


Knowledge for Climate

Midterm Review Report

Hotspot Rotterdam Region

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Mid term report Knowledge for Climate:

Hotspot Rotterdam Region

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List of abbreviations

ARR:	Adaptation strategy Rotterdam Region
CPC:	Climate Proof Cities (theme 4)
DP:	Delta Programme
HSRR:	Hotspot Rotterdam region
HSRRXX:	project code first and third tranche research projects
KfC:	Knowledge for Climate
SCBA:	Societal Cost Benefit Analysis
RAS:	Rotterdam Adaptation Strategy
RCP:	Rotterdam Climate Proof
RWS:	Rijkswaterstaat

1 Introduction

1.1 Rationale

Over the course of 2012, the eight thematic research programmes in the second tranche will reach midterm in their study. This why Knowledge for Climate (KfC) is organising a Midterm Assessment on 4 October 2012. On this day, the current state of affairs in the research programme will be presented at a thematic level. For the hotspots, this day is a good opportunity to present the first contours of their Options for Regional Adaptation Strategy (ORAS), and to show how the (expected) results of the first, second, and third tranche are brought together in the hotspot and how they affect practice.

Per hotspot, two societal reviewers will reflect on the state of affairs within the hotspots. This report of the Hotspot Rotterdam Region (HSRR) has the purpose of providing an insight into the process of question articulation, operating at the interface of science and practice, cooperation with regional stakeholders and the knowledge transfer with the ultimate objective of a widely supported, solidly substantiated adaptation strategy for the Rotterdam Region. The first contours of this regional strategy have been added as an appendix.

1.2 Hotspot Rotterdam Region

Knowledge for Climate is a research programme with the aim of developing scientifically applied knowledge for a climate proof planning of the Netherlands. To allow this knowledge to connect up with the practical situation, an organisational structure was chosen with eight hotspots under the leadership of a Hotspot Coordinator. Because the Hotspot Rotterdam Region (HSRR) is a mainport with large scale investments, a relatively high proportion of subsidies have been allocated to it.

1.2.1 Geographic boundaries

The Hotspot Rotterdam Region is not an existing or explicitly defined area. It is an indication of the region in which the most important climate challenges converge, interfere and relate to the mainport as economic engine of the Netherlands and the associated urban area. This roughly corresponds to the area referred to as Rotterdam metropolitan region.

However, due to intensive participation in the Delta Sub-Programme Rijnmond-Drechtsteden, particularly for the theme of flood management, the scope of the hotspot is not limited to the area of the Rotterdam metropolitan region. In addition to this, the metropolitan region also works extremely closely with the Haaglanden region in the fields of economy and transport (in the context of exploring the development of a larger metropolitan region, among other things) and the Drechtsteden and West-Brabant regions, which means the scope is also extended in those directions. In the following figure, the approximate area of the Hotspot Rotterdam Region (HSSR) is marked in green, with the area of the Rotterdam metropolitan region next to it (Figure 1).

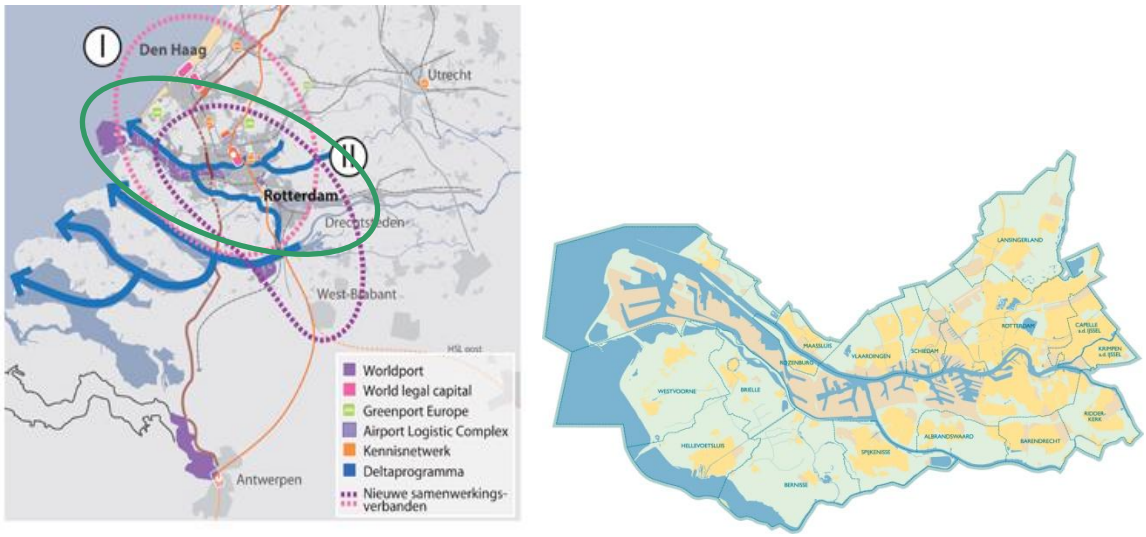

Figure 1 Location of Hotspot Rotterdam region (left) and the area of Rotterdam metropolitan region (right)

1.2.2 Parties involved

The most important knowledge users in the hotspot are: City of Rotterdam , the three water boards active in Rotterdam territory (Hollandse Delta Water Board, Delfland Water Board and the Water Board of Schieland and Krimpenerwaard), Rotterdam metropolitan region (alliance of 15 municipalities in Rijnmond region [1]), the Provincial Authority of South Holland and Rijkswaterstaat. The Rotterdam metropolitan region only became active in the KfC study at a later stage, particularly in the context of drawing up the Regional Climate Agenda, which now includes adaptation (see paragraph 3.2). The Rotterdam Port Authority was involved with the first tranche, in particular in the study into the effects of climate change on inland shipping. The Port Authority then focused its efforts in the climate dossier on participation in the Delta Sub-Programme Rijnmond-Drechtsteden.

The knowledge providers are largely from the region, such as the Erasmus University, Rotterdam University of applied sciences, Delft University of Technology, TNO and Deltares. In addition to this, other large national institutions also participate in various consortia such as WUR, VU, UU and Alterra. The private sector also plays a role as knowledge supplier and advisor in the hotspot, with an emphasis on the first and third tranche. In other words, the triple helix is fully represented in and involved with the Hotspot Rotterdam Region.

1.2.3 Organisation

The coordination of Hotspot Rotterdam Region takes place from the Rotterdam Office for Sustainability and Climate Change, under the leadership of Arnoud Molenaar as hotspot coordinator.

[1] Municipalities: Albrandswaard; Barendrecht; Bernisse; Brielle; Capelle aan den IJssel; Hellevoetsluis; Krimpen aan den IJssel; Lansingerland; Maassluis; Ridderkerk; Rotterdam; Schiedam; Spijkenisse; Vlaardingen; Westvoorne.

The coordination activities within Hotspot Rotterdam Region have been brought together in the HSRR00 project. Annually, the coordination activities (procedural, financial, legal, communication, and content coordination) are agreed and reported to KfC. The organisation of HSRR is split into two teams: the HSRR Hotspot Team and the Knowledge Coordination Team

Hotspot team Rotterdam Region
The Hotspot team HSRR consists of delegations of the most important knowledge users within the Rotterdam Region, the Rotterdam knowledge institutions and the knowledge institutions associated with Knowledge for Climate. Delegates have a mandate in the area of personal and financial deployment. The team consults on strategy approximately 2-3 times a year. The duties and responsibilities of the Hotspot team are:

- To advise and decide on the choices to be made within the HSRR, for example in relation to the research proposals, carry-over of knowledge and realisation of the adaptation strategy. Arnoud Molenaar will raise this with the KfC if necessary;
- To make financial and substantive contribution;
- to monitor cohesion with external developments and projects.

Knowledge Coordination Team
The Knowledge Coordination Team consists of five theme coordinators[2], a deputy hotspot coordinator, theme leaders[3], project leader RAS and the most important regional partners. There is a 6-weekly implementation meeting. The duties and responsibilities of the Knowledge Coordination Team are:

- Monitoring content and progress of the studies. This concerns KfC studies as well as RCP studies and relevant adjoining studies;
- Monitoring coherence between studies;
- Think-tank for development of RAS;
- Optimising knowledge input for the RAS, incl. advising the hotspot team and management group on starting up/participating in new studies, preparing the hotspot team meetings and providing input for the management group.

In order to increase involvement and equality, the Coordination Team has a rotating chair and secretary.

1.2.4 Ambitions

The various parties involved in HSRR each have their own ambitions and agenda for participating in the KfC programme. The most important reasons to participate in the research programme are:

[2] Theme coordinators are responsible for detailing a theme within the Rotterdam Adaptation Strategy (RAS). They write the text for the RAS and work together closely with the theme leaders, if this is a different person.
[3] Theme leaders: one person has been appointed within HSRR for each theme to monitor whether it provides relevant information for HSRR. Theme leaders originate from RWS, water boards and City of Rotterdam.

Solidly underpinned adaptation strategy
At the start of the KfC programme, the City of Rotterdam was already planning to reach a Rotterdam Adaptation Strategy (RAS) by means of the Rotterdam Climate Proof Programme. Rotterdam in particular saw participation in the KfC programme as a good way to solidly underpin urgency, challenges and potential measures. Other parties also saw and see KfC as a tool to better motivate their water and climate related policy, strategy and implementation programme.

The objective of the Hotspot Rotterdam Region is to make the area (city, port and surrounding area) climate proof and at the same time make it optimally attractive to work and live in. In practice-oriented research projects in the area of flood risk, urban development and transport over water, knowledge is developed which eventually contributes to the final product of the hotspot within the KfC programme: a regional adaptation strategy.

Multiplier effect
An extremely attractive element in KfC for many parties is the large multiplier effect. By combining strengths and budgets, parties can obtain research results which represent far greater value in exchange for a relatively small investment. This is not only advantageous in a substantive sense. It also makes it easier to gain support among co-financiers.

Cooperation with regional partners and knowledge institutions
Many parties in the region are involved with climate adaptation, all with their own interests and qualifications. Administrative workload and fragmentation make it more difficult to effectively achieve climate and sustainability ambitions. KfC was regarded a context within which parties could join forces and achieve co-creation. A development aspired to by many, and therefore a reason to participate.

Raising national and international profile
The opportunity to work together on the building blocks of an integrated climate adaptation strategy linked to a high quality living climate and an economically thriving region was an attractive perspective for many parties. Also, because people could see that the city and the region, and also the individual parties, could raise their profile both nationally and internationally.

2 Approach

2.1 General

The management philosophy within KfC has been one of cooperation of parties involved within an area, without immediately looking at formal duties and competences. In practice, this meant that the City of Rotterdam , 'Rotterdam' Water Boards, the provincial authorities and RWS acted as co-financiers of KfC projects, and that from a civil service level, cooperation mainly took place from a knowledge perspective.

A shift is currently taking place, also in the Delta Programme, from a phase of knowledge development towards policy making. This means that the developed knowledge and insights have to start filtering through to policy documents, answering questions such as 'who is responsible', 'what are the political ambitions', 'what set of instruments is being used', 'what frameworks are in place', and 'who finances' (the white spots in the climate adaptation barometer[4]).

Finally, it is worth mentioning that the Hotspot Rotterdam Region works from the inside out. This means that the attention for climate adaptation and strategy forming started at the City of Rotterdam . This is still the priority area. Now is the time to scale up to a regional level (see Figure 2). The experiences gained and knowledge developed in Rotterdam will be of great use. In fact, this has developed this way historically. In Haaglanden, the exact reverse is the case - they work from the outside in. The process of reaching a regional climate adaptation strategy is different for each region. Practice will show whether this has an effect on the final results. It is recommended that this aspect is considered in the "lessons learned" within KfC and the transfer of knowledge.

Rotterdam Region: Regional approach

Figure 2 Regional approach: Upscaling the Rotterdam adaptation strategy (RAS) to a regional adaptation strategy (source: 5xORAS by Royal Haskoning)

[4] The Rotterdam Climate Adaptation Barometer is described in section 3.1. A first test run shows that a lot is known about effects of climate change, objectives and possible measures.

2.2 Research questions

First tranche

In the first tranche, the question articulation was a collaborative process of knowledge users and providers. In a workshop held on 23 April 2008 about one hundred participants formulated knowledge questions with regards to climate change, and knowledge providers were able to indicate in which studies they would like to play a role. This gave rise to coalitions which in turn led to application, financing and implementation of nine study proposals. A number of those were intended as a definition study to gain an insight into what knowledge was already there (or in development) and which gaps in knowledge remained to be addressed in the second tranche. In the end, this resulted in the following studies.

Table 1 First tranche projects Hotspot Rotterdam Region

Project-code	Project name – hyperlink to study	Parties involved
HSRR01	City water system / Impact of climate changes on city water systems (surface, ground and sewage) and required adaptation strategies http://knowledgeforclimate.climateresearchnetherlands.nl/HSRR01	Deltares, Delft University of Technology, City of Rotterdam
HSRR02	Definition study 'Water Safety outside dykes' http://knowledgeforclimate.climateresearchnetherlands.nl/HSRR02	Deltares, UNESCO-IHE, Dura Vermeer, Royal Haskoning, HKV, City of Rotterdam
HSRR03b	Opened/closed Rijnmond - Waterfront Rijnmond http://knowledgeforclimate.climateresearchnetherlands.nl/HSRR03b	Delft University of Technology, HKV, Deltares, RIVM, Inbo bv, Defactor Architecture
HSRR04/ HSHL05	Region-specific climate information for Haagland and Rotterdam region http://knowledgeforclimate.climateresearchnetherlands.nl/HSHL05-HSRR04	KNMI, WUR, HH Delfland, City of Rotterdam, The Hague Region
HSRR05	Heat stress in the city of Rotterdam (see textbox page 13) http://knowledgeforclimate.climateresearchnetherlands.nl/HSRR05	TNO, Deltares, WUR, City of Rotterdam , SBR
HSRR06	Safe and well-integrated main flood defences http://knowledgeforclimate.climateresearchnetherlands.nl/HSRR06	Deltares, Royal Haskoning, City of Rotterdam , HH Schieland, WB Hollandse Delta, HH Delfland
HSRR07/ HSGR08	Relationship between observed flood risks, problem owner and household and business choices in adaptations http://knowledgeforclimate.climateresearchnetherlands.nl/HSRR07-HSGR08	VU-IVM, Deltares, HKV, City of Rotterdam

HSRR08	The effects of climate change on inland shipping via the Rotterdam region http://knowledgeforclimate.climateresearchnetherlands.nl/HSRR08	Arcadis, Deltares, TNO, VU, TU Delft
HSRR09	Adaptive building in the unembanked area in the Hotspot Rotterdam Region http://knowledgeforclimate.climateresearchnetherlands.nl/HSRR09	Arcadis, City of Rotterdam

Projects in the first tranche have made an important contribution to the formulating and sharpening of the tasks and the urgency of climate adaptation for Rotterdam (step 1 - 3 from the climate adaptation barometer, see page 20). All first tranche studies have now been completed.

Second tranche
Whilst the first and third tranche are fully coordinated by the hotspots, the second tranche is coordinated centrally.

Already during the implementation of the first tranche projects, research in the second tranche was started by the 8 thematic research consortia of KfC. A large part of the knowledge accrued for HSRR in the second tranche is still being developed and is about potential adaptation measures and the effectiveness and implementation thereof (step 4 - 5 in the barometer on page 20).

The 'open call' for the second tranche project proposals of the 8 themes is partly formulated on the basis of knowledge questions from the hotspots. In response to this, the research consortia (knowledge institutes and universities) drew up project proposals. After the so-called 'pre-proposal phase' the hotspots had to distribute 50% of their subsidy budget over the various themes and find co-financing amounting to half the value of the subsidy tokens. This was a challenging process as the project proposals were formulated at a much higher level of abstraction than the knowledge questions of the hotspots and the definition studies from the first tranche had not yet been completed.

After a prioritising session during which the parties also expressed their intention to co-finance, HSSR decided to commit itself to the following research themes in the second tranche:

- Theme 1 – Flood Risk Management
- Theme 2 – Fresh Water Supply
- Theme 4 – Climate proof urban planning (Climate Proof Cities)
- Theme 5 – Infrastructure and Networks
- Theme 7 – Governance of Adaptation

By introducing specific research questions and proposing case locations, the final research agendas in the second tranche were partly determined by the hotspots. Appendix I shows which case studies and work packages refer to HSRR.

It’s getting hot in Rotterdam

Does a city like Rotterdam also suffer from the heat-island effect? And does this lead to health problems? It seems like a simple question, but in actual fact it is not, when there is hardly any temperature data on the city. Rotterdam has stuck its neck out and, as the first city in the Netherlands, has carried out extensive research into heat in the city. The outcome: it can get up to 8 degrees hotter in the city than outside.

Rotterdam aims to be climate proof by 2025. This requires knowledge about the climate now and in the future, but especially what the effects are on the city and its inhabitants. For the city, this knowledge is limited. All the weather stations are located outside the city; very little has been measured in cities in the Netherlands. Of New York, we know that it can be up to 10 degrees cooler in Central Park than in Manhattan. So how about our cities? The core questions of the Heat Stress Project were: Is there a heat-island effect in Rotterdam, and if so, in which districts is the effect the greatest? Who suffers from it? Who is causing the problem and what are the causes? And of course: do we need to do something about it, and if so, what?

Wageningen University carried out the temperature measurements in a typically Dutch manner. The researchers cycled through Rotterdam on a few hot days with the measuring equipment on a *bakfiets* [delivery bicycle]. In addition to this, Rotterdam installed a number of fixed measuring points, where measurements are constantly carried out, and satellite images with heat measurements were consulted. But that was not all. TNO equipped almost 1,000 people with a meter and took measurements of sleep disturbances in older people. This was done to obtain an impression of how heat affects the health of older people.

The project manager Lissy Nijhuis of Rotterdam Council is pleased with the results. ‘We now have much more insight into the city climate of Rotterdam and in which districts people suffer more than average from warm days. We know more about the effects of greenery, wind and water on temperatures in the city, and especially also with the perceived temperature, i.e. how people experience the temperature. We thought water had a cooling effect, but that appears to not always be the case. When the water has heated up on a hot summer day it does provide some cooling down during the day, but doesn't during the evening hours.' In addition to this, Rotterdam now has a good zero measurement, which it can use to study the effects of measures in practice. And, certainly not unimportantly, they have mapped out where the vulnerable groups are. This knowledge is used for urban development in the city.

Knowledge for Climate has always emphasized that health effects must be of central importance, and research has to be linked to that. Debby Jochems of GGD [Public Health Service] Rotterdam-Rijnmond participated in the project. For her, the differences in temperature between the various districts were an eye-opener. The GGD advises the council on projects in the area of physical planning. Previously, this advice was very generic when it concerned heat stress; the GGD can now offer much more specific advice, using the knowledge gained in these studies. They are also able to draw more general conclusions which the GGD can apply to the surrounding councils. Whether that will actually go ahead depends on resources. After all, the GGD also has to cut budgets. Debby is keen to ensure there is some kind of future for the study: 'every four years, we carry out a health survey among the inhabitants of our service area. This time, we would like to include a question whether people are easily able to find ways of cooling down in their own home and in the district. We can then compare the answers to these questions at a district level with the details from the study project. This way, we get an impression of whether people living in a relatively warm district do in fact experience their living environment as 'warmer' than Rotterdammers who live in a slightly cooler district.'

There has been a lot of interest in this project. Lissy and her colleagues gave many presentations and led many workshops. There was also a great deal of interest from the press. National newspapers De Volkskrant and Trouw, and also TV Rijnmond and the NOS News carried reports on the project.

Third tranche

The third tranche is characterised by a bottom-up approach. The research questions were all formulated by the knowledge users from the hotspot. Nine research proposals have now been submitted which (1) fill in the last gaps in knowledge, (2) bring together the results in a Rotterdam *and* a regional adaptation strategy; and (3) valorises the results already available from the 1st, 2nd and 3rd tranche studies.

The following studies will be carried out within this tranche:

Table 2 Third tranche projects Hotspot Rotterdam Region

Project-code	Project name
HSRR3.1	Adaptive development strategies in the outer dyke areas of the Rotterdam Region
HSRR3.2	Eco adaptation in the urban delta
HSRR3.3	Drought problems in urban areas
HSRR3.4	Adaptation strategy Rotterdam Region (ARR)
HSRR3.5	Cluster proposal small knowledge gaps
HSRR3.6	Business case climate adaptation Rotterdam Region
HSRR3.7	Valorisation of adaptation knowledge: Sustainable Delta Cities
HSRR3.8	Climate resilience of the city: connect adaptation and mitigation
HSRR3.10	Governance: Flood risk management and urban development: to mutually reinforcing partnerships in the Feijenoord district

2.3 Knowledge dissemination

Sharing Rotterdam's knowledge and experience **within Knowledge for Climate** is predominantly done via the Climate Proof Cities (theme 4) network during project and consortium meetings.

Within Rotterdam itself, the transfer of knowledge to colleagues other than those parties involved with KfC has proven to be a major challenge. This requires specific and explicit attention in the safeguarding process which is developed as a part of the RAS.

The climate adaptation knowledge which has been and will be developed **within Hotspot Rotterdam Region** will be used for a further scale-up to regions and cities outside the hotspot. Rotterdam is a leader in climate adaptation policy and research in the Netherlands, and thereby acts as a role model for other cities, especially with regards to the subjects of city water, heat stress and integrated adaptation strategy development.

In addition to this, Rotterdam works closely together with Rotterdam University of applied sciences (Water Management) and Erasmus University Rotterdam (EUR). Whilst the Rotterdam courses focus mainly on applied knowledge and governance, the cluster with the Delft University of Technology is

particularly aimed at theoretical knowledge. There is cooperation with these educational establishments in various projects within the Hotspot Rotterdam Region.

At a **national level**, knowledge sharing mainly takes place by means of events such as:

- the conference organised by Rotterdam and KfC in 2010 “Deltas in times of Climate Change”, with 1200 participants;
- Water Living Space conferences;
- Knowledge Festival Delft.

At a national level, knowledge from the Hotspot Rotterdam Region is also used in the Delta Programme. The project results from the first tranche were immediately used for strategy development in the sub-programme Flood management. In addition to this, knowledge development within the hotspot was linked to the sub-programmes Rijnmond-Drechtsteden and New construction & Restructuring.

Knowledge development in Rotterdam now also takes place through **international knowledge exchange**. For this purpose, Rotterdam founded the international knowledge network ‘Connecting Delta Cities’[5] (CDC). The CDC network offers opportunities for cooperation and knowledge transfer between delta cities across the globe, and is also seen as an important bridge to the international market. The cooperation between Rotterdam and Ho Chi Minh City, for example, originated from the CDC network (see paragraph 4.3). Also: Rotterdam is welcoming an increasing numbers of delegations from the Netherlands and particularly from abroad. These too are moments when knowledge is transferred.

Last but not least, Rotterdam Council was appointed *peer city* in the EU Cities Adapt Project in August 2012, by the European Union (DG CLIMA). In this context, the knowledge and experiences of Rotterdam Council, partly gained in the KfC programme, will be shared with comparable European cities.

2.4 Cooperation

2.4.1 Cooperation within the Hotspot Rotterdam Region

Cooperation can generally be regarded as good. By starting with a large-scale start meeting (April 2008) held at an appealing location and in the presence of high-profile participants such as former prime-minister Mr Lubbers, the majority of the stakeholders was mobilized straight away. The times when co-financing had to be found within the hotspot led now and again to a certain amount of tension.

Another form of tension is revealed in the double role Rotterdam at times experiences. On the one hand, the partners appreciate that Rotterdam often takes the lead, on the other hand, it must not become all about Rotterdam and nothing else. For example, an ARR which is too strongly focused on Rotterdam may be experienced as "threatening" for the regional councils, and that is certainly not the intention. In other words this is an issue worth monitoring.

[5] www.deltacities.com

2.4.2 Cooperation with other hotspots

There is regular (informal) contact with the other urban hotspot within the KfC programme, Hotspot Haaglanden Region. Knowledge and experience from the research projects is exchanged, for example by means of contributions to workshops or other activities related to projects or the research consortia (second tranche) such as Climate Proof Cities (theme 4). The substantive theme that connects both hotspots most strongly is urban water. The areas focused on in both hotspots with regards to climate adaptation research are different and complimentary: the strength of Hotspot Rotterdam Region lies in the development of knowledge in the field of 'city' and 'port', whereas Hotspot Haaglanden is more focused on ‘glass’ (greenhouse horticulture) and ‘grass’ (soil-bound agriculture, nature and coast).

In the context of drawing up regional adaptation strategies, conversations are held regarding coordination between both hotspots. No concrete agreements have yet been made in this respect. The priority both at Hotspot Rotterdam Region and Haaglanden Region lies with drawing up their own well-substantiated and broadly supported strategy. In a subsequent phase, possibly also in the context of the potential establishing of the metropolitan region Rotterdam-The Hague, considerations may be made regarding joint strategy development. Climate adaptation is one of the themes on the management agenda of this potential new cooperative body. It is as of yet unclear how the further drawing up of the substantive agenda of the metropolitan region will proceed.

Besides the Hotspot Haaglanden Region there are also relationships with cities which do not fall under a hotspot but *are* involved with the KfC programme, such as Amsterdam, Arnhem and Tilburg. Contact takes place via the consortium Climate Proof Cities (theme 4) which carries out research in these cities. The outcomes of this research in these cities are also of interest to the Hotspot Rotterdam Region and vice versa. Moreover, there are also links with the KfC hotspots Major Rivers and South-West Netherlands Delta. From the second tranche theme Flood risk management(theme 1) there are various projects which relate to these hotspots and to Rotterdam.

2.4.3 Cooperation with the Delta Programme

Just after the start of the RCP programme, the national Delta Programme[6] (DP) was also launched. Mayor Aboutaleb was appointed administrative chair of the steering committee DP sub-programme Rijnmond-Drechtsteden on behalf of Rotterdam Council, which created a direct link between Rotterdam/RCP and the Delta Programme. The Rotterdam metropolitan region is also represented by Aboutaleb.

The Flood management theme within the RCP programme is largely covered by the DP sub-programme Flood risk management and KfC research from the second tranche (theme 1). Conversely, the DP sub-programme Water Safety also uses knowledge from the KfC study within Hotspot Rotterdam Region.

[6] http://www.government.nl/issues/water-management/delta-programme

Results from the first tranche projects HSRR02 and HSRR03b, HSRR06, HSRR09 were immediately used for the strategy development within this DP sub-programme.

The DP sub-programme New construction & Restructuring is (to a lesser degree) related to Hotspot Rotterdam Region. In the study, which is carried out in this sub-programme, Rotterdam is often put forward as a case. The contact between the Delta Programme and the hotspot mainly runs via a number of people who are active in both programmes.

So-called delta decisions are being prepared within the National Delta Programme. These decisions, which are to be taken by the National Government in 2015, partly determine the context for the local and regional adaptation policy. The development of the RAS and the ARR will take place in interaction with the Delta Programme and will anticipate the delta decisions which are to be taken in 2015.

3 Development of the Adaptation Strategy Rotterdam Region

The results from the first, second and third tranche projects within Hotspot Rotterdam Region are not only utilised by stakeholders directly involved with the projects, but in the end they also contribute to a cohesive final product of the hotspot in 2014: the 'Adaptation Strategy Rotterdam Region' or de ARR. The realisation of this product takes place within the third tranche project HSRR3.4 (Table 2 and Figure 5). There are a number of parallel processes within HSRR, which provide building blocks for this ARR.

3.1 Building block I: Rotterdam Adaptation Strategy (RAS)

Adapting to climate change is one of the ten challenges named in the Rotterdam Programme on Sustainability and Climate Change 2010-2014set out by the Municipal Executive. The drawing up of a Rotterdam Adaptation Strategy (RAS) is one of the most important actions to meet this challenge. The RAS describes what the effects of climate change are on the city, what this means for the functioning of the city and what the risks are. It indicates which measures are effective and achievable and do not only cost the city money, but also deliver benefits. The guiding principle is that a climate proof city is also economically stronger and more attractive. The decisions required to be able to carry out the adaptation strategy, and the partners in and outside the city that play a leading role in this are also named in the RAS.

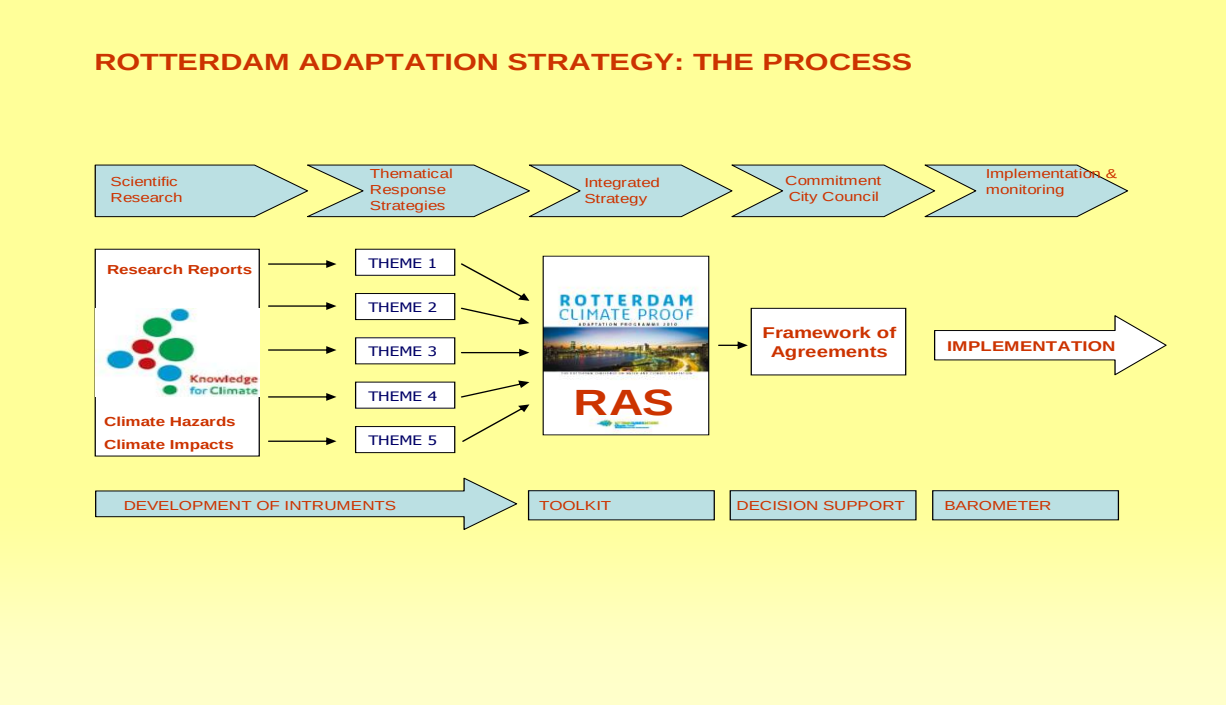

Figure 3 Overview of the development of the Rotterdam Adaptation Strategy (RAS)

The Rotterdam Climate Proof programme

Attractive city and added economic value

Rotterdam Climate Proof renders Rotterdam 100% climate proof by 2025. By responding to climate change, the city continues to be safe, accessible and attractive in the future. For the people who live and work there, and for the companies based there. This is a substantial ambition which will be achieved from three starting points:

1. Knowledge: Rotterdam develops into a national and international leader in water and climate knowledge, and raises its profile as such.
2. Actions: Investing in climate solutions makes the city and the port more attractive to inhabitants, companies and knowledge institutes.
3. Raising profile and spin-off: Innovations and knowledge are developed, applied and marketed as export product.

Innovative applications in the area of water management make the city more attractive. The construction of *waterpleinen*, or water-plazas for instance. Or the use of floating constructions. These are appealing projects which make Rotterdam - the lowest lying delta metropolitan area in Europe with one of the largest ports in the world - a role-model for other delta cities. Rotterdam Climate Proof thereby contributes to the Rotterdam knowledge economy and cashes in on opportunities on the international growth market of Water and Climate.

Transition

Over the last ten years, an important transition has taken place within the water management of Rotterdam; from water as enemy to water as friend and symbol of the start-up of processes and innovations which go further than solving water issues. This transition occurred gradually on the basis of a sectoral Water Plan (2001), the vision Rotterdam Water City 2035 (2005) and the integrated Waterplan2Rotterdam (2007) in Rotterdam Climate Proof (2008) which became part of the Sustainability programme 2010-2014. With the RCP, climate adaptation was also raised on the administrative agenda, and a first step was taken in the development of an adaptation strategy. An equivalent process has to some extent also taken place at other stakeholders, including at the Province of Zuid Holland.

The Rotterdam approach

The approach of Rotterdam Climate Proof is characterised by:

- The integration of water, climate, spatial planning and the socio-economic challenge;
- Making optimal use of opportunities for the city and the port;
- Drawing up a cohesive and area-wide adaptation strategy;
- Pro-active approach aimed at flexibility and resilience.

Rotterdam Climate Adaptation Strategy (RAS)

For a climate-proof Rotterdam, the first priority is sustainable protection against flooding of bankes and unembanked areas. In addition to flood risk, the City has to be prepared for other consequences of climate change, including an increase in the frequency of heat waves, salinisation of ground water, altered possibilities of transport over water and more changeable ground levels. It is essential that an adaptive strategy is pro-active and adapts to changing circumstances. In the Rotterdam Adaptation Strategy (RAS) it becomes clear in what ways measures can be used to render an area climate proof. With the implementation of RAS, Rotterdam is properly prepared for the future!

At the start of the Rotterdam Climate Proof programme in 2008, a subdivision was made into five substantive themes which are used as guiding principles:

1. Flood management
2. Urban Water Systems
3. Adaptive Building
4. Urban Climate
5. Accessibility

To reach an integrated adaptation strategy, these themes are worked out substantively; bottlenecks, challenges and measures to be taken are mapped out; all relevant players are involved; and an investigation is carried out into how climate adaptation can be safeguarded most effectively within the organisation and at external stakeholders.
The steps which lead to the Rotterdam adaptation strategy are effectively illustrated in the developed climate adaptation barometer (Figure 4), which indicates what (sub-) questions the RAS answers. Typical of the RAS is that there is not only a problem analysis, and measures are mapped out, but an insight is also provided into how and where these measures have to be in place at what moment in time, to achieve an effective implementation.

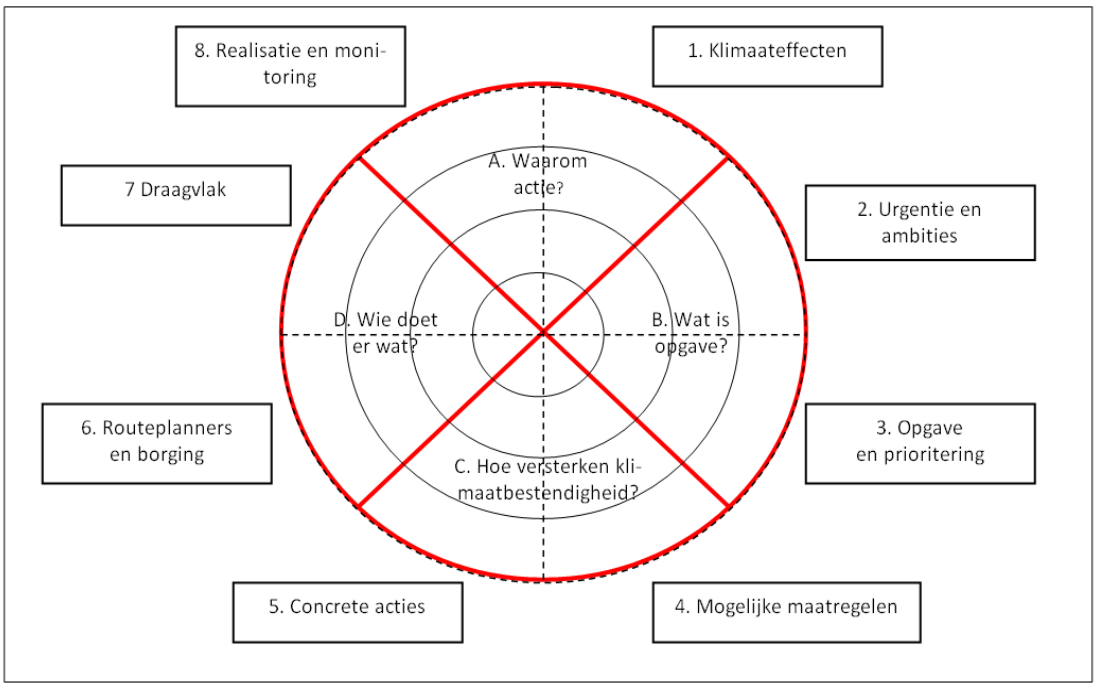

Figure 4 Climate adaptation barometer (Klimaatadaptatiebarometer - conceptversie d.d. 1 november 2011)

Rotterdam aims to deliver a RAS approved by the Municipal Executive by late 2013/early 2014. It will consist of a main document in which the adaptation strategy is described concisely and appealingly (integrated vision and plan). This includes background documents per theme with the deeper analyses and underpinning based on KfC research. Finally, a covenant is delivered which describes in what way parties, such as the government organisations with an involvement in the delta programme, are involved and what agreements are made.

An important part of the RAS is the assurance plan. The RCP programme will have to be substantively anchored before the end of 2013. The anchoring of climate adaptation at different locations in organisations and at various scale levels is important in this process, such as:

- retaining knowledge;
- anchoring in spatial plan processes (for example comparable methods such as the water test);
- anchoring in design, implementation and management (for example a training process for city planners);
- anchoring in the administrative agenda (i.e. via a core team which is also responsible for monitoring the RAS and keeping it up to date).

Finally: Rotterdam is not waiting for the RAS to be established before taking measures. In the context of the Water Plan there are already serious investments being made in the creation of additional water storage. The city is already experiencing the consequences of increasingly intensive peak showers. Green roofs, water-plazas, permeable road surfaces and underground water storage are ‘no-regrets‘ measures in this context. This is also happening elsewhere; in Schiedam for example, an innovative form of water storage has been created under a road.

Rotterdam Adaptation Strategy

Rotterdam is working towards an integrated strategy which will prevent the city from experiencing negative consequences from climate change. For a structured approach, the strategy is first worked out into five themes. Research is carried out on the basis of KfC research and area knowledge into the effects are of climate change on the city, and which city functions and areas are vulnerable in relation to the theme concerned. Aims, ambitions of the city, and potential measures are then mapped out. Per theme, combinations of measures are combined into logical (sub-) strategies per theme, linked to a time path (adaptation pathways). The preferred strategies per theme, together form the integrated strategy. Mid August 2012, the impression per theme is as follows.

Flood Management

Most important effects of climate change:	The rising sea levels and changing river distributions lead to an increase in the risk of flooding in banked and unembanked areas. Long drought periods cause risks to the stability of dykes, e.g. peat dykes.
Vulnerable functions and areas:	In recent decades, the potential consequences of flooding have greatly increased due to urbanisation, also in unembanked areas . In embanked areas, flooding can lead to victims and large-scale economic damage. In unembanked areas it particularly causes damage to infrastructure and involves the risk of economic damage. In the Rijnmond-Drechtsteden region, part of the water defences already fail to meet current standards. For dykes on the north bank of Rotterdam, a height deficiency will occur in the 2nd half of this century.
Main line (sub-)strategy	Keep using the space in the current water defences system for as long as possible. When strengthening the water defences on the basis of regular tests, take into considerations the insights and decisions from the Delta Programme. Opt for flexible, multi-functional methods of implementation. Tailored solutions for unembanked areas .

Urban Climate

Most important effects of climate change:	Longer dry and hot periods. Increase of the Urban Heat Island effect and heat stress. Health problems (also those related to heat related air quality problems) and reduction of thermal comfort both inside and outside.
Vulnerable functions and areas:	Stony, densely built-up areas of the city. Health of vulnerable groups of inhabitants.
Main line (sub-)strategy	In the redevelopment of urban areas, take building and planning methods into consideration. Strengthening green structure. Informing inhabitants.

Urban Water System	
Most important effects of climate change:	Increase of both extreme and prolonged periods of rainfall. Long periods of drought cause a deterioration of water quality, partly due to the inlet of more salty water.
Vulnerable functions and areas:	Areas with a shortage of surface water storage and insufficient drainage capacity of sewage. Areas where ground levels of homes cannot be brought back to distribution level and storage in the outside space is not possible (subsidence). Surface water that is primarily dependent on water from the Meuse for replenishment. Buildings which do not have piled foundations or are built on wooden piles.
Main line (sub-)strategy:	Combined, area-dependent use of measures to strengthen storage and drainage capacity of surface water and sewage systems and measures in spatial planning (outside space, green roofs, water-squares).
Accessibility	
Most important effects of climate change:	In the winter higher temperatures will lead to more periods with temperatures around 0 degrees Celsius, and therefore more freezing/melting situations, which may lead to road surface damage. More frequent higher temperatures in summer lead to the heating and insufficient cooling of constructive parts of the mobility system. Long dry periods lead to lower river discharges. Extreme precipitation occurrences lead to loss of travel time.
Vulnerable functions and areas:	More freezing/melting situations can lead to road surface damage. Longer periods of heat lead to damage to asphalt, bridge roadways which expand and possibly no longer close, and damage to rails. This can lead to congestion, loss of travel time and therefore economic damage in the main urban road network. Low river distributions lead to lower loading levels of ships and more transport movements.
Provisional main line (sub-)strategy:	Monitoring occurrence and effects of extreme weather events (precipitation, temperature) and launch preliminary research into preventative and curative measures (early warning system, expand dynamic traffic management system).
Urban Climate	
Most important effects of climate change:	The rising sea levels and changing river discharges lead to an increase in the risk of flooding in residential areas outside dykes.
Vulnerable functions and areas:	Buildings in older areas outside dykes with a residential function (e.g. Noordereiland). Infrastructure and public services.
Main line (sub-)strategy:	Tailored solutions when restructuring residential areas outside dykes. In new building projects, take future higher water levels into consideration and adjust construction methods and/or method of preparing sites for building.

3.2 Building block II: Regional Climate Agenda Urban Region

The Rotterdam metropolitan region is seen by the regional councils as *the* party able to facilitate regional cooperation in the area of climate adaptation. From the metropolitan region, a Regional Climate agenda[7] was already drawn up in 2008, which for the time being mainly focuses on mitigating measures. In 2011, a start was made with exploring a regional approach of climate adaptation.

On April 26 2011, the exploratory workshop "Regional Climate Adaptation" took place in the context of the joint ORAS project of the KfC hotspots, supported by Royal Haskoning, under instruction of KfC. Various councils and water boards in the Rotterdam urban region noted a strong added value in regional cooperation in climate adaptation, and momentum was gained to actively and practically achieve regional cooperation in the area of climate adaptation. The metropolitan region then started a foresight study into the needs of regional councils. The administrative study visit “Practical examples of adjustments to public space to climate change” of 1 December 2011 was a part of this. The foresight study showed that councils want more insight into what climate change means to their municipality, knowledge about practical applications in the short and medium term, and to share knowledge and experiences with other councils.

In order to meet this need, a translation was made to the region on the basis of the national Climate Effect Atlas. In addition to this, a first inventory was made of potential measures to be taken (a toolbox), for a number of relevant themes (e.g. flood risk management, municipal water management, urban climate and salinisation). At the same time, four sub-regional work sessions were organised, with civil servants involved from different councils with similar area characteristics and climate challenges, with the addition of experts from the water board. The activities were carried out as a part of the third tranche KfC project HSRR3.4.

The purpose of the 4 sub-regional workshops was mainly to make an estimation at a local level of the urgency to take action on the basis of the regional climate effect atlas and the spatial planning in place. The substantive focal points which arose from these workshops are shown in Table 3.

[7] *Regional climate agenda “Energy for the future”*: “In the regional Climate Agenda, the councils of the Rotterdam urban region work together on a major reduction of CO2 emissions. Our aim is to emit 40% less CO2 in 2025 than in 1990. For this purpose we are combining our strengths and carrying out cooperation projects which combat energy waste and utilise sustainable energy sources. The urban region hereby contributes to the sustainable development of the region.” Klimaatagenda.stadsregio.nl

Table 3 Results sub-regional workshops: overview climate adaptation priorities of each municipality

Salinisation										XX					
Urban Climate	XX	XX			XX										
Urban water	XX			x	XX		XX			XX			x		x
Accessibility	XX														
Water safety	XX				XX		XX			XX			x		
Please note: **Urban climate** is mainly heat. **Urban water** is mainly intensive showers, ground water, drought and subsidence. **Water safety** applies embanked and unembanked areas.	R' dam	BAR-councils			Waterweg and IJssel Councils					Voorne Putten					L'land
	Rotterdam	Barendrecht	Albrandswaard (*)	Ridderkerk	Vlaardingen	Maassluis (*)	Schiedam	Capelle a/d Ijssel (**)	Krimpen a/d Ijssel (**)	Hellevoetsluis	Brielle (*)	Bernisse (*)	Spijkenisse	West Voorne (*)	Lansingerland

(*) = Not present, and this question has therefore not been answered
(**) = No challenge.
XX= Potential challenge which requires additional action.
x= Potential challenge where no additional effort is required (has already been mapped out, work is being carried out on it).

Flood risk is an important regional focal point, particularly for the councils along the Nieuwe Waterweg. In a regional context this is already addressed via the DP sub-programme Rijnmond Drechtsteden. The metropolitan region is also involved with the third tranche KfC project HSRR3.1 regarding Adaptive Building. The distance between these activities and the council employees is still very significant. There is little knowledge of what is happening in the Delta sub-programme or the KfC project.
Urban water (particularly problems after intensive showers) is also an issue in almost all municipalities. This is also passed off with a comment of: "We will solve the problem when it occurs".

Both in regard to potential problems and opportunities for climate adaptation, there is a lack of knowledge on the part of councils. However, the expectation is that this will not be resolved in the short term. Searching for no and low regret measures and 'learning to deal with uncertainties' appear to be the most important elements of a regional strategy. In addition to this, the councils state that an integrated approach is essential: Adaptation is more than just the environment or only green, water, urban planning, etc. As a corollary, it is also important to cut the tie between climate adaptation and people that are involved individually.

The sub-regional workshops showed that councils are not quite on the same line, and have divergent views of the urgency of climate adaptation. One of the things that does come across clearly from the workshops is a request to pick up on a number of issues at a regional level. The added value of cooperation lies predominantly in the following, according to the councils of the urban region:

- Regional scheduling: both for managers and civil servants.
- Strengthening the regional establishment climate.
- Exchange of knowledge: best practices, results of the KfC programme, making measuring methods more uniform, applying experiences toolbox.
- Combining strengths: applications for subsidy, planning research, etc.
- Coordinating communication: water problems in unembanked areas, subsidence and soil settling, multi-layer safety, etc.

Finally, the conclusion is reached that in the cooperation with other parties - Rotterdam Council, Knowledge for Climate, Haaglanden Urban District - there is now momentum to take action.

On the basis of the above results of the (sub-)regional exploration, a plan of approach is drawn up on how climate adaptation is developed further as an extra item in the Regional Climate Agenda (including ambitions in this area of the region) and links processes to the climate agenda. In the meantime, the coordination and cooperation with the Haaglanden Urban District and the City of Rotterdam is continued. Particularly with regard to the exchange of results and examples, having an Societal Cost Benefit Analysis (SCBA) carried out for adaptation measures which are also relevant to the region, applying for subsidies from KfC and drawing up the ARR.

3.3 Building block III: SCBA

What does adaptation deliver in terms of the consequences of climate change for the city? Is the implementation of adaptation measures not more costly than just waiting to see how the climate develops and responding ad hoc? And which measures offer the best returns in Rotterdam? The questions will be answered in a societal cost-benefits analysis which is to be carried out. Partly thanks to the KfC studies, there is now a lot of information available on potential adaptation measures, but there is only extremely limited information on the costs and benefits. This knowledge is essential for a correct assessment to be made.

In the third tranche of the KfC (HSRR3.4) a generically applicable instrument for economic considerations shall be developed, which will enable the costs and benefits of various options for strategies for the 5 RAS themes to be assessed. The aim is to compare the cost-benefits ratio of various strategy options and to obtain a (partial) substantiation for an (administrative) choice of the strategy that is to be applied. This can also be used to investigate what the added economic value is of an adaptation strategy in Rotterdam in comparison to 'not doing anything', or in other words, no integrated adaptation strategy.

When carrying out the SCBA, cooperation takes place with theme 8 of Knowledge for Climate (policy-supporting instruments).

3.4 Adaptation Strategy Rotterdam Region (ARR)

The adaptation strategy for the Rotterdam Region (ARR) will be drawn up with the aid of the above-mentioned building blocks. In turn, the three building blocks are to a large extent fed by the studies which are currently being carried out within KfC, and those carried out in the future. The relationship between the KfC tranches, the building blocks and the final product looks as follows:

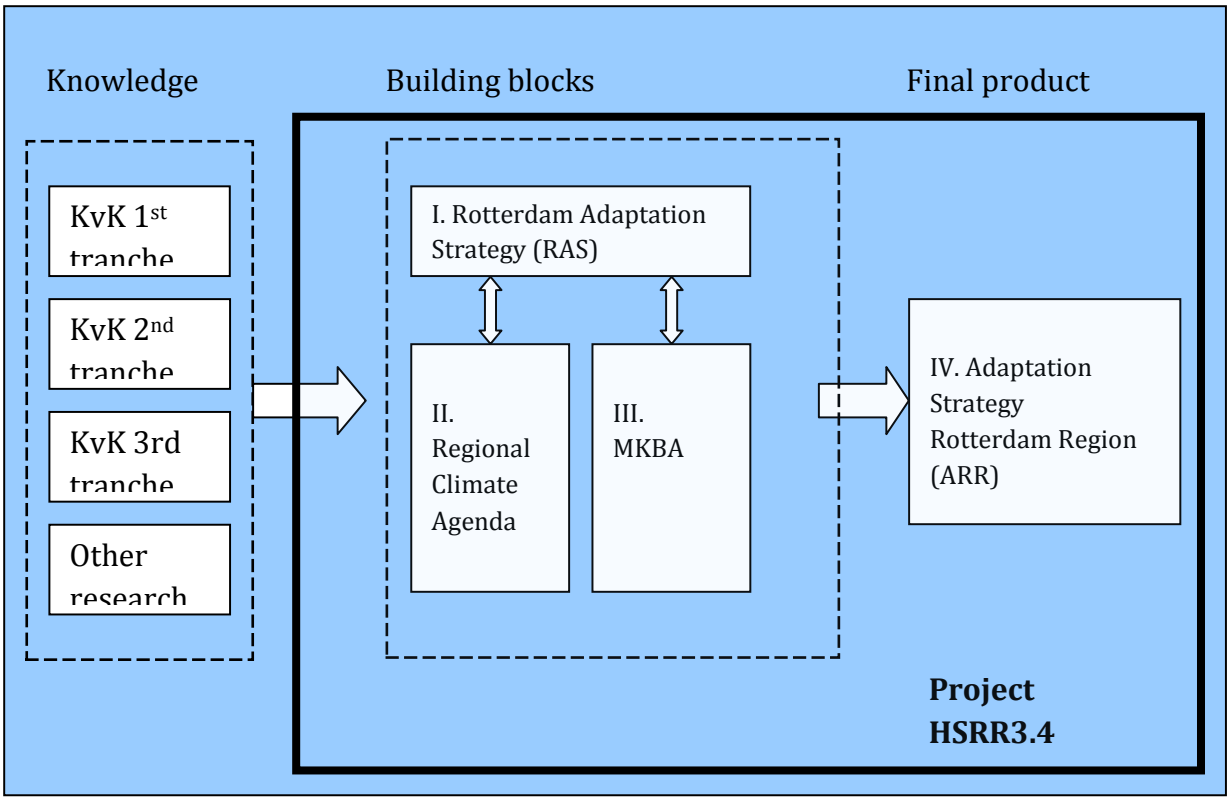

Figure 5 Relationship between research in the KfC tranches, the three building blocks and the final product of HSRR3.4

Eventually, the ARR will have to offer access to the knowledge developed within KfC and the Rotterdam region, and offer points of reference to regional councils for possible measures and further research in the area of climate adaptation. The substantive focus will be on region-wide and even supra-regional themes such as flood risk and accessibility, but also themes which are not included in the RAS such as subsidence and salinisation[8]. In the area of flood risk there is already a great deal of coordination

[8] Climate change and subsidence were analysed in the "Haaglandse" Knowledge for Climate Project Future Veenweide (climate adaptation and lowering ground levels, method and application in the Middle Delfland. Part of the area lies in the urban region of Rijnmond. Two of the three cases, Aalkeetbuitenpolder and polder Noord Kethel even largely. The results of this study may provide input for the ARR (in cooperation with Haaglanden).

between regional parties in the context of the Delta Programme. Other themes such as urban water and heat stress require local measures and must be worked out in further detail per regional council. The RAS serves mainly as a source of information and inspiration in this process. Themes which are not part of the RAS will be raised when identifying regional focus points during regional workshops (see *3.1.2 Building block II: Regional Climate Agenda Urban Region*). Eventually, challenges and actions will be defined both for the supra-regional and region-specific themes. It is as of yet unclear how wide such a 'framework of agreement' can be approached. The abstraction level of adaptation strategies in the ARR will differ per theme and depends on the spatial scale level at which each theme is approached.

Appendix II indicates the first contours of the ARR.

IPCC AR 5 and KNMI*Next* 2013

The description of the climate effects is based on the KNMI06-scenarios. These scenarios are based on model calculations carried out for the Fourth Assessment Report of the IPCC (AR4 2007). In September 2013, the report of study group I of the IPCC will be published about the natural scientific aspects of climate change. Reports of the study groups II (impacts, adaptation) and study group III (mitigation) will be published in 2014 (IPCC, AR5). The first model calculations are now available. These preliminary results show that the expected average global rise in temperature is comparable with the previous generation scenarios.

In the autumn of 2013, new KNMI [Royal Netherlands Meteorological Institute] studies will also be published. The KNMI strives to include research results in the area of regional/local effects of climate change in the new scenarios (Knowledge for Climate theme 6: High-quality Climate Projections). Part of the production process of the new scenarios is interaction with stakeholders, including the Hotspot Rotterdam Region. After publication of the new scenarios, an analysis will be made of whether, and if so, how these lead to changes in the draft RAS and ARR.

4 Evaluation

4.1 Connecting science and practice

Specifically for the second tranche, the consortia carry out extremely large-scale research projects, consisting of a multitude of work packages that incorporate a large number of case studies. The studies are also more scientific in nature and have a longer running time. Every consortium also deals with a multitude of knowledge users, because several hotspots are involved per theme, with several stakeholders each. All in all, an extremely complex construction in which the distance between the knowledge users and the knowledge suppliers is such that there is danger of (1) knowledge not connecting to the needs of the end user (practical level or mismatch of supply and demand); and (2) the knowledge is delivered too late to be included in policy-making. HSRR does its utmost to meet these challenges by (1) steering at a strategic level in programme council meetings and the thematic steering committees and (2) especially by the heavy use of theme leaders and theme coordinators[9] on various themes, work packages and case studies. Whether the outcomes will be of use for policy making shall only become clear when the first research results are published.

Another point for attention is the scalability of the results. For example, it became clear during a workshop of the integrated CPC case "Bergpolder" that a number of researchers are reluctant to make statements about other parts of the city on the basis of measurements and analyses in Bergpolder, let alone about other cities in the region and the Netherlands. From a scientific viewpoint, this is understandable. However, from the point of view of the hotspot there is a clear need to create policy for larger areas than the area measured.

[9] Theme leaders: one person has been appointed within HSRR for each theme to monitor whether it provides relevant information for HSRR. Theme leaders originate from RWS, water boards and Rotterdam Council. Theme coordinators are responsible for the implementation of a theme within the Rotterdam Adaptation Strategy (RAS). They write the text for the RAS and work together closely with the theme leaders, if this is a different person.

The first and the third tranche are more question-led and therefore have a more applied character - also due to the participation of consultancy agencies.

4.2 Process

Participation in the KfC programme was pioneering for many parties. Familiarising yourself with subsidy procedures, understanding financial rules, identifying legally and administratively clever cooperation constructions, it was a major challenge. On the side of KfC it was also pioneering, which led to interim changes to the rules. With an understanding for increasing insight; the procedural changes implied that a large number of additional personnel had to be assigned to get to the bottom of the consequences of the changes and to maintain support with external parties.

The three tranches have each had their own process and dynamics. The first tranche was basically a bottom-up process by knowledge users and providers at hotspot level. The second tranche is characterised by a top down approach. The third tranche was bottom-up, but this time the knowledge users were much more in the lead. It is recommended to evaluate these three approaches.

It has also proven to be challenging to widely share knowledge within the hotspot, and to ensure that that knowledge is effectively fed through to the various organisations.

4.3 Gains for the Hotspot Rotterdam Region

Adaptation strategy with strong foundations

An important reason to participate in the KfC programme was, and still is, to obtain information upon which to base water and climate related policy. This was partially successful, but will become particularly clear after the completion of the 2nd and 3rd tranche results. Bottlenecks are: (1) timing; the results often become available too late for implementation in the SCBA and adaptation strategies. Of course, the SCBA can be re-assessed, and strategies can be updated, but due to administrative reasons, this is not ideal. The lack of sequentiality (2) also means the three tranches do not connect well to each other. This has caused particular problems for the subject of urban water systems. The closing of the submission period of the 3rd tranche before the publication of 2nd tranche results makes it difficult to safeguard the required translation and up-scaling of research results. By submitting (and accepting) process proposals, this appears to have been overcome. Finally, (3) the practical applicability of the results will need to be carefully monitored.

Cooperation with regional partners

Partly under the influence of the KfC programme, cooperation in the region has been strengthened and momentum has been created. The provincial authorities and the council carried out the "Climate monitoring in the city" project and on the basis of the Region-specific climate information for the

Haaglanden and Rotterdam Region, the idea arose for the Interreg-project Raingain (cooperation Rotterdam, provincial authority, TU Delft and international partners).

Multiplier effect
The multiplier effect has proven to be an extremely attractive aspect of the KfC programme. This made it easier to organise co-financing.

Raising national and international profile
By setting out the Rotterdam Climate Proof Programme, the Municipal Executive of Rotterdam has chosen for the development of a climate adaptation strategy and has at the same time indicated that it sees economic opportunities in the strategy. The creation of economic spin-off from the knowledge and experience which is accrued with KfC among other things, is an important secondary goal. Rotterdam strives to raise the profile of the city in the area of climate adaptation; visibility is one of the cornerstones within the RCP programme. Two types of '**export products**' can now be distinguished.

Firstly, technical measures in the area of climate adaptation are developed which are applicable in a wide range of urban areas. The water-plaza has also been introduced elsewhere now, for example in Sao Paulo with which Rotterdam has a G2G (Government to Government) cooperation programme. In this context a Dutch consortium advises Sao Paulo on creating more water storage.

Secondly, there are unique export opportunities regarding strategy and approach with the 'Rotterdam Approach on Climate Adaptation'[10]. The offer of a complete strategy approach which can be translated to other situations is new. There is high demand and a large market for this knowledge: the fast-growing cities in coastal areas and deltas elsewhere in the world. This becomes apparent from the cooperation programme between Rotterdam and Ho Chi Minh City in Vietnam[11]. **Ho Chi Minh City** communicated its need for the knowledge and experience from the Rotterdam climate adaptation programme. In March 2011, a cooperation agreement was signed. Ho Chi Minh City is now developing its own adaptation programme on the basis of the 'Rotterdam Approach' and is supported in this process by a Dutch consortium. The **Connecting Delta Cities** network initiated by Rotterdam is able to fulfill a bridging function in opening up this global growth market.

A strong development is that this 'raising of visibility' increasingly takes place at a **regional level** and with many hotspot stakeholders. The administrators of Delft, Rotterdam and Drechtsteden have joined forces and position themselves as the 'Delta Technology Nucleus'. Concepts and measures from the adaptation knowledge of the region are brought into practice in various ways. The region thereby automatically becomes a living showcase and a shop window for innovations. This also literally happens

[10] The Rotterdam approach is charecterised by: holistic approach, city as test ground, innovations leading to economic spin-off and an attractive city.
[11] www.vcaps.org/en

by contributing to the exhibition in the Floating Pavilion together with the Netherlands Water Centre. In terms of region, resources are pooled to optimise the valorisation chain.

In the last phase of KfC there is increasing attention being given to the wider application and valorisation of the developed knowledge. This seamlessly connects to the Topsector policy. In the Innovation Contract Water, "**Sustainable Delta Cities**" has been included as a potential business case, which means that there is recognition at a national level that this is a niche. Specifically in the Delft-Rotterdam-Drechtsteden region, the opportunities to respond to this market appear to be on the increase. In the third tranche project HSRR3.7 "Valorisation", this opportunity will be grasped and the following question will be at the centre: how can the KfC knowledge be further valorised in the context of the development of sustainable delta cities?

5 Conclusions and outlook

5.1 Conclusions and "lessons learned"

This report aims to provide an insight into the process of question articulation, operating on the interface of science and practice, cooperating with regional stakeholders and knowledge and the carry-over of knowledge with the ultimate objective of a widely supported, solidly substantiated adaptation strategy for the Rotterdam Region.

Previous experience shows that participation in the KfC programme has led to great results. Momentum has been created to get climate adaptation on the administrative agenda and to reserve budget for research. The first tranche has provided the information required for the first version of the Rotterdam and regional adaptation strategies. Partly due to this reason, the Rotterdam region has been able to raise its international profile as a leader in the area of climate adaptation.

However, it has been proven that demand for instant knowledge is difficult to unite with long-term scientific research and that bridging the distance between science and practice requires constant efforts from all parties. The carry-over of knowledge within and outside of government (for example parties such as housing associations and developers) also deserves more attention. Now that the concept strategies are almost ready, a good moment has arrived to enter into a wider dialogue.

5.2 Outlook

Hotspot Rotterdam Region foresees the following in the next two years:

- A closer cooperation with regional stakeholders in order to arrive at a widely supported, jointly produced ARR. The plan of approach which will be drawn up late 2012, partly on the basis of the Mid Term Review, will describe this process in more detail;
- Strong guidance on the second tranche: timing and practical applicability of results.
- An interesting process to integrate all relevant KfC knowledge in the ARR: ARR as living document.
- An Administrative process to have the Rotterdam Adaptation Strategy formally approved;
- A joint (HSRR-KfC) international final convention in 2014 as a follow-up to the successful Deltas in Times of Climate Change conference in autumn 2010.

Appendix 1: Factsheets second tranche projects and cases

See separate document

Appendix 2: Table of contents ARR

The Adaptation Strategy Rotterdam Region (ARR) is still a working document and not public

1. Introduction

2. Climate change and urgency for the Rotterdam region
   2.1. Socioeconomic scenarios
   2.2. Effects of climate change
   2.3. Vulnerable areas and relevant policy areas
   2.4. Urgency (including the costs of doing nothing)

3. Opportunities and tasks for the region
   3.1. Policy aims and ambitions
   3.2. Tasks
   3.3. Opportunities

4. A climate-proof region
   4.1. Objectives of the region
   4.2. Approach
   4.3. Knowledge

5. Building blocks for the adaptation strategy
   5.1. Starting points adaptation strategy
   5.2. Step-by-step plan for an adaptation strategy
   5.3. Regional and local steps
   5.4. Promising measures
   5.5. Responsibilities
   5.6. Integrated approach

6. The Adaptation Strategy Rotterdam Region (ARR)
   6.1. Introduction (including distinction between local and regional adaptation strategy)
   6.2. The ARR
   6.3. Required activities
   6.4. Required decisions