ASSESSING THE GOVERNANCE ARRANGEMENT FOR SUBSURFACE RAINWATER STORAGE

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■ The horticulture sector in the Netherlands is a global trendsetter and of fundamental importance to the export position of the Netherlands. Stimulated by changing societal expectations, horticulturalists and policy makers have engaged in improving the sustainability in the horticulture sector. The development of sustainable systems for delivering water is also encouraged by the Dutch government.

In recent years, nature-based solutions (NBS) or combined natural and engineered systems (cNES) have emerged as an attractive alternative to conventional water and wastewater treatment methods by offering lower environmental impact, a reduction in operational costs and socio-economic advantages such as conservation of the natural environment and minimisation of visual/aesthetic impact (Stathatou et al., 2018). Investments in cNES will not only need to address treatment performance and financial criteria, but also demonstrate that such systems comply with governance arrangements and meet stakeholder approval. This article is concerned with understanding the relationships between cNES and wider governance frameworks. The goal of this article is to develop a clearer picture of the governance factors affecting the adoption of cNES using subsurface rainwater storage at a horticultural area in the Netherlands as a case study. Here, a cNES was adopted (rainwater capture, managed aquifer recharge, and re-abstraction) to supply non-potable water to horticulturists. The cNES was used as an alternative to the conventional method of desalinating brackish water, which has a negative impact on groundwater quality through the disposal of brine.

This article is structured as follows: the first section presents a brief literature overview on the current governance issues concerning cNES. This is followed by an in-depth governance analysis of the horticulture case study where a cNES has been applied. Based on the lessons learned from this case study, several recommendations are provided in the final section for future developers of cNES schemes in the Netherlands and abroad.

Governance issues of cNES

Before we start to examine the case study, a short literature overview is provided on the current governance issues concerning the implementation of NBS, in particular cNES. It is increasingly recognised that the factors shaping the uptake of NBS and cNES are not exclusively technical, but are also socio-political effected by constraining and enabling governance issues.

Constraining governance issues

Probably one of the most constraining issues in implementing a cNES is the overwhelming dominance of conventional systems (engineered infrastructure) for water and wastewater management in the current realm of governance (UN Water, 2018; Lafortezza et al., 2018; Scott et al. 2016). This dominance is reflected in market behaviour, engineering demands and consequently

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in the minds of policy makers resulting in regulatory and legal frameworks tailored towards conventional infrastructure (Davis et al., 2015). A certain sense of bias is pinned against the development of non-conventional systems such as cNES, which are often perceived to be more uncertain than conventional infrastructure due to the natural elements operating within them. Many policy makers typically prefer tried and tested solutions, which creates a barrier for the adoption of alternative, non-conventional systems (Scott et al., 2016). Another possible constraint is that cNES often require much greater levels of cross-sectorial and institutional cooperation, particularly when applied at landscape scale. The natural elements of cNES could potentially have a range of environmental implications (for habitats, energy usage, etc.) that can fall under the purview of a wide range of policy regimes. The application of a cNES often crosses many different sectorial areas of interest accompanied by a diverse array of stakeholders with different perspectives and priorities (Nesshöver et al., 2017; Scott et al., 2016). Policy makers who are more accustomed to top-down government interventions might be more tempted to opt for less complex, conventional options that require a low degree of involvement from other stakeholders (UN Water, 2018).

Moreover, cNES can sometimes face more hurdles under environmental legislation than standard systems, due to their potentially significant land requirements and the disturbances created from their installation and (sometimes) from their operation and maintenance. Where those disturbances might be seen as a degradation of the water environment (prohibited under the European Water Framework Directive) or where they might affect protected areas (e.g. Natura 2000 areas), this can create barriers for adopting cNES, even though ultimately the system may be complementary to the natural landscape.

Enabling governance issues

In order to address the above mentioned challenges, enabling conditions are needed in order for cNES to be considered equitable alongside other water management options. Confidence needs to be instilled and myths need to dispelled among policy makers that cNES can provide the primary water service objective it is meant to fulfil (Mander et al., 2017). According to an article by Mills et al. (2015), the best way forward to solve this is to embrace continual innovation and research during the implementation of a cNES, adaptively manage it in a scientifically rigorous manner, and at the same time acknowledge that natural systems are dynamic and complex. The consideration for a cNES needs to be based on accurate assessments designed specifically for local applications and less on generalised preconceived assumptions (UN Water, 2018). Clearer evaluations of performance will draw in investment from financial firms to advance cNES further into other areas (Davis et al., 2015).

In addition, to enhance inter-sectorial collaboration, specific water problems and cNES solutions need to be clearly defined and presented as an alternative or complement to other options (Barton, 2016). The project design of a cNES needs to (at least) include what it will offer, whom it will benefit, how much it would cost and how it should be managed. This will strengthen the uptake of a cNES within the overall design of policies and strengthen the support among stakeholders (Barton, 2016). A harmonized framework of policies across multiple scales and disciplines is necessary in order to deliver the multiple co-benefits to stakeholders that a cNES can offer (Raymond et al., 2017).

Furthermore, beneficial regulatory and legal frameworks are also key to providing enabling conditions for cNES to be adopted in society. Governments need to asses, and if needed, modify existing regulatory and legal frameworks to remove barriers for adopting cNES. This can be done, for example, by providing subsidies for developing cNES or creating direct policy levers to enable easier uptake of cNES (van der Jagt et al., 2017; Bennet & Ruef, 2016).

Governance assessment of the horticulture cNES case study

Case study description and assessment methodology

In the west of the Netherlands, a new horticulture area is being developed. The conventional method for horticulturalists to satisfy their water demand is to desalinate brackish groundwater, which has led to salinization of groundwater reserves through the disposal of brine. In order to resolve this issue, the new area aims to optimally use rainwater for irrigation purposes. The cNES involved here captures rainwater that falls on the nearby logistic centre and infiltrates into the ground for horticulturalist to use in times of freshwater shortage. Before rainwater enters the subsurface, it is treated by sand filtration to prevent well clogging and pollution of the groundwater. The horticulturalists produce paprikas, tomatoes and roses and are the main users of water from the subsurface rainwater storage system. The project developer has received a subsidy from the provincial government to build the necessary infrastructure.

For this study, we analysed data collected from a series of semi-structured interviews with key stakeholders: the project developer, the provincial government, the water board and a horticulturalist. The interviews were conducted using a list of questions relating to financing, policy, regulation, stakeholder collaboration and customer awareness for the applied cNES. Our

approach to the interviews with questions posed in a systematic and consistent order, while at the same time allowing space to ask additional questions to stimulate more mindful and considered responses, resulted in the identification of enabling and constraining issues. The interviews were recorded and the results were summarized in individual interview reports which interviewees were invited to review and approve. After all interviewees approved their interview report, the content of the interview reports was analysed and integrated. Content analysis was adopted as the major form of transcript analysis.

Enabling governance issues within the case study

- **Provincial sustainability policy**

In our efforts to describe the enabling governance issues, our results from the interviews showed that the project was aided by the provincial government's sustainability policy. The provincial government implemented policies to enhance sustainability in the area by providing necessary subsidies such as the one granted to the project developer. Water conservation measures such as the use of rainwater are encouraged, while conventional methods of extracting groundwater and discharging brine are discouraged.

- **Regulatory guidelines**

Furthermore, legislation was also beneficial for the realisation of the new horticulture area. The European Water Framework Directive (WFD), for example, aims to limit the impact of humans on groundwater quality. The guidelines of the WFD have been translated into national legislation and the water boards are committed to these. The new system ensures that no brine from conventional method is discharged into the subsurface resulting in improved groundwater quality.

Constraining governance issues within the case study

- **Uncertainty surrounding water delivery**

During the preliminary planning stages of the subsurface infiltration system, horticulturalists were concerned about several aspects of the design. At first, the project developer wanted to have one large collective groundwater well from which water will be distributed to the horticulturalists. This was met with discontent among horticulturalists who did not want to be dependent on a third party for their water delivery. The project developer scrapped the centralised plan to allow horticulturalists to have their own infiltration wells. A second concern among horticulturalists was that the water distribution canals were easily susceptible to vandalism. In response to these concerns, the project developer made sure that all water distributing canals have a protective fencing and that the canals were to be covered with seam.

- **Inflexibility of granted subsidy**

Another constraining governance issue was related to the subsidy. The granting of the subsidy to the project was met with some dissatisfaction by the water board. The water board felt that the subsidy should have been aimed at encouraging circular systems where post-treatment is incorporated into the design. However, the project developer is not responsible for the post-treatment after its water is delivered to the horticulturalists. The provincial government understood the remark of the water board, but mentioned that the subsidy was granted at a time (2015) that the obligatioon of post-treatment was not yet part of regulatory requirements. If the provincial government grants a subsidy formally and legally under certain conditions for a four year period, the provincial government cannot say halfway that the conditions have changed.

Additionally, the project developer was frustrated with the subsidy. Despite its good intention, the bureaucratic procedures related to the subsidy were strenuous. At the start of 2017, the project developer made clear that it intended to tweak the development of the horticulture area slightly in response to new wishes from the horticulturalists mentioned earlier. Since the project developer is bound to a subsidy agreement with the provincial government, a request for change had to be approved by the provincial government. According to the project developer, this request took more than a year to be approved, which delayed the development of the project.

- **Strenuous obtainment for infiltration permit**

Furthermore, hydrologists from the water board, who are authorised to issue permits for the infiltration, storage and extraction of rainwater, were concerned that the area was not suited to subsurface rainwater storage due to it being several meters below sea level with a high ground water level. In the end, the water board eventually granted the permit to the project developer after a detailed effect-report concluded that the risks associated with the storage of subsurface rainwater were not severe. According to the project developer, it was a strenuous procedure and it took over a year before the infiltration permit was issued.

- **Lack of customer awareness**

Lastly, it was noted that horticulturalists, and the retail outlets that they supplied, did not communicate anything about water supply options to the customers who purchased the horticultural produce. According to the water board, the project developer and the provincial government, the customers have little to no knowledge that their products are irrigated more sustainably with rainwater. The horticulturalists do not directly advertise that their products are irrigated

with stored rainwater. The use of public relations (PR) regarding initiatives taken at the project site were largely non-existent. The distribution centre of a nearby supermarket, which is involved in capturing rainwater on its roofs, also did not sell itself as contributing to sustainable water supply.

Discussion and Conclusions

This study sought to develop a clear picture of the constraining and enabling governance issues affecting the adoption of cNES at a horticulture area in The Netherlands. The conventional method of desalinating brackish groundwater was no longer seen as sustainable due to the resulting brine contaminating groundwater. Rainwater was seen as an alternative high-quality source that could satisfy the water demand of horticulturalists even in dry periods. Based on the interviews that were conducted with involved stakeholders, it became clear that the provincial government aims to stimulate these sustainability initiatives by granting subsidies. The realisation of the cNES, however, was by no means an easy procedure. This was particularly apparent with regards to the uncertainty surrounding water delivery, the inflexibility of the granted subsidy, the strenuous obtainment for the infiltration permit and the lack of customer awareness.

In a broader sense, economic considerations, more than policy or regulatory considerations, are currently the primary drivers for adopting NBS and cNES. However, policy initiatives can have a very strong influence on economic feasibility, and this was clearly illustrated in the fact that the cNES in the Netherlands benefited from targeted, policy-driven financing schemes geared towards enhancing sustainability. Despite their supportive influence, it was also clear that such financing schemes can also introduce barriers to cNES adoption if they create inflexible project arrangements. Additionally, the adoption of cNES in general, may be more significantly influenced in the future by the emergence of more stringent discharge requirements for wastewater, increasing the attractiveness of cNES as a 'polishing' step. Moreover, as cNES typically have lower embedded carbon emissions and require less energy, climate change adaptation policies might further favour the adoption of cNES schemes.

Recommendations

Our analysis has generated some specific recommendations for adopting a cNES in the Netherlands, but they can also have wider application.

1. *Develop a clear picture of the characterisation and distribution of risk* – One of the biggest challenges was the need for the project developer to adjust to the risk perceptions of the horticulturalists. Because the horticulturalists are large water users whose commercial interests depend directly on having a reliable water supply of suitable quality, they were highly risk averse. This meant that the project developer had to make numerous changes to the initial project plan in order to manage the perceived risks. By developing a clear picture of perceived risks amongst all stakeholders in the early planning stages of a project, the need for such adjustments in later stages could be avoided.

2. *Investigate customer awareness / attitudes towards different water options* – It was clear that the horticulturalists, and the retail outlets that they supplied, did not communicate anything about water supply options to the customers who purchased the horticultural produce. We would recommend that such an investigation be undertaken. There is general public support for NBS and cNES, and in this case, if a mechanism could be found to communicate to customers that produce has been grown with water from a cNES, it could enhance the appeal of the products and draw trade for the retailer.

3. *Improve flexibility in funding arrangements* – This project benefited from a targeted provincial government subsidy, aimed at supporting more sustainable water management projects. While, targeted subsidies can be vital in ensuring that innovative systems can become financially viable, it also introduced some barriers. At the time the subsidy was granted, project specifications became enshrined in a funding agreement between the government and the project developer. It then became very difficult to alter the project specifications in light of new information or new priorities. Both the project developer and the local water board felt that the lack of flexibility in the initial project specifications, and the general level of bureaucracy around the funding, was more of a hindrance than a benefit. In order to ensure that such subsidies can be used most effectively, it is important to allow a degree of flexibility in the funding arrangements to enable some adjustments as projects develop.

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ABSTRACT

Sustainable water systems, such as combined natural and engineered systems (cNES), can be used to alleviate water stress conditions. This paper addresses subsurface rainwater storage as an alternative water source for horticulture, and assesses the governance arrangement to support such systems. Interviews with stakeholders in a cNES scheme at a horticulture site in the Netherlands, revealed that the cNES benefited from targeted, policy-driven financing geared towards enhancing sustainability. It was, however, also clear that such financing schemes can introduce inadvertent barriers to cNES adoption if they create inflexible project arrangements.