

# Water sustainability of investors: Development and application of an assessment framework

Rick J. Hogeboom <sup>a,\*</sup>, Ilja Kamphuis <sup>a</sup>, Arjen Y. Hoekstra <sup>a, b</sup>

<sup>a</sup> Twente Water Centre, University of Twente, Drienerlolaan 5, 7522NB, The Netherlands

<sup>b</sup> Institute of Water Policy, Lee Kuan Yew School of Public Policy, National University Singapore, 259770, Singapore

## ARTICLE INFO

### Article history:

Received 9 April 2018

Received in revised form

14 August 2018

Accepted 16 August 2018

Available online 17 August 2018

### Keywords:

Water sustainability

Sustainable investing

Water footprint

Water disclosure

Corporate water stewardship

Corporate social responsibility

## ABSTRACT

Although corporate social responsibility in general and corporate water stewardship specifically are of increasing concern to businesses, investors are lagging behind in fostering water sustainable investment practices – despite the large impact their investment decisions have on the state and shape of tomorrow's water resources. This paper is the first-ever study to assess whether and how investors include water sustainability criteria in their investment decisions, by scrutinizing their publicly released policies on the topic. We hereto (1) developed an assessment framework using the water footprint concept, (2) applied it to twenty large investors in a case study for the Netherlands, and (3) ranked them accordingly. We found that, by and large, water sustainability is a blind spot to investors, resulting in disclosed policies being neither well-demarcated nor clearly formulated, especially regarding the supply chain of the activities invested in. There is a long way to go before investors can ensure efficient, sustainable and fair water use in their investment policy, but our framework helps investors direct their urgently needed improvement process, to transition toward water sustainable production systems in a circular economy.

© 2018 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

## 1. Introduction

Sustainable use of the Earth's finite freshwater resources is imperative for future economic development (WWAP, 2017). Without adequate water supply, factories come to a halt, food production hampers, and eventually entire economies falter. However, managing this precious resource wisely is not a commonplace, as is illustrated by the World Economic Forum (WEF) consistently ranking water crises in the top-three of systemic risks posed to the global economy in terms of impact (WEF, 2017). Saliently, before 2010 water did not make it even to their top-twenty. Reaching Sustainable Development Goal (SDG) 6 – ensuring availability and sustainable management of water and sanitation for all – requires a financial injection of at least US\$ 2.6 trillion until 2050, part of which inevitably will have to come from private investors (Kolker et al., 2016). Not acting on water sustainability could diminish national growth rates by as much as 6 percent of GDP by 2050 (World Bank, 2016). On the positive side, there are substantial opportunities for companies and investors

alike to start and fund (water) sustainable business models (Damania et al., 2017), which can realise large sustainability gains (Sumaila et al., 2017) at even no cost to risk and return (Utz et al., 2015).

Recently, the corporate world started waking to the realisation that improved water management is fundamental for future prosperity and human wellbeing (Roca and Searcy, 2012). Responses and action initiatives include disclosure of water use and pollution (CDP, 2015), identifying water risks (Larson et al., 2012), and striving toward good water stewardship (Kelly, 2014) through corporate certification schemes (AWS, 2017), developing business platforms to share best and emerging practices (CEO Water Mandate, 2017) and suggesting context-based water targets for companies (Pacific Institute, 2017).

Regarding disclosure, CDP releases reports for investors seeking assurance that their investments are well placed to generate favourable returns and avoid value destruction because of negative impacts on water systems (CDP, 2015). In their survey of over 1000 publicly listed companies, managing US\$ 63 trillion in assets, almost two-thirds of respondents reported exposure to substantive water risk, both in their operations (2400 risks identified) and supply chain (800 risks identified). However, the same survey showed that only 11% of companies publish a company-wide water

\* Corresponding author.

E-mail addresses: [h.j.hogeboom@utwente.nl](mailto:h.j.hogeboom@utwente.nl) (R.J. Hogeboom), [i.kamphuis@alumnus.utwente.nl](mailto:i.kamphuis@alumnus.utwente.nl) (I. Kamphuis), [a.y.hoekstra@utwente.nl](mailto:a.y.hoekstra@utwente.nl) (A.Y. Hoekstra).

policy that includes, among others, the setting of performance standards for both direct operations and suppliers. Beyond disclosure, water scarcity and pollution may pose physical, regulatory and reputational risks (Morrison et al., 2010). Companies are setting up ways of dealing with such risks (Larson et al., 2012), partly because of an intrinsic believe that action is needed, but also – perhaps more cynically viewed – in an attempt to extend their business' control over water resources or to protect their brand name (Hepworth, 2012). Water stewardship, then, goes a step further, by evaluating water use sustainability across the entire value chain, the formulation of water consumption and pollution reduction targets, an adequate implementation plan, and proper reporting on all of the above (Hoekstra, 2014a).

While companies are thus trying to make current business models more water sustainable or water-proof for the future, to date, the role of investors is underexposed (Vörösmarty et al., 2018). Moreover, there are signs that the role of investors is modest at best, as they are lagging behind in fostering and facilitating more (water) sustainable business practices (Busch et al., 2016).

Despite these observations, a host of initiatives to help and guide investors to become more sustainable emerged over the past decade, each with its own approach, method and definitions. For example, Responsible Investment (RI) – or Sustainable Responsible Investment (SRI) – aims to integrate environmental, social and governance (ESG) factors into investment decisions (Eurosif, 2016). Such factors are often incorporated to a limited extent, due to lack of trustworthy ESG indicators and data (Busch et al., 2016), and varying collective beliefs on what RI ought to entail (Louche and Dumas, 2016). Investors may also incorporate ESG or similar criteria through Corporate Social Responsibility (CSR) programmes (see Carroll and Shabana (2010) for a review and Oh et al. (2013) for two case studies); by carrying out triple bottom line assessments (Norman and MacDonald, 2004); by adhering to the United Nations initiated Principles of Responsible Investment (UN PRI, 2017); or by becoming certified by the Alliance for Water Stewardship (AWS, 2017). Topics encompass various sustainability domains, ranging from child labour to carbon emissions, and from deforestation to human rights. Although the long lists of both initiatives and topics suggests that sustainability is high on investors' agendas, the gist of recent literature reveals investor progress on water sustainability is skin deep at best, hindered primarily by a lack of perceived urgency about, a shared taxonomy on and meaningful indicators regarding water sustainability of their investments.

The ill-addressing of water sustainability by investors is particularly alarming in regard to future water issues, since the economy of tomorrow is shaped to a large extent by choices made by investors today. After all, investments today in new or updated farms, firms and factories will have ramifications for future water resource use and pollution. Failure by investors to transition from business-as-usual to more sustainable water practices implies water resources will continue to be further depleted, polluted and needlessly wasted, while prolonged inconsideration of sharing water resources fairly among users increases the likelihood of conflicts. Current investment practices thus sustain unsustainable production systems in a circular economy a utopian vista.

This paper aims to contribute to the slim body of knowledge on how investors relate to water concerns, by investigating whether and how investors currently include water sustainability criteria in their investment decisions. Ideally, the facts on the ground are assessed, namely the water sustainability of actually invested-in projects or portfolios. Since such ground-truthing is an unreachable goal because of the inaccessibility of relevant data, we resorted to drawing on policy documents released to the public to make the assessment instead.

We developed and applied a framework to assess these policies of investors regarding their incorporation of water sustainability criteria. The application is done for a case study including twenty large investors - banks, pension funds and insurers – in the Netherlands. The assessment of investors' policies is concluded with a ranking of the investigated investors, to distinguish leaders and frontrunners from followers and stragglers, and to incentivise investors to improve their business practice with regards to water resources.

Although the focus is on Dutch (institutional) investors, the scientific soundness and comprehensiveness of the proposed framework render it suitable for wider application. Investors form a major actor group that is being overlooked in contemporary water management discourse. This paper provides a first and timely attempt to systematically address the role investors play in contributing to sustainable water use. By bridging the worlds of investors and water managers, this study combines perspectives for mutual learning.

## 2. Method and data

The method consists of three main parts: (1) the definition of water sustainability in this study, (2) the development of a framework to assess investors' investment policies on inclusion of water sustainability criteria, and (3) the procedure of applying this framework to twenty Dutch investors.

### 2.1. Water sustainability defined

In this study, water sustainability is defined along three dimensions of sustainability – efficient allocation, sustainable scale and equitable distribution – as first proposed by Daly (1992), and refined and tailored to water by Hoekstra (2014b). These three dimensions, encompassing economic, environmental and social concerns, can be operationalized using the water footprint (WF), a temporally and spatially explicit indicator of water consumption and pollution (Hoekstra et al., 2011). The green WF represents rainwater consumption of a human activity, the blue WF refers to surface water and groundwater consumption, and the grey WF provides a measure of water pollution. Using WF tools and these three dimensions, connections between water use, economic development, business practice, and social and environmental risks can be better understood (Herva et al., 2011). The dimension of efficient allocation of water can be operationalized by formulating water footprint benchmarks per product or process; sustainable scale by defining a water footprint cap per river basin; and equitable distribution by defining fair water footprint shares per community (Hoekstra, 2013). These dimensions have to be assessed in both the direct operations of any prospective investment and its supply chain, since in many cases direct water use comprises only a fraction of supply chain water consumption (Linneman et al., 2015).

### 2.2. Framework development

A framework was developed to assess how investors' investment policies incorporate aspects relevant to sustainable use of water. The framework is inspired by that of Linneman et al. (2015), who developed a framework to assess water transparency of stock-listed companies (rather than water sustainability of institutional investors). The framework consists of nine categories – labelled A to I and shown in Fig. 1 – which collectively cover criteria relevant to water use and pollution associated with prospective investments. Each category contains three to seven equally weighted assessment criteria, which are formulated as closed questions. Answers to the questions result in a score of zero to two or three

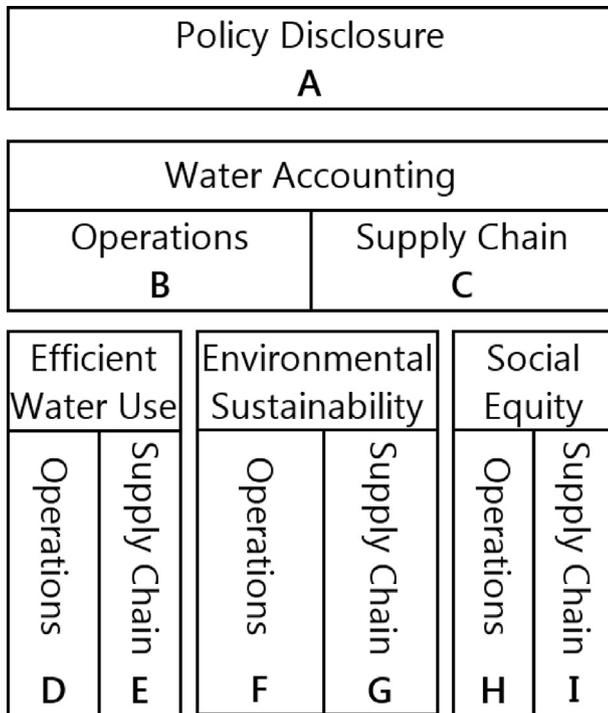


Fig. 1. Assessment framework with nine categories.

points per question, where a zero-point score indicates the investor does not consider the criterion at all, and the maximum score – two or three points, depending on the question – implies the investor considers the criterion to its best capacity. We roughly followed a progressive scoring approach, meaning that points can be scored fairly easily on the first question within a category (e.g. testing if the investor is aware of the particular criterion at all, without further qualifications), but that scoring on subsequent questions becomes increasingly difficult (e.g. questioning that goes beyond mere awareness, testing if specific metrics are employed and/or evaluated against set targets).

In order to aggregate criterion scores to the category level, the sum of the points scored on each question within the category is taken. The resulting total category score in points is subsequently expressed as a percentage: a total of 0 points corresponds to a 0% category score, while all points scored on the category questions translates to a 100% score. This is done to avoid that categories with more questions attain a higher weight. Thus, the final investor score on water sustainability is calculated as the average percentage score over all nine categories, where each category contributes an equal weight of 11.1%.

Category A on “Policy Disclosure” assesses the transparency of an investor regarding sustainability issues in its investment policy in general and water sustainability specifically. Although reporting is not the same as actually acting in a sustainable manner, disclosure facilitates the enfolding of a debate on water, and allows the general public to hold the investor accountable. This category is prerequisite, since without disclosure scores cannot be assigned to remaining categories. Questions range from whether the investor discloses information on sustainability in general at all, to whether the investor reports on following certain sustainability guidelines, or frameworks or directives regarding water sustainability.

Categories B and C on “Water Accounting” cover the quantification (measuring and monitoring) of water consumption and pollution, both in direct operations and in the supply chain of the activity created by the proposed investment. Accounting water use

and pollution is imperative in any complete assessment of water resources, because water use or pollution reduction targets can only be formulated once direct and indirect claims to freshwater are known; you cannot manage what you do not measure. Water accounts in and by themselves do not provide a comprehensive indication of sustainable water practice; rather, such accounts serve as a basis for the remaining categories, which relate to three dimensions of wise water use (Hoekstra and Wiedmann, 2014).

Categories D and E on “Efficient Water Use” concern the efficient use of water resources by the activity emerging from the prospective investment. Criteria range from simply showing awareness of the notion of water efficiency in direct operations of an investment, to adopting benchmarking procedures in the supply chain and setting reasonable water use and pollution targets against which to compare water use and pollution caused by prospective investment activities.

Categories F and G on “Environmental Sustainability” put the water use and pollution resulting from an investment (as quantified in categories B and C) in the context of locally available water resources – both at the location(s) of the direct operations and at the locations where supply chain activities will take place. Questions probe whether the investor considers potential water scarcity issues, such as violation of environmental flow requirement in the basin(s) where the activities are planned, and how it anticipates on resolving these issues through response strategies.

The last categories H and I on “Social Equity” cover an investor’s awareness of and response to social equity concerns that may result from the water use and pollution that will come along with the activity targeted by the investment. Of interest are both community concerns in the place(s) of the activity itself and community concerns in the locations of the supply chain of the activity.

The questions in each category and a format for how points are assigned to each question are enclosed in the [Supplementary Materials 1](#).

### 2.3. Framework application and ranking

The assessment framework is applied to the eighteen largest investors in the Netherlands based on their asset value in 2016. Asset values, viz. the worth of the investor, serve as a proxy for assets under management of the investor (i.e. the total market value of assets an investment company manages on behalf of its clients). Although the latter is the preferred indicator of an investor’s size, no unambiguous data could be retrieved for this parameter. Asset values for 2016 are taken from the Dutch National Bank (DNB, 2016). Since hardly any published policy briefs by private investors are available to the public, selection eligibility was limited to banks, insurance companies and pension funds.

Triodos Bank and ASN Bank were added to the subset of the eighteen largest investors, on the basis of their perceived leading role in sustainable investing and the accompanying expectation that we might uncover examples of best practices by including them. Although ASN Bank is a brand in the SNS Bank holding, it has its own policies and operates independently. The resulting selection of twenty investors includes nine banks, five insurance companies, and six pension funds, as listed in [Table 1](#).

To assign scores to the criteria of the framework, we solely relied on publicly disclosed information on an investor’s investment policy. We analysed information published or referred to by the investor itself on its official websites, in both English and Dutch languages, and on multiple webpage domains if applicable. All webpages and (policy) documents were used which contained or pointed to information regarding investment policy, water, sustainability, and other relevant search terms such as Corporate Social Responsibility, Environment Social and Governance factors,

**Table 1**

The twenty selected Dutch investors and their asset values in 2016 as taken from DNB (2016).

| Investor Name           | Investor Type     | Assets (EUR billion) |
|-------------------------|-------------------|----------------------|
| ING Bank                | bank              | 886                  |
| Rabobank                | bank              | 687                  |
| ABN AMRO Bank           | bank              | 416                  |
| ABP                     | pension fund      | 384                  |
| PFZW                    | pension fund      | 186                  |
| BNG Bank                | bank              | 163                  |
| NWB Bank                | bank              | 104                  |
| Nationale-Nederlanden   | insurance company | 94                   |
| Aegon Levensverzekering | insurance company | 75                   |
| Shell Pensioenfond      | pension fund      | 68                   |
| PMT                     | pension fund      | 66                   |
| SNS Bank                | bank              | 64 <sup>a</sup>      |
| bpfbOUW                 | pension fund      | 57                   |
| REAAL                   | insurance company | 56                   |
| Achmea Verzekeringen    | insurance company | 52                   |
| PME                     | pension fund      | 43                   |
| ASR Levensverzekering   | insurance company | 42                   |
| NIBC Direct             | bank              | 24                   |
| ASN Bank                | bank              | 11 <sup>b</sup>      |
| Triodos Bank            | bank              | 9                    |

<sup>a</sup> Including ASN Bank assets.

<sup>b</sup> Assets under management in 2016 (ASN Bank, 2016).

Responsible Investing, Triple Bottom Line, and People Planet Profit. For the selected twenty investors, we scrutinized 44 unique websites and 226 relevant documents published on or linked to by these websites. Webpages and documents thus found and analysed are listed in [Supplementary Materials 2](#).

The final investor score on water sustainability directly determines the ranking of the selected investors.

### 3. Results

The ranking of the twenty selected Dutch investors on how well they incorporate water sustainability criteria in their investment policy is shown in [Fig. 2](#). The colours represent the various categories of the assessment framework. [Table 2](#) provides a more detailed scoring overview, containing percentage scores per

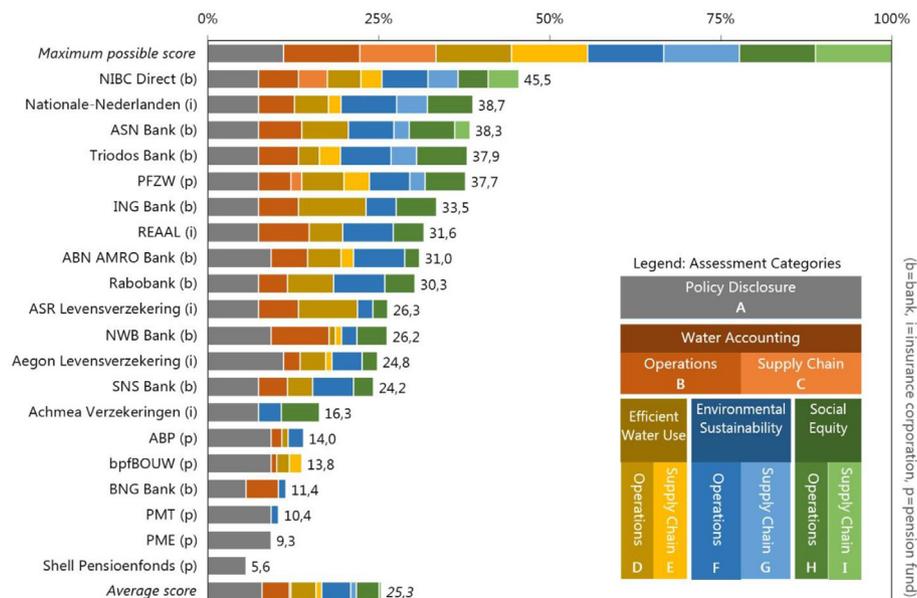
investor per category.

The top-three highest ranked investors comprises NIBC Direct (46%), Nationale-Nederlanden (39%) and ASN Bank (38%). The following excerpt from NIBC Direct's policy illustrates its awareness of the various dimensions related to water sustainability:

“At NIBC, we recognize that we operate in a complex world, where climate change, water scarcity, biodiversity loss and population growth create significant sustainability challenges and unprecedented pressures on natural and human systems. The increasing demand for - and scarcity of - resources may lead and has led to conflicts, political and economic instability. We are committed to take environmental criteria into consideration in our business activities, including protection and conservation of biodiversity and maintaining the benefits of ecosystem services. (...) In addition to the risks and standards mentioned in our Sustainability Policy and sector specific policies, NIBC considers the following:

- Impacts on natural resources and ecosystem services;
- Pollution to air, water, and land resulting from the client's operations (land or ground water); ( ...)
- Environmental impact assessments and taking appropriate measures to manage environmental impacts, including policies, management systems, or supply chain criteria.” NIBC Direct (2017).

The scores show that typically investors score highest in category A “Policy Disclosure”, with an average score across investors of 72%. Of the remaining categories, those concerning direct operations yield substantially higher scores (average scores category B: 36%; D: 33%, F: 38%; H: 30%) than the categories assessing supply chains (average scores category C: 3%; E: 8%, G: 8%; I: 3%). All individual investors score higher in operations than supply chain categories as well. While thirteen out of twenty investors score points in all four operations categories, only one (i.e. NIBC Direct) scores points in all four supply chain categories. Moreover, eleven out of twenty investors do not score any points in the supply chain categories at all. The scores indicate that generally, the role of the supply chain in water sustainability receives little to no attention in investment policy.



**Fig. 2.** Ranking of selected large Dutch investors on incorporation of water sustainability criteria in their investment policy.

**Table 2**  
Overview of scores per assessment category.

| Investor Name           | Type <sup>a</sup> | Disclosure A (%) | Water Accounting |                    | Efficient Water Use |                    | Environmental Sustainability |                    | Social Equity    |                    | Total (%) |
|-------------------------|-------------------|------------------|------------------|--------------------|---------------------|--------------------|------------------------------|--------------------|------------------|--------------------|-----------|
|                         |                   |                  | Operations B (%) | Supply Chain C (%) | Operations D (%)    | Supply Chain E (%) | Operations F (%)             | Supply Chain G (%) | Operations H (%) | Supply Chain I (%) |           |
| ABN AMRO Bank           | b                 | 83.3             | 47.6             | 0.0                | 44.4                | 16.7               | 66.7                         | 0.0                | 20.0             | 0.0                | 31.0      |
| ABP                     | p                 | 83.3             | 14.3             | 0.0                | 8.3                 | 0.0                | 20.0                         | 0.0                | 0.0              | 0.0                | 14.0      |
| Achmea Verzekeringen    | i                 | 66.7             | 0.0              | 0.0                | 0.0                 | 0.0                | 30.0                         | 0.0                | 50.0             | 0.0                | 16.3      |
| Aegon Levensverzekering | i                 | 100.0            | 21.4             | 0.0                | 33.3                | 8.3                | 40.0                         | 0.0                | 20.0             | 0.0                | 24.8      |
| ASN Bank                | b                 | 66.7             | 57.1             | 0.0                | 61.1                | 0.0                | 60.0                         | 20.0               | 60.0             | 20.0               | 38.3      |
| ASR Levensverzekering   | i                 | 66.7             | 52.4             | 0.0                | 77.8                | 0.0                | 20.0                         | 0.0                | 20.0             | 0.0                | 26.3      |
| BNG Bank                | b                 | 50.0             | 42.9             | 0.0                | 0.0                 | 0.0                | 10.0                         | 0.0                | 0.0              | 0.0                | 11.4      |
| bpfBOUW                 | p                 | 83.3             | 7.1              | 0.0                | 16.7                | 16.7               | 0.0                          | 0.0                | 0.0              | 0.0                | 13.8      |
| ING Bank                | b                 | 66.7             | 52.4             | 0.0                | 88.9                | 0.0                | 40.0                         | 0.0                | 53.3             | 0.0                | 33.5      |
| Nationale-Nederlanden   | i                 | 66.7             | 47.6             | 0.0                | 44.4                | 16.7               | 73.3                         | 40.0               | 60.0             | 0.0                | 38.7      |
| NIBC Direct             | b                 | 66.7             | 52.4             | 38.1               | 44.4                | 27.8               | 60.0                         | 40.0               | 40.0             | 40.0               | 45.5      |
| NWB Bank                | b                 | 83.3             | 76.2             | 0.0                | 8.3                 | 8.3                | 20.0                         | 0.0                | 40.0             | 0.0                | 26.2      |
| PFZW                    | p                 | 66.7             | 42.9             | 14.3               | 55.6                | 33.3               | 53.3                         | 20.0               | 53.3             | 0.0                | 37.7      |
| PME                     | p                 | 83.3             | 0.0              | 0.0                | 0.0                 | 0.0                | 0.0                          | 0.0                | 0.0              | 0.0                | 9.3       |
| PMT                     | p                 | 83.3             | 0.0              | 0.0                | 0.0                 | 0.0                | 10.0                         | 0.0                | 0.0              | 0.0                | 10.4      |
| Rabobank                | b                 | 66.7             | 38.1             | 0.0                | 61.1                | 0.0                | 66.7                         | 0.0                | 40.0             | 0.0                | 30.3      |
| REAAL                   | i                 | 66.7             | 66.7             | 0.0                | 44.4                | 0.0                | 66.7                         | 0.0                | 40.0             | 0.0                | 31.6      |
| Shell Pensioenfonds     | p                 | 50.0             | 0.0              | 0.0                | 0.0                 | 0.0                | 0.0                          | 0.0                | 0.0              | 0.0                | 5.6       |
| SNS Bank                | b                 | 66.7             | 38.1             | 0.0                | 33.3                | 0.0                | 53.3                         | 0.0                | 26.7             | 0.0                | 24.2      |
| Triodos Bank            | b                 | 66.7             | 52.4             | 0.0                | 27.8                | 27.8               | 66.7                         | 33.3               | 66.7             | 0.0                | 37.9      |
| Maximum Possible Score  |                   | 100.0            | 100.0            | 100.0              | 100.0               | 100.0              | 100.0                        | 100.0              | 100.0            | 100.0              | 100.0     |
| Lowest Score            |                   | 50.0             | 0.0              | 0.0                | 0.0                 | 0.0                | 0.0                          | 0.0                | 0.0              | 0.0                | 5.6       |
| Highest Score           |                   | 100.0            | 76.2             | 38.1               | 88.9                | 33.3               | 73.3                         | 40.0               | 66.7             | 40.0               | 45.5      |
| Average Score           |                   | 71.7             | 35.5             | 2.6                | 32.5                | 7.8                | 37.8                         | 7.7                | 29.5             | 3.0                | 25.3      |

<sup>a</sup> b = bank, i = insurance company, p = pension fund.

Regarding the type of investor, the pension funds score lower than banks and insurance companies. Five out of six pension funds are ranked in the bottom-six of twenty investors investigated. There appears to be no noteworthy difference between the scores of banks and insurance companies. Regarding the asset size of investors, no pattern emerges for the results either. Both smaller and larger investors are ranked in the top-five, as well as in the bottom-five.

#### 4. Discussion

All assessed investors in some form express a willingness to contribute to a more sustainable world by adopting or supporting sustainability guidelines, frameworks or principles. All twenty investors, for example, are signatories of the United Nations' Principles for Responsible Investment (UN PRI, 2017). However, in analysing policy documents to assign scores to water sustainability criteria, it was found that their good intentions did not trickle down to effectuate clear water policy. In many cases, policy is formulated in general, ambiguous, superficial or even meaningless terms (cf Scholtens (2014)). For example, eleven out of twenty investors state water considerations – in its widest sense – influence their investment decisions, but without bothering to give any further explanation. Alternatively, some (mainly low scoring) investors publish several policy documents amply stressing the importance of sustainability, but do not specify the role of water. Shell Pensioenfonds, for example, only mentions the word 'water' twice in all sustainability documents investigated, and PME thrice. Apparently, water does not have a place in their perspective on sustainability. Another example is from SNS Bank's holding company De Volksbank, which mentions the word 'water' 32 times in its 'Carbon Profit and Loss Methodology' – more than in all of their other documents combined – but only in the context of translating water consumption to CO<sub>2</sub>-equivalents (De Volksbank, 2016). Such attention for detail regarding CO<sub>2</sub> is absent in their water policies, and so is a definition or explanation of how exactly they account for

water use. In addition, many investors mention examples of a reduction in water consumption of their investments in absolute terms, conveying the impression of sustainable business practice. However, without any further explanation or comparison, such statements are meaningless. Only once consumption is considered per unit of output and compared to benchmark values, meaningful sustainable water practice can be claimed. ASR Levensverzekering's real estate branch ASR Vastgoed provides an example of good practice in this regard. In assessing a prospective investment,

"ASR Vastgoed performs a BREEAM assessment, which uses recognized measures of performance set against established benchmarks, to evaluate (...) a broad range of categories and criteria. They include aspects related to (...) water use, (...), and pollution." (UN PRI, 2015).

The less exemplary findings, however, confirm a study by Daub (2007) of a decade ago, stating that disclosed documents may provide only superficial information, using interchangeable terminology and even leading to a value of the disclosed information that "tends to hover around zero".

Another finding that emerged from the assessment is that water policy is often fragmented and lacking coherence. For all investors with an above-average ranking, the scores are based on at least three and up to ten different documents or webpages. No investor received its total score solely based on a single document. Even if dedicated water chapters were available, additional points could still be assigned based on other documents. Because of the fragmentation of relevant information on water sustainability, it proved cumbersome to isolate or define a coherent water policy for most investors.

Related to the fragmentation is the ambiguity surrounding who is responsible when an investor outsources the management of its assets, especially if both asset manager and investor have their own, potentially conflicting policies about dealing with water sustainability. A similar confusion arises when an investor is a subsidiary of

a larger holding company, with similarly potential discrepancies in individual policies. Even in absence of such institutional difficulties, it was often unclear which documents should be leading, if fragmented documents contradicted each other. As a rule, scores were assigned based on the most favourable documents. That being said, some investors have dedicated 'green' or special focus funds with stricter policies than the parent company or other funds held by the investor. In such cases, we let the policy representative of the majority of the investors' activities be guiding in assigning scores. In any case, the complexity of the investors' organizational set-up should not inhibit sustainable water practice (Lagoarde-Segot and Paraneque, 2018).

Some investors include water aspects in their policy not assessed by our framework, such as flooding, sea level rise, biodiversity and hydroelectricity. These were not the focus of our resources-based assessment, but relevant nonetheless to different sustainability contexts.

While the focus of this study is the investor's consideration of water sustainability criteria in prospective investments, some investors report on water use of their own in-house operations. Rabobank (2015) and Aegon (Aegon Asset Management, 2016), for example, both explicitly account for water use in their offices. Although a praiseworthy exercise, the arguably much larger water use by their investments is largely left unnoticed.

The scoring of investors is based on disclosed policies rather than on actual ground-truthed performance, which limits the interpretation of our resulting water sustainability assessment. Moreover, in addition to disclosed policies investors may comply with internal, possibly confidential procedures. Aegon, for example, hints to the existence of internal procedures in an informal Q&A interview format presented in its Responsible Investment Report 2016 (Aegon Asset Management, 2016). If included in our assessment, these internal documents, might have given rise to higher scores than assigned in this study. On the other hand, publicly available documents might keep up appearances of actual investment practice, indicating too high scores might have been assigned.

The ranking of investors based on the assessment framework is subjective to some degree. Firstly in the composition of the framework itself, but also in the weighting of categories and the scoring within each category. While the former is an inherent design consequence, for the latter two, a closer look at the distribution of points scored over the nine categories shows that investors with a high total score received this score based on points assigned in multiple categories. No investor that scores high points in operations categories outranks investors with fewer points spread over both operations and supply chain categories. We would not expect differently, since typically investors start considering supply chains only after covering water criteria in direct operations. A change in weighting may therefore alter the absolute scores, but will affect the ranking only to a limited extent.

Future research may refine, test and build upon our framework and findings, especially in capturing and describing intricacies related to which policies are guiding in practice, how these policies are applied, and the actual ground-truthing of water sustainability of activities invested in. This may for instance be done in a case study setting, where collaboration is sought with selected investors and their local investees.

Few rankings of Dutch investors are available for comparison. In the Fair Finance Guide (FFG) ranking of general sustainability of Dutch financial institutions, ASN Bank, SNS Bank and Triodos Bank score high points, followed at a distance by NIBC Direct, in the category 'Climate Change' (Brink et al., 2016a). In FFG's insurers subsection, Nationale-Nederlanden is in the bottom of the list (Brink et al., 2016b), while they lead the water sustainability ranking in our study. The main reason for the difference in rankings

appears to be the main focus of FFG on CO<sub>2</sub> reduction measures, while we confined ourselves to water criteria.

Although the framework is applied to Dutch banks, pension funds and insurance companies, it can readily be used for other countries and types of investors as well. The framework provides a reference for the inception of new investment policy on incorporating water sustainability criteria, or for uptake in Corporate Social Responsibility practice or ESG frameworks (Peiró-Signes et al., 2013). Given the plethora of sustainability frameworks, principles and standards available, and the resulting dilution of focus (Krajnc and Glavič, 2005), the water sustainability criteria of our framework are preferably integrated with existing efforts on developing common taxonomies, such as e.g. those by the Pacific Institute (2017).

Since certain sectors, such as the Food and Beverage industry and Mining, are more water-intensive or susceptible to water risks – in either their operations or supply chain – we recommend investors to start implementing water sustainability criteria specifically in these sectors (Rueda et al., 2017). Some investors, such as ABN AMRO (ABN AMRO, 2017) and Aegon Levensverzekering (Aegon Asset Management, 2016), already formulate their Responsible Investment policy- including water aspects - sector-specific.

## 5. Conclusion

The state of water resources in the future greatly depends on the extent to which investors today include water criteria in their investment decisions. This study set out to find out how investors include water sustainability criteria in their investment decisions, thereby contributing to the body of knowledge on how the currently overlooked and under-addressed actor group of investors relate to water concerns.

The main conclusion is that despite their expressed good intentions, the low total score of even the highest scoring investors in the Netherlands (<46%) indicates that their ambitions have not trickled down (yet) to effectuate clear water policy. Investors score points on disclosure and reporting –the first, readily doable step – but that in itself does not guarantee actual water sustainable investment practice. Assessing numerous policy documents revealed that, by and large, disclosed policy on water sustainability is neither well-demarcated nor clearly formulated. This confirms earlier observations by Scholtens (2014), Lambooy (2011) and Daub (2007), and bolster scepticism about an imminent and prompt transition to water sustainable production systems in a circular economy. That being said, preliminary but promising water policies, such as that of frontrunner NIBC Direct, or a sector-specific approach as pursued by ABN AMRO and Aegon Levensverzekering, lead the path in the right direction and deserve recognition.

The practice of accounting for water use and pollution in both operations and supply chains of the activities emerging from prospective investments is imperative, but we found that especially the supply chain part of the value chain is being overlooked by most investors. In addition, low scores in Categories D – I (Table 2) show that investors are still a long way from guaranteeing that their prospective investments safeguard efficient water use, fit a sustainable scale, and ensure a fair sharing of limited water supplies.

Moreover, we discovered how a lack of mutual understanding and exchange between the investor community and the water management community inhibits the development of sound, practical and science-based water investment policy. Concurrently, increased collaboration may hold the linchpin for developing water sustainable investment practices. The assessment framework developed and applied in this study is a first attempt to straddle the gap by providing investors with systematic handles to give

substance to their own improvement process to incorporate water criteria into investment decisions. In the end, the purpose of assessing and ranking investors is to incentivise them to improve.

In light of the severity of water issues faced today, we stress the urgency to take action, both specifically toward incorporating water criteria into investment decisions and generally toward more water sustainable economies.

## Acknowledgements

This work was partially supported by NWO Earth and Life Sciences (ALW), project 869.15.007. The work was partially developed within the framework of the Panta Rhei Research Initiative of the International Association of Hydrological Sciences (IAHS).

## Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.jclepro.2018.08.142>.

## References

- ABN AMRO, 2017. Summary, Agri-commodities Policy. ABN AMRO. [https://www.abnamro.com/en/images/Documents/040\\_Sustainable\\_banking/070\\_Sustainability\\_policy/ABN\\_AMRO\\_Summary\\_agri-commodities\\_policy.pdf](https://www.abnamro.com/en/images/Documents/040_Sustainable_banking/070_Sustainability_policy/ABN_AMRO_Summary_agri-commodities_policy.pdf). (Accessed 5 January 2017).
- Aegon Asset Management, 2016. Responsible Investment Report 2015. Aegon Asset Management. <http://www.nbim.no/contentassets/96608d5f04eb4a138fa888f8df937b70/responsible-investment-2015.pdf>. (Accessed 12 May 2016).
- ASN Bank, 2016. ASN Bank Verslag 2016. Den Haag: ASN Bank. [https://verslag.asnbank.nl/2016/FbContent.aspx/pub\\_1000/Downloads/ASN\\_Bank\\_verslag\\_2016.pdf](https://verslag.asnbank.nl/2016/FbContent.aspx/pub_1000/Downloads/ASN_Bank_verslag_2016.pdf). (Accessed 14 November 2017).
- AWS, 2017. Alliance for Water Stewardship Certification. <http://a4ws.org/about/>. (Accessed 25 October 2017).
- Brink, H., Riemersma, M., Simons, M., de Wilde, J., 2016a. Eerlijke Bankwijzer: Beoordeling Van Het Duurzaamheidsbeleid Van Tien Bankgroepen [Fair Finance Guide: Assessment of the Sustainability Policy of Ten Banking Groups. Profundo, Amsterdam. [www.profundo.nl/files/download/EB1612.pdf](http://www.profundo.nl/files/download/EB1612.pdf). (Accessed 10 January 2017).
- Brink, H., Riemersma, M., Simons, M., de Wilde, J., 2016b. Eerlijke Verzekeringswijzer: Beoordeling Van Het Duurzaamheidsbeleid Van Tien Verzekeringsgroepen [Fair Finance Guide: Assessment of the Sustainability Policy of Ten Insurance Companies]. Profundo, Amsterdam. <http://eerlijkegedwizjer.nl/media/373416/vierde-update-beleidsonderzoek-actualisering-beoordeling-beleid-verzekeraars-17-11-16.pdf>. (Accessed 10 January 2017).
- Busch, T., Bauer, R., Orlitzky, M., 2016. Sustainable development and financial markets: old paths and new avenues. *Bus. Soc.* 55 (3), 303–329.
- Carroll, A.B., Shabana, K.M., 2010. The business case for corporate social responsibility: a review of concepts, research and practice. *Int. J. Manag. Rev.* 12 (1), 85–105.
- CDP, 2015. CDP Global Water Report 2015. CDP, London. <https://www.cdp.net/en/research/global-reports/global-water-report-2015>. (Accessed 26 October 2017).
- CEO Water Mandate, 2017. UN Global Compact's CEO Water Mandate. <https://ceowatermandate.org/>. (Accessed 11 February 2017).
- Daly, H.E., 1992. Allocation, distribution, and scale: towards an economics that is efficient, just, and sustainable. *Ecol. Econ.* 6 (3), 185–193.
- Damania, R., Desbureaux, S., Hyland, M., Islam, A., Moore, S., Rodella, A.S., Russ, J., Zaveri, E., 2017. Uncharted Waters: the New Economics of Water Scarcity and Variability. World Bank, Washington D.C. <https://openknowledge.worldbank.org/bitstream/handle/10986/28096/9781464811791.pdf?sequence=2&isAllowed=y>. (Accessed 26 October 2017).
- Daub, C.H., 2007. Assessing the quality of sustainability reporting: an alternative methodological approach. *J. Clean. Prod.* 15 (1), 75–85.
- De Volksbank, 2016. De Volksbank Carbon Profit and Loss Methodology. <https://www.dev Volksbank.nl/uploads/media/downloads/0001/02/d90b7773dc882856562af1c16c9cca4e6ed1793.pdf>. (Accessed 12 May 2016).
- DNB, 2016. Data on Financial Institutions. <https://www.dnb.nl/en/statistics/statistics-dnb/financial-institutions/index.jsp>. (Accessed 12 May 2016).
- Eurosif, 2016. European SRI Study 2016. Brussels: European Sustainable Investment Forum (EUROSIF). <http://www.eurosif.org/wp-content/uploads/2016/11/SRI-study-2016-LR-.pdf>. (Accessed 25 October 2017).
- Hepworth, N., 2012. Open for business or opening Pandora's box? A constructive critique of corporate engagement in water policy: an introduction. *Water Alternatives* 5 (3), 543–562.
- Herva, M., Franco, A., Carrasco, E.F., Roca, E., 2011. Review of corporate environmental indicators. *J. Clean. Prod.* 19 (15), 1687–1699.
- Hoekstra, A.Y., 2013. The Water Footprint of Modern Consumer Society. Routledge, Oxon.
- Hoekstra, A.Y., 2014a. Water scarcity challenges to business. *Nat. Clim. Change* 4 (5), 318–320.
- Hoekstra, A.Y., 2014b. Sustainable, efficient and equitable water use: the three pillars under wise freshwater allocation. *WIREs Water* 1 (1), 31–40.
- Hoekstra, A.Y., Chapagain, A.K., Aldaya, M.M., Mekonnen, M.M., 2011. The Water Footprint Assessment Manual: Setting the Global Standard. Earthscan, London.
- Hoekstra, A.Y., Wiedmann, T.O., 2014. Humanity's unsustainable environmental footprint. *Science* 344 (6188), 1114–1117.
- Kelly, P., 2014. What to do when we run out of water. *Nat. Clim. Change* 4 (5), 314–316.
- Kolker, J., Kingdom, W., Trémolet, S., Winpenny, J., Cardone, R., 2016. Financing Options for the 2030 Water Agenda. World Bank, Washington, DC. <https://sustainabledevelopment.un.org/content/documents/11995HLP%20Financing%20Options.pdf>. (Accessed 10 October 2017).
- Krajnc, D., Glavič, P., 2005. How to compare companies on relevant dimensions of sustainability. *Ecol. Econ.* 55 (4), 551–563.
- Lagoarde-Segot, T., Paraque, B., 2018. Finance and sustainability: from ideology to utopia. *Int. Rev. Financ. Anal.* 55, 80–92.
- Lambooy, T., 2011. Corporate social responsibility: sustainable water use. *J. Clean. Prod.* 19 (8), 852–866.
- Larson, W.M., Freedman, P.L., Passinsky, V., Grubb, E., Adriaens, P., 2012. Mitigating corporate water risk: financial market tools and supply management strategies. *Water Alternatives* 5 (3), 582–602.
- Linneman, M., Hoekstra, A., Berkhout, W., 2015. Ranking water transparency of Dutch stock-listed companies. *Sustainability* 7 (4), 4341–4359.
- Louche, C., Dumas, C., 2016. Collective beliefs on responsible investment. *Bus. Soc.* 55 (3), 427–457.
- Morrison, J., Schulte, P., Schenck, R., 2010. Corporate Water Accounting: an Analysis of Methods and Tools for Measuring Water Use and its Impacts. United Nations Environment Programme/Oakland: Pacific Institute, Nairobi. [http://pacinst.org/wp-content/uploads/2013/02/corporate\\_water\\_accounting\\_analysis3.pdf](http://pacinst.org/wp-content/uploads/2013/02/corporate_water_accounting_analysis3.pdf). (Accessed 12 January 2017).
- NIBC Direct, 2017. NIBC Sustainability Policy Environment Policy Supplement. NIBC Direct. <https://www.nibc.nl/media/1444/environment-supplement.pdf>. (Accessed 4 October 2017).
- Norman, W., MacDonald, C., 2004. Getting to the bottom of “triple bottom line”. *Bus. Ethics Q.* 14 (2), 243–262.
- Oh, C.H., Park, J.H., Ghauri, P.N., 2013. Doing right, investing right: socially responsible investing and shareholder activism in the financial sector. *Bus. Horiz.* 56 (6), 703–714.
- Pacific Institute, 2017. Exploring the Case for Corporate Context-based Water Targets. Pacific Institute, Oakland, USA. <https://www.ceowatermandate.org/files/context-based-targets.pdf>. (Accessed 2 November 2017).
- Peiro-Signes, A., Segarra-Oña, M., Mondéjar-Jiménez, J., Vargas-Vargas, M., 2013. Influence of the environmental, social and corporate governance ratings on the economic performance of companies: an overview. *Int. J. Environ. Res.* 7 (1), 105–112.
- Rabobank, 2015. Annual Report 2015. Rabobank. <https://www.rabobank.com/en/images/rabobank-annual-report-2015.pdf>. (Accessed 12 May 2016).
- Roca, L.C., Searcy, C., 2012. An analysis of indicators disclosed in corporate sustainability reports. *J. Clean. Prod.* 20 (1), 103–118.
- Rueda, X., Garrett, R.D., Lambin, E.F., 2017. Corporate investments in supply chain sustainability: selecting instruments in the agri-food industry. *J. Clean. Prod.* 142 (4), 2480–2492.
- Scholtens, B., 2014. Indicators of responsible investing. *Ecol. Indic.* 36, 382–385.
- Sumaila, U.R., Rodriguez, C.M., Schultz, M., Sharma, R., Tyrrell, T.D., Masundire, H., Damodarani, A., Bellot-Rojas, M., Rosales, R.M.P., Jung, T.Y., Hickey, V., Solhaug, T., Vause, J., Ervin, J., Smith, S., Rayment, M., 2017. Investments to reverse biodiversity loss are economically beneficial. *Curr. Opin. Environ. Sustain.* 29, 82–88.
- UN PRI, 2015. RI Transparency Report 2014/5 ASR Nederland N.V. United Nations Principles for Responsible Investment (UN PRI). [https://www.unpri.org/download\\_report/10040](https://www.unpri.org/download_report/10040). (Accessed 5 May 2017).
- UN PRI, 2017. Principles for Responsible Investment. <https://www.unpri.org/about/the-six-principles>. (Accessed 25 October 2017).
- Utz, S., Wimmer, M., Steuer, R.E., 2015. Tri-criterion modeling for constructing more-sustainable mutual funds. *Eur. J. Oper. Res.* 246 (1), 331–338.
- Vörösmarty, C.J., Osuna, V.R., Koehler, D.A., Klop, P., Spengler, J.D., Buonocore, J.J., Cak, A.D., Tessler, Z.D., Corsi, F., Green, P.A., Sánchez, R., 2018. Scientifically assess impacts of sustainable investments. *Science* 359 (6375), 523–525.
- WEF, 2017. The Global Risks Report 2017. World Economic Forum, Geneva. [http://www3.weforum.org/docs/GRR17\\_Report\\_web.pdf](http://www3.weforum.org/docs/GRR17_Report_web.pdf). (Accessed 11 January 2017).
- World Bank, 2016. High and Dry: Climate Change, Water, and the Economy. World Bank, Washington, DC. <https://openknowledge.worldbank.org/handle/10986/23665>. (Accessed 10 October 2017).
- WWAP, 2017. The United Nations World Water Development Report 2017. Waste-water: the Untapped Resource. WWAP (United Nations World Water Assessment Programme), Paris. <http://unesdoc.unesco.org/images/0024/002471/247153e.pdf>. (Accessed 10 October 2017).