RainGain Business Models

Executive summary

December 4, 2015

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ABEL

Executive summary (1)

Background and method

- Rebel was asked to create a business model for the rain radar located in Rotterdam, which is part of the RainGain project, a European INTERREG project, and to pave the way for the next steps for the project.
- In order to gain insight in possible business models and business cases, Rebel first interviewed a number of experts, potential data users, and potential operators before developing the model.
- Based on these insights, Rebel first focused on the costs involved for taking further steps in the development of the radar. For this reason, several parties who could contribute to this development were asked to submit proposals.
- Secondly, Rebel investigated whether there was a possible income flow to cover these costs, by developing two business models.
- For the most feasible business model Rebel calculated the business case.
- Finally, Rebel advised on the next steps in the project, mainly how to cover the necessary costs for further development of the radar.

Executive summary (2)

Business models

- The proposed business models contain two different products: a historic dataset and a forecasting product. Those products have several potential users, with different potential and criteria. Potential data purposes includes research, more efficient sewage investment decisions, more efficient water management operation (water authorities) and consumer weather prediction application.
- The advanced radar technology, and especially the application in urban environments, is a unique innovation. Interviews illustrated that the market is not ready yet for this application:
  - potential data users (water boards, other municipalities, Zestienhoven) want to see benefits demonstrated before investing in the radar. Willingness to pay is therefore at present not existing/low.
  - for some potential users, two hours of improved forecast is not sufficient for added value in their business model and thus they are not willing to contribute to further development.
- The relatively 'low-hanging fruit' is to use the historic data within the municipality.
- Showing the results of these first records can in a later stage persuade other parties to join. After a successful start-up phase, the RainGain radar ownership can be transferred to another entity, which will be able to scale-up radar coverage in other cities and sell the data to multiple users.

Executive summary (3)

Business case

- The total investments in the physical radar amounts to 450K (covered). The cost for model development (100K) and operational maintenance (100K in the first year) are not yet covered. It is at this stage uncertain which party will cover these costs. Benefits solely based on more efficient sewage investment decisions are estimated at 400k EUR per year.

Next steps and recommendations

- Accept the innovative character of the project, meaning that there will be no direct revenue stream during the start-up phase and come to an agreement with the project partners (municipality of Rotterdam, TU Delft and involved water authorities) concerning necessary financing of the project.
- Start thinking of up-scaling early on. A vast network will increase the coverage, thereby increasing the forecast period of the radar (and thus the added value of the radar).
- Monitor benefits in operational water management, including improvements due to RainGain data, to show proven results to other potential data users.
- Make radar data available for the public by means of a real time visualisation.
- Integration of radar output in the Nationale Regenradar provides opportunities in terms of a larger potential customer base.

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Introduction: RainGain project Rotterdam

- RainGain Rotterdam is part of a European Interreg project. The project aims to improve the prediction of pluvial floods in the urban environment.
- In Rotterdam an innovative X-band radar is installed which enables highly reliable and accurate precipitation measurements and prediction.
- The Province of South Holland, Municipality of Rotterdam and Delft University of Technology participate in the project. Through the municipality, also regional water authorities are associated to the RainGain project. These water authorities co-invested in the radar.
- Objectives of the project are:
  - To obtain detailed rainfall data at an urban scale.
  - Improve weather models by means of improved data quality.
  - To enhance the knowledge on urban water system and thereby improve urban water management practice to make cities more resilient to rainfall-induced floods.

(source: RainGain.eu)

Rebel assignment: business model for RainGain

- Rebel was requested by the project team to create a business model for RainGain and to pave the way for the next steps for the project (primarily focused on the radar exploitation).

<u>Context and challenges of the project:</u>

- Looking at a weather radar from a business perspective is new in the Netherlands. There are currently 2 radars in the Netherlands, both owned and operated by the KNMI, a publically funded organisation.
- A previous market study by Procap (2014) concluded that benefits of the radar mainly exist for municipalities, water authorities, knowledge institutes, insurance companies and greenhouse entrepreneurs. They also conclude that many of these beneficiaries require a rain forecast of multiple (>12) hours. Such a long term prediction is currently not possible.
- Government policy: in general, the open data policy of the Dutch Government requires that a publically funded project should be open to the public (open data). This hampers the ability to create earnings by selling data: why would someone pay for data that is openly available?

Business model and business case explained

- Rebel will look into business models for RainGain and value the financial impact of the model by means of a business case. Below is a definition of the two:
  1. **Business model** (in Dutch: *verdienmodel*)**:** a model reflecting the tasks and roles of parties involved in a business or project.
  2. **Business case:** the financial costs and benefits of a business or project.
- In order to gain insight in possible business models and business cases, Rebel interviewed a number of experts, potential data users, and potential operators (see attachment).
- From these interviews we determined:
  - Cost and benefit estimations.
  - Actor's willingness to contribute financially to the project.
  - Actor's willingness to get involved in the project.
- Due to the innovative character of the project, the project turned out to be a 'quest' for possibilities in which several iteration loops were required.
- This slide deck includes the main findings of the business model analysis. Other results of the project include an outline on the next steps between the project partners.

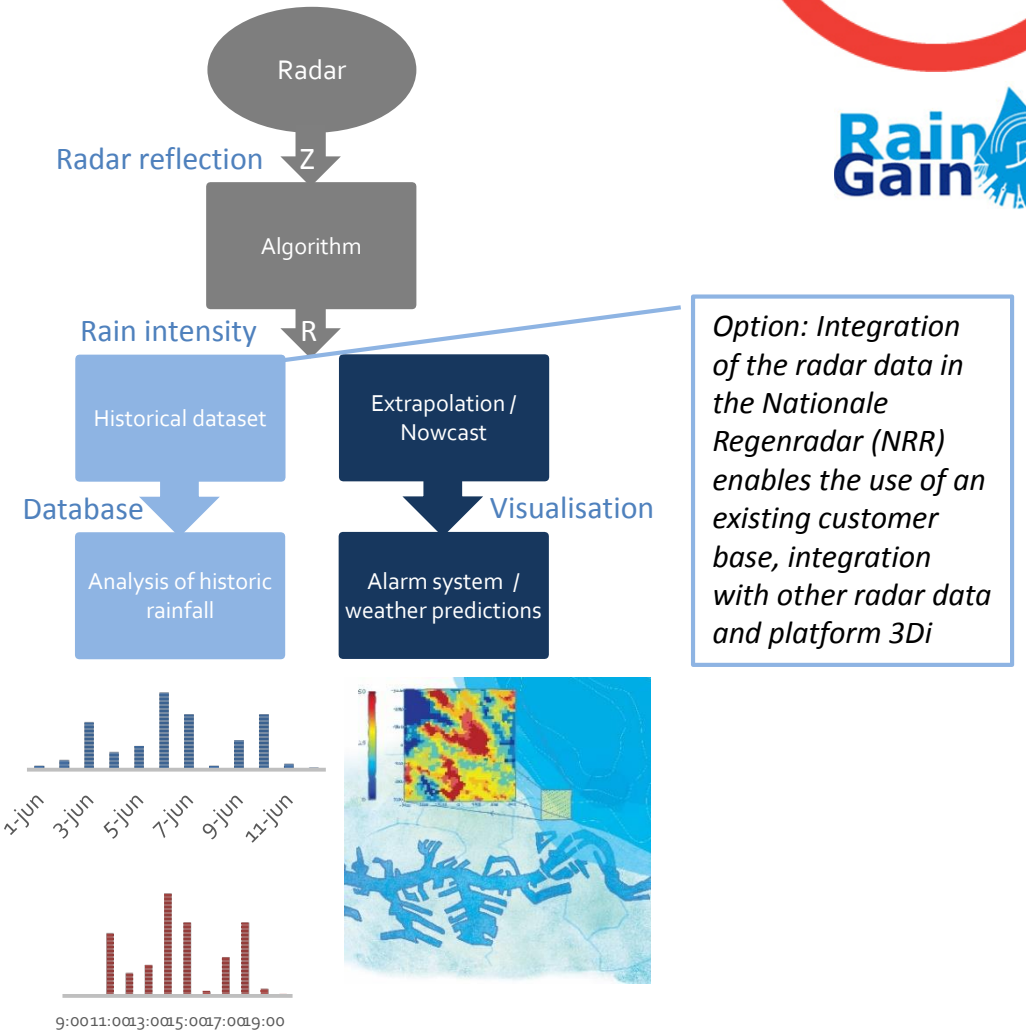
1. Business models

Business model for RainGain

- A business model (in Dutch: *verdienmodel*) reflects the tasks and roles of parties involved in a business or project.
- The models were drafted (see attachments) based on interviews with:
  - Potential data users.
  - Actors who can potentially play a role in the exploitation of the radar (operators).
  - Experts.
- The models contain two different products: a historic dataset and a forecasting product.
- Those products have several potential users, with different potential and criteria.
- Together with experts, the models were fine-tuned to a growth model defining the first and second step of radar exploitation.

The RainGain radar has two application purposes

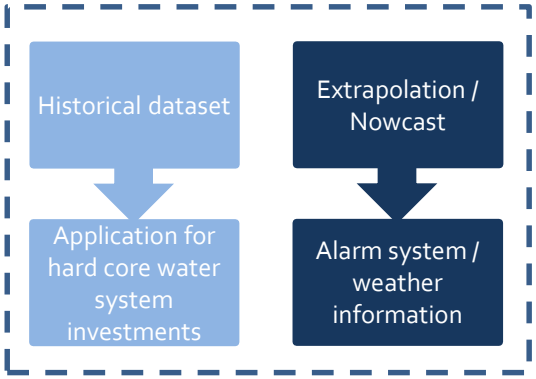
- The radar produces reflection images.
- An algorithm translates these reflections into rain intensity data.
- Intensity data can be used for two application purposes:
  1. Historical dataset, enabling analysis of historic rainfall data on specific locations in e.g. 3Di sewage modelling tool (see next slide).
  2. Extrapolsation/nowcast of rain intensity allowing short term (±2h) rainfall predictions.



The potential products have different users

TU Delft Historic data contributes to the understanding of the climate system. More accurate data of the radar will contribute to improved measurements and weather models.

Insurance company Can make use of the rain data and for internal processes (to judge damage reports).



Greenhouses
Greenhouses could assist water authorities in dynamic water management (manage water level by means of greenhouse water bassins). Rainfall predictions can help to predict when to deploy the greenhouse bassins, although minimum of 4h is required to intervene.

Municipality of Rotterdam - sewage
Based on historical data, combined with sewerage modelling tool (3Di) Rotterdam can identify bottlenecks in the hard core water system.
Investment decisions can be taken more efficiently based on this analysis.
Dynamic water systems can operate more effectively based on the rain data.

Water authorities
Accurate prediction of heavy rainfall can improve milling procedures, however information is required 12h in advance.
Water authorities would benefit from a higher quality of rain data.

Airport (Rotterdam-The Hague)
For safety measures, the airport has several measurements for storms, snow and glazed frost. If the radar can actually improve data quality, the airport might be interested, but first wants to see the results.

Rotterdam – Gritting Accurate snow or glazed frost predictions can enable more efficient gritting routes, although 2 hours might be too short to actually gain advantages.

Rotterdam - Cyclists ('Fietsplan')
Rotterdam tries to make cycling more comfortable.
RainGain could contribute to that:
- Part of the Fietsplan is to install rain sensors at traffic lights to adjust the cycling flow in case of rain. RainGain radar could be used for the rain information.
- A special rain prediction app ('Buienradar Rotterdam')
- Weather information on dynamic traffic management authorities

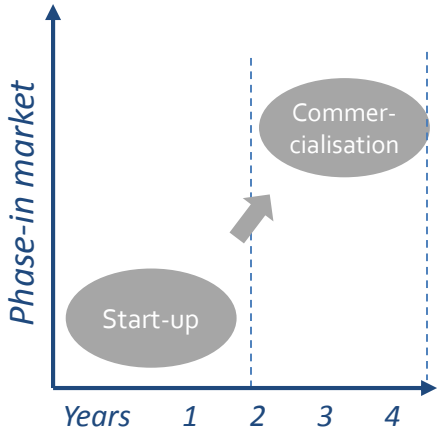
Involving RainGain in this project can contribute to the visibility of the radar and a positive public opinion.

Legend: **Both historic and extrapolation** | **Historic** | **Extrapolation**

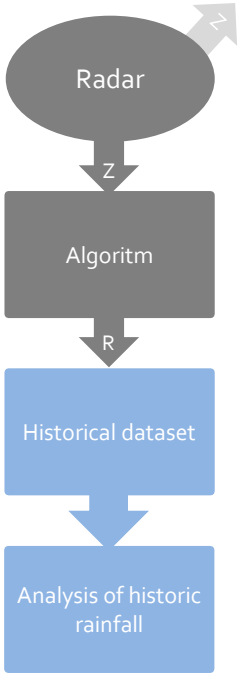
A growth model seems the logical starting point

- Interviews show that **willingness to pay is** -for now- **non-existing**:
  - *First seeing is believing*: potential data users want to experience the advantages before investing in the radar. Willingness to pay is therefore now nihil.
  - For some potential users, two hours of forecast is not sufficient for added value in their business model.
- The technology of the radar, especially the application in an urban environment is innovative and **not yet market ready**.
- The relatively 'low-hanging fruit' is to **use the historic data** within the municipality. Showing the results of these first records can in a later stage persuade other parties to join.
- This does not mean no progress should be made on the **second product, the nowcast/extrapolation**. Showing nowcast rainfall prediction can have a strong communicative value. To gain direct benefits from the radar, Rebel recommends to start with the historic data. Parallel to this, nowcast interfaces can show results of the radar.

The project team accepted the Rebel advise to start with a relatively simple - publicly funded – start –up model focused on showing results for the project partners and exploiting the historic data product within the leading partner Rotterdam. In a later phase, a commercial model can be developed (slide 12).



Start-up model explained



Owner: Rotterdam

Developer: TU Delft

Developer: e.g. NRR

User: Rotterdam

With current partners and involvement of the municipality and TU Delft, the focus of the radar in the start-up phase is on the historic data product.

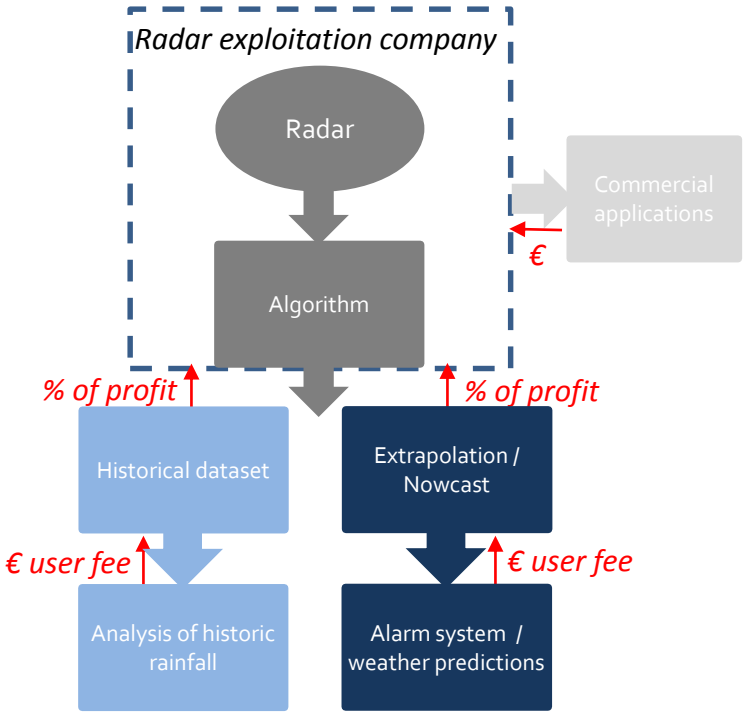
Radar
- Ownership & exploitation/maintenance of radar by Rotterdam.
- Maintenance contract with radar manufacturer SSBV.
- Operational maintenance (database, quality assurance/control). Suspects: TU Delft, KNMI.

Algorithm
- TU Delft develops the software and an algorithm to enhance the raw data.

Historic dataset
- Data is included in e.g. the Nationale Regenradar (NRR) as an enhancement of the data quality. This tool allows for integration into sewage model 3Di.

Analysis of historic rainfall
- Analysis of historic rainfall data, combined with sewage model 3Di allows for more efficient investment decisions for the project partners.
- Tool is developed for the project partners (Rotterdam, water authorities), but can be sold to other users, who pay a monthly fee.

Commercial model explained



Radar and algorithm

- Ownership of the radar and algorithm will be transferred to another entity and must be priced accordingly.
- Rain intensity data is accessed free, but commercial parties pay a % of their revenue in case of successfull exploitation.
- Radar exploitant actively approaches other regions for up-scaling/national coverage.

Monitoring and analysis tool / extrapolation

- The tool (developed during start-up phase) can be further enhanced by the same company, however competition is possible from other applications.
- Multiple application developers can develop extrapolation tools.

Analysis of historic rainfall / Alarm system and weather predictions

- Tool and service is actively commercialised to other municipalities/water authorities, who pay a monthly fee.
- Users include municipalities, water authorities, airport, greenhouses.
- App developers are welcomed to create user specific app's, such as a cycling weather prediction app.

A start-up model is the most feasible short term option

- There is potential for multiple types of users of possible RainGain products, however:
  - Most of the applications are public.
  - First seeing is believing: the radar needs to be operable and show success for other parties to join. Willingness to pay is now nihil.
  - In case of commercial exploitation, data will not be fully open, users will pay a fee (e.g. a percentage of their revenue) for the data, otherwise the exploiting party will have no income stream to cover costs.
  - A commercial model is in this phase purely hypothetical. There is at this point no income stream to cover exploitation costs as users are currently not willing to pay for the data.

→ Focus on start-up model: take the first step to show results.

Part 2. Business case

Business case

- A business case contains the financial costs and benefits of a business or project.
  - Financial means that the costs and benefits actually translate into euros in a cash flow, balance sheet or profit and loss.
  - The RainGain radar will also have social benefits, e.g. reduced damage to private property. These social benefits are not included in a business case, as they do not directly translate into euros.

- The business case includes:
  - Costs of the radar.
  - Expenses covered y/n.
  - Potential financial benefits of the radar (see attachement).

Key issues concerning business case (1)

Funding Unknown factor: who will cover the necessary funding and who is now paying for what?	Suspects: Rotterdam, TUD, water authorities
Costs For the radar to be operable, several steps need to be taken: • Algorithm development and operational maintenance (data quality assurance, database management). • Model development. The costs for these steps are not yet covered.	€100k per fte (yr 1: 1fte, yr 2: 0.5fte, yr 3 and 4: 0.25fte) Phase 0: €25k, phase 1: €45-100k (depending on chosen model)
Benefits (estimation) The radar has the potential of contributing to cost savings in water system investments. These savings however, require a different way of working, thus changes in the asset management of the sewage system.	- Investment in sewage system per year: €40 mln - Potential savings (total): 10% - Potential savings due to RainGain: 10% (1% of total) - Potential savings due to RainGain €400k

Key issues concerning business case (2)

- The total investments in the physical radar amounts to 450K (covered).
- The cost for model development (100K) and operational maintenance (100K in the first year) (not covered).
- From year two, the maintenance costs drop gradually to a lower amount.

It is uncertain which party will cover these costs.

- As no specification of contributions can be made, a business case per project party is not possible. The business case therefore covers the entire project.

The business case overview

(seperate excel file available)

Input

Investment costs

☑ Investment radar (municipalities, water boards, province, EFRO)	450,000	€
☑ Model development		
Cost for developing model: phase 0	25,000	€
Cost for developing model: phase 1	75,000	€

Operational costs

Maintenance (contract SSBV)	25,000	€/yr
Data connection	20,400	€/yr
Roof rent	-	€/yr
Operational maintenance per fte	100,000	€/fte
Year 1	*1*	*fte*
Year 2	*0.5*	*fte*
Year 3 - 4	*0.25*	*fte*
User fee for weather model		€/yr

Benefits

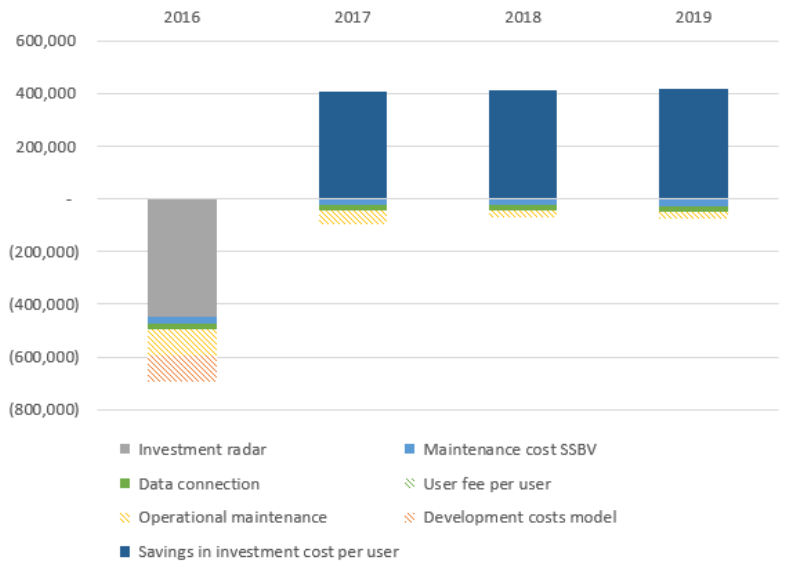
☑ Include benefits in outcome

Savings investments costs

Investment cost for hard core water system	40,000,000	€/year
Potential savings for hard core water syst.	10.00%	
Share of savings contributed by RainGain	10.00%	
Savings due to RainGain	*1.00%*	

Assumption: renovation of hard core water system will take place with or without radar. The investment decisions are made more efficient due to RainGain data. Benefits of radar therefore lie in more efficient investment decisions.

Outcome



Return radar owner (based on savings) 19.74%

Funding gap (striped area)	
Funding gap year 1	200,000
Funding gap year 2	50,750
Funding gap year 3	25,756
Funding gap year 4	26,142
Total funding gap 4 years	302,648

Next steps and recommendations

Next steps

- Come to an agreement with the project partners (municipality of Rotterdam, TU Delft and involved water authorities) concerning necessary financing of the project. The province of South Holland will have a limited role, but will support the project financially.
  - Try to find additional European funding for further enhancement of the radar technology
- Accept the innovative character of the project, meaning that there will be no direct revenue stream during the start-up phase.
- A project organisation should be in place after the Interreg period (ending at September 30 2015): appoint a project leader, establish a governance model focused on a smooth cooperation between the project partners.

Recommendations

- Start thinking of up-scaling early on. In order to commercialise the radar system, more radars in the Randstad are required. A vast network will also increase the coverage, thereby increasing the forecast period of the radar (and thus the added value of the radar).
- Monitor benefits in operational water management, including improvements due to RainGain data, to show proven results to other potential data users
  - E.g. keep track of weather cases which a normal rain radar did not record but RainGain did.
  - Communicate these results and benefits of the radar publically.
- Make radar data available for the public by means of a real time visualisation.
  - The 'Fietsplan' provides an opportunity for public involvement. The plan includes to install rain sensors at traffic lights to adjust the cycling flow in case of rain. Involving RainGain in this project can contribute to the visibility of the radar and a positive public opinion.

Attachments

Interviews

Experts	Data users
TU Delft: Marie Claire ten Veldhuis (assistant professor in Urban Drainage) & Wouter Koole (project coordinator)	Hollandse Delta: Bart Mol, Alex de Klerk (responsible for Nationale Regenradar and RainGain)
TU Delft: Herman Russchenberg (prof. Chair Remote Sensing)	Delfland: Stefan Jansen Saskia Jouwersma (project leader 'Dynamische gietswaterbassins)
Procap: Brechtje van Boxmeer (consultant for RainGain market study)	Schieland Krimpenerwaard: Jeroen Willemsen, Mechiel van Appeldoorn (responsible for NRR and RainGain)
Potential operators	Verkeersonderneming Rotterdam: Joeri Jongeneel (cycling coordinator)
Neelen & Schuurmans: Frederik Gevers Deynoot (consultant water management)	Municipality of Rotterdam: Johan Verlinde (project leader RainGain), John Akkerhuis ('Fietsplan')
RH/DHV: Hanneke Schuurmans (project leader Nationale Regenradar)	Municipality Delft: Ferrie Förster (alderman water and economy)
KNMI: Frank Lantsheer (head of model division), Hidde Leijnse	Municipality Westland: Inge Muhlig (water coordinator)
	Rotterdam-The Hague Airport: Rien Koster (Manager Havendienst)
	ITS/Beter Benutten: Klaartje Arntzen, Willem Scheper, Joost Beenker
	Mainport Rotterdam: Ruud Melieste en Marc Eisma *(not interested)*

Business case: inputs

Cost component	Cost	Unit	Coverage	Data source
Investment radar	450,000	€	By municipalities, water authorities, province, EFRO	Procab (2014) RainGain marktonderzoek
Model development				
Cost for developing model: phase 0	25,000	€	Not yet covered	H. Schuurmans (RHDHV). Offerte operationalisering RainGain. 08-02-2015
Cost for developing model: phase 1	75,000	€	,,	
Maintenance (contract SSBV)	25,000	€/yr	Covered by municipality	Johan Verlinde (Mun. of Rotterdam). 07-15-2015
Data connection	20,400	€/yr	Covered by municipality	
Roof rent	-	€/yr	No costs for first 4 years	
Operational maintenance per fte	100,000	€/fte	Not yet covered	Estimate by Herman Russchenberg. 07-07-2015
Year 1	1	fte		
Year 2	0.5	fte		
Year 3 - 4	0.25	fte		

Financial benefits*	Cost	Unit	Data source
Investment cost for hard core water system	40,000,000	€/year	Gemeentelijk Rioleringsplan 2011-2015 (p.70)
Potential savings for hard core water syst.	10.00	%	Estimate by Wim van Vliet. 08-27-2015
Share of savings contributed by RainGain	10.00	%	
Savings due to RainGain	*1.00*	*%*	

*Financial benefits merely include benefits which are actually visible in the budget. Social benefits are not included.
Assumption: renovation of hard core water system will take place with or without radar.
The investment decisions are made more efficient due to RainGain data. Benefits of radar therefore lie in more efficient investment decisions.