building, the Water Board could make both financial and environmental profits from the soil excavation, as well as the construction of the levees. Finally, the combined upkeep of the dikes will yield savings.

Involved parties

Municipality of Den Bosch, Water Board Aa & Maas

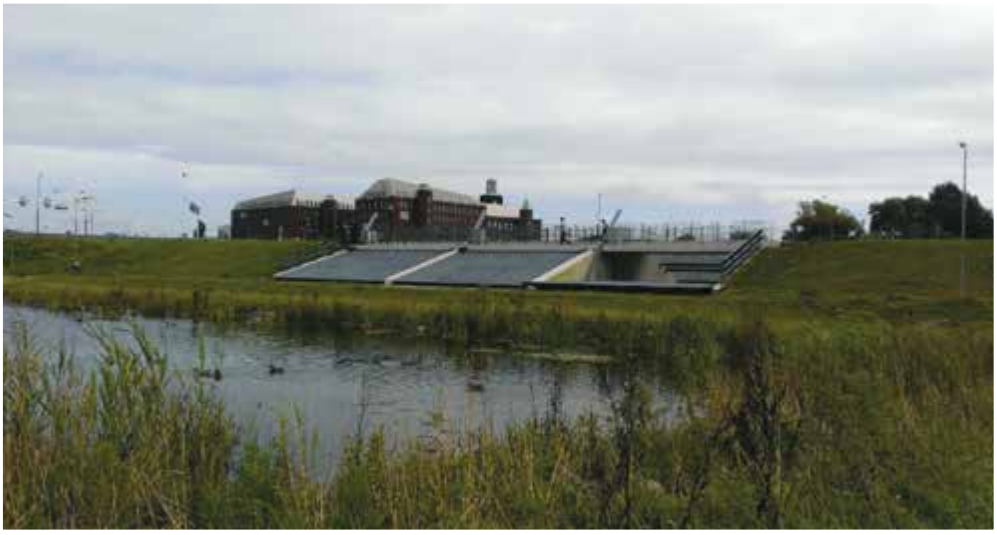


Photo retrieved from website Water board Aa en Maas

principle of good spatial planning deserves to be tightened up here, by requiring that every action strengthens all elements of the area and their coherence as much as possible. This is not enough, however. In order to be able to make the step to 'planning by invitation' in practice, the modification of sectoral regulations is also required, so that it is easier to make integrated assessments. To stimulate multifunctionality, it is important to raise the issue of such obstacles so that they can be removed. Precursors in the field of multifunctionality prove that it helps to put things on the agenda. Although the new environmental law will be in place in 2018, there are already some tentative signs that it develops in the right direction.

Resilience

The circular economy concept gives recycling a new boost. Recycling is about re-using raw materials from old products for new products. The idea of circularity adds extra meaning to this by putting the emphasis on design and building processes which make better recycling possible later. Multifunctionality is a different phenomenon, but one that fits well into the circular economy. Casus like AEB, Fairphone and Roetz Bikes show how a circular business case often also is a multifunctional business case. Circularity easily leads to serving one or more goals, since a product is made and at the same time nature, wellbeing, renewable energy and other interests are furthered. Circular business cases like other multifunctional business cases are multipurpose, and most often these purposes are for the better, not the worse. They develop the sustainability of the environment, and interesting is how this can grow. Many multifunctional business cases have a future value and can spiral up when an extra function is added. Will this help create resilient environments that can adapt to climate change?

Business case

When a measure serves two or more purposes, they share the resources necessary for this measure. For example, road and dyke share the resource (ground), and in the Westelijk Veenweidegebied, agriculture and water management share the same space. In both cases, sharing these resources saves money. Energy is needed for water management, agriculture and to combat subsidence, and the costs of this fall as a result of wet farming. As a result of sharing resources the business case, in the first instance, rests on saving costs. Some business cases go no further than this, such as using dredged material instead of sand in the embankment of a road or noise barrier.

Often, but not always, the resources people share are also able to generate extra returns. For example, a home is an excellent environment in which one can also receive care. This avoids the costs of a nursing home and the care is often more effective than in the latter, because a lot of people feel better in their own home. A beneficial relationship between one measure and two or more purposes is not a matter of course. It only occurs if resources are shared. That clarifies what it is to use one measure for more purposes, but that is largely uncharted territory. We have never really familiarised ourselves with this and we are only starting to do it now. This book makes a contribution to that process and a not unimportant step is to look at the sharing economy, and make multifunctionality part of that.

7.4 Opening the treasure chest

What if....? What would have happened in Gouda if there had been no combination of functions? A new high dike would have been built in front of an old levee, with an empty space between. It would have been a lot more expensive to build, required more raw materials and led to the inefficient use of space, with fragmentation and suboptimal social integration. To the south of Den Bosch, there would have been no HoWaBo if, in accordance with current policy, compensation for the Maas Project had taken place at the location itself. The decision to relocate to Den Bosch yields massive direct savings. If, on top of this, no multifunctionality had been realized, all municipalities involved would have implemented their own sub-plans, soil would have been brought in for the levees or the levees would not have been developed as part of the landscape element with nature-related values.

It is only really possible to achieve a combination of goals if it is socially profitable. When is that the case? When do the people in the project dare to make a combination? When are they convinced that a project will help them and is a real business case? Multifunctionality is the best kept secret in the economy and society. The opportunities have been there for the taking for a very long time, but the ambition, the necessity and the preconditions for realizing them were not yet present to an adequate degree. The treasure chest of combinations is

only opening slowly because the next combination becomes profitable due to the pressure of economic and/or social circumstances. The trends in many sectors of society show how multifunctionality helps to shape the environment. Shareholders start working together and find out what they can expect from one another. That goes from project to project, with people discovering, for example, that agriculture, care and education go together, or water defences and generating energy. Once a new combination has been tried out, it is easier for people in other places to set up comparable combinations.

Naturally, it is important to work on creating the right preconditions, to look for better methods and to gather more knowledge about where and how we can put them into practice. The most important item on the agenda, however, is simply to get down to work. Make use of the new awareness of finiteness, study the specific qualities of the area, decide what your aim is and go in search of supporters and shareholders to capitalize on the existing qualities. Multifunctionality creates a sense of freedom. You can turn around, step out of your 'box', make a difference. Give me some freedom, enjoy your freedom. The cage is open. Where there's a will, there's always an appropriate way to be found for tackling a project. Open the treasure chest and discover the power of multifunctionality, and in the process, help to reinvent multifunctionality.

OVERDIEPSE POLDER

Since the beginning of 2011, the Overdiepse Polder along the river Maas near Waalwijk has been undergoing complete redevelopment in connection with the project 'Room for the River' www.ruimtevoorderivier.nl/english. The polder will be preserved for agriculture, whilst at the same time the river water can flow through it temporarily on average once every twenty-five years. Local residents and their animals live on terps (artificial hills) and the urban areas upstream of the Overdiepse Polder will suffer less from flooding as a result.

All eighteen farms have been demolished. Nine of these are rebuilt on terps, and the other nine have been relocated or bought out. The current dike will be lowered and serve in this way as an inlet for the river water when water levels are high. There will also be an ecological zone with alternating elements, such as channels and higher sections with trees. The wide, open character of the polder will be preserved. The combination concerns the safety of the catchment area of the river Maas and the agricultural use of the Overdiepse Polder. This safety is not so much the result of a flood defence structure, but because the creation of an overflow area downstream makes it unnecessary to heighten the dike upstream.

More information

www.youtube.com/watch?v=YpSmmUOCJ10


Holland.

Colophon

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This publication was commissioned by the Netherlands Ministry of Economic Affairs.

Netherlands Enterprise Agency is a department of the Netherlands Ministry of Economic Affairs that implements government policy for agricultural, sustainable, innovative, and international business and cooperation. Netherlands Enterprise Agency is the contact point for businesses, educational institutions and government bodies for information and advice, financing, networking and regulatory matters.

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Special thanks to
Nicole van Buren (Dutch Council for the Environment and Infrastructure)
Bert Groffen (Royal HaskoningDHV)
Geertje van Engen (AT Osborne)