

Lessons on climate adaptation in small and medium sized cities in Overijssel

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Climate change is one of the most challenging problems faced in urbanized areas today. Droughts and periods of heavy rainfall occur more often, causing severe damages and negative effects within the build environment. It is acknowledged that the conventional urban water management approach is unsuitable to cope with the current and future challenges. One of the main reasons for this unsuitability is that the hard measures, such as increasing the capacity of the sewage system, are not sufficient to deal with the effects of climate change. A solution to this problem is to adapt urban water management towards an approach that is more sustainable and that connects technology with the environment in a way that it makes urban areas resilient to climate change. Several cities in the Netherlands have been implementing climate change adaptation projects. This research identified the lessons learned from such projects in six cities in the Province of Overijssel. These lessons can be useful for governmental organizations like municipalities, water authorities, and provinces in improving their current and future climate adaptation processes and efforts.

Introduction

In the Netherlands, climate adaptation is mostly done within urban areas, since the population density is high, the country is highly urbanized, and economic activities are intensive in these areas. Several cities have already been making efforts in building resilience into their cities. For instance, Rotterdam, the second largest city in the Netherlands, is known as one of the global front-runners in preparing for climate change. Several smaller cities are also doing efforts in adapting their water management to increase the resilience towards the impact of climate change. Examples of these cities and also part of this research include Zwolle, Enschede, Hengelo, Almelo, Deventer, and Kampen.

There is little knowledge about the performed climate adaptation projects in these cities and their success. The aim of this research was to fill this knowledge gap and identify which lessons have been learned and can be exchanged. These lessons can be used by governmental organizations like municipalities, water authorities, and provinces in choosing and improving current and future climate adaptation processes and efforts.

Methodology

The research consisted of a desktop research and interviews with experts of different governmental organizations that are responsible for realizing the climate adaptation projects. The first step was to identify the climate adaptation projects in the six cities which are part of this research. Next, it was determined whether these projects were successful or not. At last, the lessons learned were identified.

The data gathered from literature and the interviews was used as input for the comparison matrix. This matrix was used to analyse the 20 projects which were studied (Figure 1). These were classified into nine categories based on their nature (Table 1). These categories were divided into three levels: city, street/quarter, and building. The projects within each category were compared to each other to identify the differences and similarities and the lessons learned. Based on the lessons learned per category and the data gathered through the interviews, five general lessons learned for climate adaptation projects were identified as well. At last, general criteria for successful climate adaptation projects were determined based on these lessons learned.

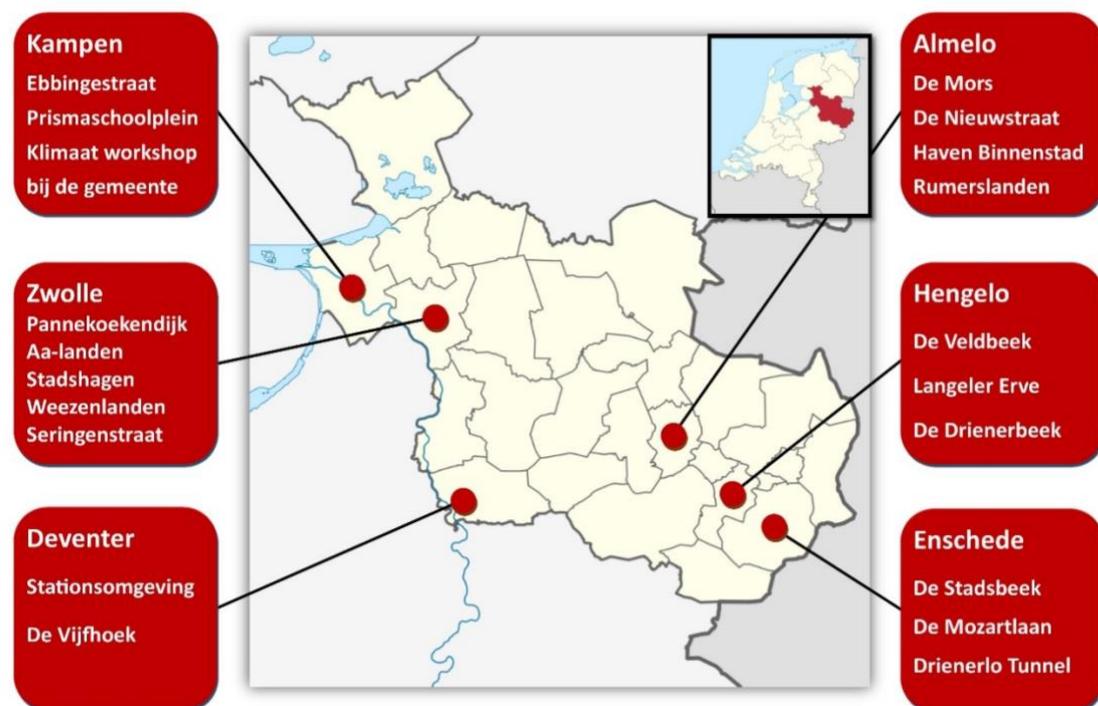


Figure 1 Overview of climate adaptation projects in six cities in Overijssel. Based on (Frohne, 2009; TUBS, 2011)

Lessons learned per category

To be able to compare the projects, only the categories with two or more projects were included in the analysis. For instance, the category 'information campaign' could not be included as it had only one project. Five categories remained as a result, and several lessons learned were identified from the comparison of the projects within those categories.

1. Water drainage at building level

Rainwater was disconnected at private property at all three projects within this category.

- Before the project is started it should be studied if an area is suitable to start a disconnection project. For this purpose, a survey should be performed amongst citizens about desires and barriers. Once it is decided that an area is promising, the citizens should be given the opportunity to decide on several aspects of the project. Besides, the whole neighbourhood should be involved right away in such a project.

- Money alone is not the right incentive for citizens to disconnect rainwater. A feeling of urgency among citizens is essential to have a successful project regarding disconnecting rainwater. Besides, efforts should be made by the municipality in the public area first, from there, it should be studied what can be done at private property. The less effort the citizens have to put in, the more successful the project will become.
- Before starting the project, awareness should be raised about climate adaptation and disconnecting rainwater. Having citizen ambassadors within the neighbourhood to raise awareness and to engage other citizens works well. It is also useful to have an external project supervisor during all phases of the project because of the close communication of the municipality with the citizens. Besides, clear communication with citizens is crucial to meet their expectations and to have a smooth and successful process.

Table 1 Overview of projects per category and levels. Categories are based on (Runhaar et al., 2012)

Level	Category	Project
Building	Water drainage	Aa-landen Seringenstraat De Mors
	Unpaved garden	Prismaschoolplein
Street/quarter	Additional flood defences or reinforcing existing ones	Pannekoekendijk Stadshagen Weezenlanden
	Drainage system	De Mozartlaan Rumerslanden Ebbingestraat Stationsomgeving
	Water storage facility	De Stadsbeek De Veldbeek De Drienerbeek Haven Binnenstad
	Better water infiltration and water outlet	Langeler Erve De Vijfhoek
	Increased sewer capacity or enhanced maintenance	Drienerlo Tunnel
	Extra green space and increased sewer capacity or enhanced maintenance	De Nieuwstraat
City	Information campaign	Climate workshop at the municipality

2. Additional flood defences or reinforcing existing ones at street/quarter level

At the Pannekoekendijk project, the existing flood defence was improved. The Stadshagen project included the construction of a noise barrier that can, if necessary, also function as a water barrier. Within the Weezenlanden project, a flood defence was constructed, which is integrated into the buildings.

- To ensure sufficient financing and to involve stakeholders, a clear overarching overview should be developed during the planning phase of these large projects. This overview should include how the different projects or parts of the projects will connect to make the whole chain complete, when these (sub)projects will start, how the whole chain will be financed, and how this all will lead to the final objective(s). During the planning phase all relevant stakeholders should be involved.
- To make this type of projects as cost efficient as possible, it should be ensured that they are integrated into the environment and, if possible, have other purposes as well. It depends on the local context how the measure can be integrated into the environment, thus how it will look like and if it is possible to give other purposes to the measure as well.

3. Drainage system at street/quarter level

At the Ebbingestraat project, hard measures were constructed to drain water off the street. The other three projects included the construction of green measures.

- Spatial plans in which water and green is integrated should be made to make sure that water and green are included into redesign/renovation projects. Measures in a certain area/neighbourhood/city should be connected to each other to make all measures work effectively. This should be done by starting projects out of an overarching vision/plan.
- It is difficult to define at the start if the measure is sufficient to drain all the water during periods of heavy rainfall. This means that the measure should be monitored regarding levels of flooding during and after heavy rainfall, and extra measures should be applied, if needed.
- The situation/area should be assessed in combination with the capacities of the municipality and other initiators in order to decide which drainage measure is the best to apply. It should be taken into account that green measures are relatively cheap compared to hard measures however green measures require more space compared to hard measures.

4. Better water infiltration and water outlet on street/quarter level

At both the *Langeler Erve* project and the *Vijfhoek* project, permeable pavement was used to drain water off the street. At the *Vijfhoek* project, this was also used in the parking lane.

- The construction of infiltration facilities should be guided properly, since contractors might lack specific knowledge, which is crucial for the measure to function well.
- Permeable pavement can work well, however maintenance and management of the pavement seem to be difficult and expensive. Pilots have to show if there are other possibilities regarding material and/or the maintenance method, which might make the management easier.

5. Water storage facility at street/quarter level

Within the project *Haven Binnenstad*, water storage was created by constructing a harbour in the city. At the other three projects, water storage was created by constructing or renovating brooks.

- To secure financing from the province or the national government, a public relations campaign should be organized. The water authority and the municipality alone are not able to finance such projects. Besides, the costs of the current project and the future linking projects should be known before the start of the first project. Overall, before starting such a project, the relationship between goal efficiency and cost efficiency should be well elaborated.
- This kind of projects should be started out of an overarching vision. This will ensure that the project is integrally linked to other projects and interests. Examples of integral links are 1) disconnecting rainwater towards the brook, 2) ways to drain water from other areas towards the brook, 3) making water visible in the city to create water experience and water awareness. Making water visible also creates added value to the quality of the public space, as it provides recreation

possibilities, looks beautiful and attractive, and cools the city.

- Efforts should be maximized so that the stakeholders get as much as possible out of the project. This will make people more enthusiastic and the more social return will be realised. This can be done by involving all stakeholders from the area within the design phase. Watersystem advice should also be involved during the planning phase to make sure management and maintenance levels can be kept on a sufficient level in the future. Involving citizens and allowing them in helping to design the project and add their desires and ideas to improve the local environment, will help in getting them involved and receive their support.
- The technical aspect is already a difficult one. However, the process is the most difficult aspect, because these projects are expensive, take long time to realize, demand relatively large space, require collaboration with a lot of stakeholders, and, in some cases, have to be executed in several phases. Sufficient capacities are needed to ensure a smooth process.

General lessons for climate adaptation projects

The five general lessons that are presented in this section are relevant for municipalities and other initiators in cities for choosing and improving current and future climate adaptation processes and efforts.

- The effects of climate change should always be realised with investments for the long term. When climate adaptation is not integrated into long-term planning, it is almost certain that within several decades, the measures have to be taken again. To prevent such situations, preconditions regarding climate adaptation and/or water and green should be integrated into long-term zoning plans and environmental plans.
- It is best to design measures in a way that water is visible. This makes it easier to raise awareness regarding climate adaptation, increase the water experience in the area and recreation possibilities,

and thereby improve the quality of life and the environment.

- The perspective should go beyond the administrative boundaries of the municipality: the whole watersystem should be seen as one and connected with other cities within the same watersystem. Additionally, an overarching plan/vision should be created before starting any project. It should be made sure that all sub-plans/projects contribute to a bigger vision/plan. This is needed to make the city climate resilient in the long term. In case one subproject does not function well, this influences the functioning of the other subprojects.
- In designing the measures, an effect-oriented approach should be adopted rather than a norm-oriented one. During the design phase, watersystem advice and/or the future managers/maintainers of the measures should be involved to make sure that management and maintenance will not be too difficult or expensive. The measures should also be designed in a way that it is 'foolproof': they will not lose their function over time due to changes in the area. Climate adaptation measures are particularly vulnerable in this respect. Symbol tiles work well to make climate adaptation measures visible.
- One of the problems in some, mainly smaller, cities is that there is not enough budget and staff available within the municipality to integrate climate adaptation well into the city. In the present situation, climate adaptation is mostly integrated into an area redesign/renovation projects, while large, sole measures are not a viable option. In some cases, large measures are necessary to reduce or solve high levels of nuisance and/or damage caused by for example flooding. It is important that this will be brought under attention within the municipality to create the feeling of urgency and to make sure this will change to ensure that the city really becomes resilient in the future. The internal process of the municipality should also be

effective and efficient. This should be done by creating awareness within the municipality at all professional disciplines are related to climate adaptation. A similar mindset should be created within these disciplines.

Conditions for success

The lessons learned lead to a set of conditions that define a successful project regarding urban climate adaptation in general. These conditions can be summarised as follows:

- 1) The collaboration between all stakeholders is excellent from the planning phase until the end of the project,
- 2) Climate adaptation measures within the project are integrally linked to other projects and interests,
- 3) The project is well integrated into the environment, and
- 4) The project adds value to the quality of the public space by creating water experience and water awareness.

Conclusion

Overall, this research identified lessons learned mainly on the planning/design phase, on the implementation process of the projects, and on the actual results achieved. This research did identify little lessons learned on the actual functioning of the measures regarding the reduction of the negative effects of climate change. The main reason for this is that the vast majority of the measures has not yet been or will not be monitored and/or officially evaluated in terms of their actual functioning.

The lessons per category, the general lessons, and the general conditions for success described by this research, are relevant and can be used by governmental organizations, such as municipalities, water authorities, and provinces in choosing and designing future climate adaptation efforts and to improve the implementation process of such projects.

Recommendations

In 2017, the Ministry of Infrastructure and Environment and the Ministry of Economic Affairs developed a national plan for climate adaptation, the Deltaplan Spatial Adaptation. This plan contains actions and objectives for the responsible governmental organizations for spatial planning. The objective of the plan is to accelerate and frame the process towards spatial adaptation. In order to accelerate this process, it is important that, besides large cities, the small and medium sized cities make efforts. It might be true that the efforts in large cities will be the most efficient ones for reducing the impact of climate change. However, small and medium sized cities relatively consist of a larger urban area. For the Netherlands to become climate adaptive, these cities should be actively involved in climate adaptation.

This research makes three recommendations to governmental organizations which initiate, are involved in, and/or manage climate adaptation measures.

- 1) All climate adaptation projects and measures should be monitored, and an official evaluation should be performed for each climate adaptation project. This will make it easier in the future to assess whether a project is successful or not, and how the climate adaptation projects and their associated measures should be improved.
- 2) This research identified both specific lessons for different levels and categories and general lessons that are relevant for all climate adaptation projects. These lessons can be applied, in case similar projects are implemented in the future. This will increase the success of the implementation process of the project and the measures within the project.
- 3) It should be ensured that the conditions for successful projects are fulfilled at each climate adaptation project. Doing so, will increase the success of the process of the project and will increase the success of the measures within the project.

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