INVESTOR RISK ANALYSIS: WHY GROUNDWATER MATTERS?

The value of groundwater

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Groundwater resources are extensively used in production processes by large international companies all over the world. The knowledge about (the state and the trends of) these resources need to substantially increase for the benefit of all: the investors, society and environment.

Water scarcity already affects about 2.7 billion people around the world for at least one month per year and by 2025 this will worsen to severe water shortages if consumption continues at current rates. As surface water availability decreases in the face of climate change and consumption, reliance on groundwater is likely to grow even faster.

Globally, groundwater provides more than 40% of water for drinking and for irrigated agriculture, and a third of water supply for industry. At the same time, there are strong indications that the majority of largest aquifers in the world are under the stress due to over-extraction and/or pollution. The magnitude of a groundwater stress is often not known because many aquifers are still poorly regulated and monitored.

Large international companies face high exposure to the depletion and/or pollution of aquifers in situations where no clarity exists about state of the aquifer and related pressures, impacts and trends. The absence of effective monitoring, governance frameworks and enforcement (including data disclosure) leads to poorly controlled use, often opposing large companies against other consumers like small farmers and domestic water supply. Besides, pollution due to the overuse of fertilisers and industry discharge are affecting drinking water for hundreds of millions of people. This confronts companies with existential threats, urging them to assess risks and use groundwater in evidence-based, sustainable manner. Moreover, companies need to act beyond the site operations and help improve water governance if they are to ensure their sustainable growth. This is recognised by some leading companies and is referred to as a water stewardship approach.

BUSINESS INCENTIVE FOR ACTION

Due to the nature of a business enterprise, companies are minimising costs of production, but prepared to share broader societal and environmental costs of groundwater when obliged by regulations, driven by public-relation motives or when it is in their long term interests. This valid argument is often used when questioning company motivation to mitigate adverse impacts of their operations or to engage in sustainable water management more broadly, for example, assisting in improving the water-use efficiency of other consumers or facilitating aquifer recharge schemes.

There is in fact is a wide-range of water-related business risks that create strong economic incentives for companies to invest in more sustainable water management. Even the public-relation gains are of direct economic value for companies, especially large, global brands. Societal expectations for corporate sustainability ("ethical good and services"), including efficient and responsible water-related policies and practices, have risen in recent decades. Furthermore, the financial community is increasingly seeking to invest in companies that manage short- and long-term water-related risks, recognise shared water challenges and strive to meet stakeholder expectations on water.

Due to these socio-economic changes, clear advances in corporate water policies have been made in last years, often in a framework of a broader environmental and/or social responsibility policies and programmes. The UN Global Compact's "CEO Water Mandate" initiative (see the box below) serves as a framework for this, particularly at policy and governance level.

CEO Water Mandate (https://ceowatermandate.org/)

In order to increase engagement of international business community in water and sanitation, a "CEO Water Mandate" initiative was launched in 2007 by the UN Secretary-General and the UN Global Compact, implemented in partnership with the Pacific Institute. These key partners work together as the CEO Water Mandate Secretariat. The UN Global Compact is the world's largest corporate sustainability initiative, with more than 12,000 corporate participants and stakeholders from more than 140 countries. The CEO Water Mandate mobilizes business leaders to advance water stewardship, sanitation, and the Sustainable Development Goals – in partnership with the United Nations, governments, peers, civil society, and others.

In the framework of the CEO Water Mandate a number of guidelines (such as on Corporate Water Disclosure) and tools (mostly for Water Risk Assessment) have been developed, to support corporate water stewardship. Although groundwater needs more adequate (re)presentation in related tools, guidelines and programmes, corporate water stewardship is a proper context to engage companies in water management, at various scales.

The CEO Water Mandate's Corporate Water Disclosure Guidelines offer a common approach for companies to meaningfully and consistently report water information to stakeholders. Water disclosure:

- contributes to understanding water risks, opportunities, and impacts
- demonstrates good practice and commitment to stakeholders and
- assist in establishing dialogue, trust, and accountabilitv with stakeholders

The guidelines do take groundwater (withdrawal) in account in advanced Performance analysis of the Current State (fig 1), but **withdrawal data are seldom published**. Besides, reporting on external impacts (Implications) of withdrawals should be based groundwater monitoring data (i.e. groundwater quantity and quality measurements). These **data and state of monitoring are rarely available**, even in exemplary CEO case-studies related to groundwater.

The CEO Water Mandate Corporate Water Disclosure Guidelines build up on earlier standardisation processes such as the **Carbon Disclosure Project** (CDP, https://www.cdp.net).

On behalf of investors, CDP's Water Disclosure requests information from over 2,500 of the world's largest companies operating in high water impact sectors. The information includes water withdrawal volumes

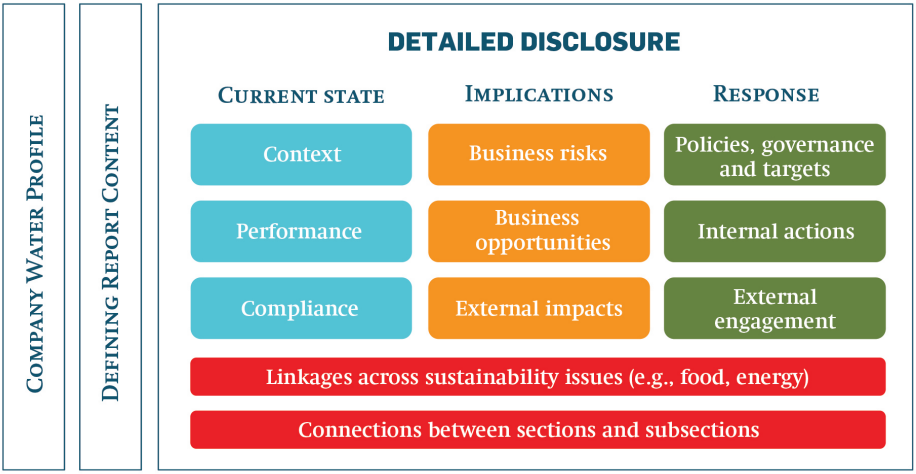

Fig. 1 - Corporate Water Disclosure Framework

In 2012, 53% of Global 500 companies responding to CDP Water Disclosure reported that they have experienced detrimental water-related impacts in the last five years, while 68% identified water as a risk to their business (CDP 2012). In the CDP Global Water Report 2015, a high number of respondents (73%) reported opportunities.

by source, discharges by destination and consumption. The annual request, which is closely aligned to the CEO Water Mandate's guidelines, aims to catalyse good water management in companies as well as allow investors to assess water risk exposure and response, and water opportunities. The response data for each company is freely available through the CDP website, and CDP annual water report provides a valuable overview per sectors and by regions, indicating current state and trends about corporate water use, disclosure and management etc (fig 2).

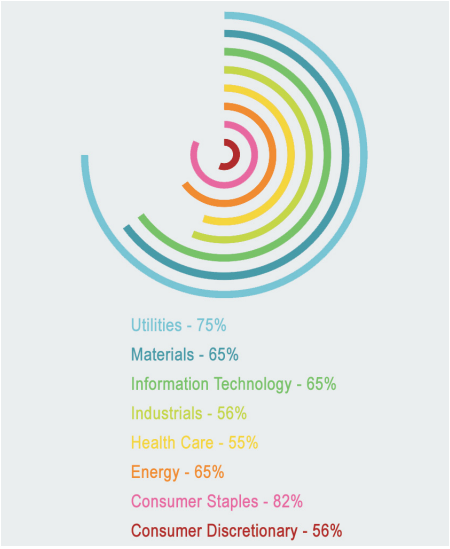

Fig. 2 - Sectors most exposed to substantial water risk

Companies analyse water related risks and opportunities following various (internal) procedures and using assessment tools.

WATER RISK ASSESSMENT TOOLS

CEO Water Mandate introduces the Water Stewardship Toolbox as a broad scale of analysis tools, guidelines and projects/case studies. For the risk analysis, the most relevant are 'context' tools developed to understand stress and assess risks and impacts. An overview of several frequently used tools is given in table 1 (next page).

Most of the water risk tools provide a simple risk screen that identifies risk operations or value chain stages that are likely to have water issues (see further UNEP and CEO Water Mandate: Corporate Water Accounting, 2010). For the operational water efficiency, companies often look only at internal processes, assuming sufficient water supply. However, for the management of water-related social and environmental impact and communication on water risk with stakeholders -detailed assessment is required, which brings data/information availability issue: **implementation of any Water Ste-**

NAME OF TOOL	SCALE	GROUNDWATER DATA REQUEST	DATA SOURCES
WBCSD Global Water Tool www.wbcsd.org/	River Basin	Asks for 'Water Withdrawal Freshwater Sources', specifying groundwater, which is then an aggregated 'Total Water Withdrawal' figure.	AQUASTAT, Aqueduct datasets used but not indicator "Groundwater Stress"
GEMI Local Water Tool http://gemi.org/water	Site Level	Asks companies for inventory of site water use, specifying groundwater and name of groundwater body.	AQUASTAT, linked to WBCSD Global Water Tool
WWF Water Risk Filter http://waterriskfilter.panda.org/	River Basin	Asks company to provide total annual groundwater withdrawal data.	AQUASTAT, Gleeson, et al., 2012. Blue Water Footprint Mekonnen & Hoekstra, 2011.
WRI's Aqueduct - Water Risk Atlas www.wri.org/	River Basin	"Groundwater Stress" ratio of groundwater withdrawal relative to its sustainable recharge rate over a given aquifer.	Gleeson et al, 2012, AQUASTAT IGRAC
Bloomberg & Natural Capital Declaration Water Risk Valuation Tool www.naturalcapitalfinancealliance.org	Site Level	Asks for water withdrawals at the site level, or this is estimated based on production at location, but no differentiation of surface and ground water.	Aqueduct, 'Bloomberg Intelligence' mine asset

Table 1 - Water Risk Assessment Tools

wardship programme asks eventually for a sufficient insight in the groundwater situation at the local scale.

WATER STEWARDSHIP

Water stewardship is promoted as the use of water in ways that are socially equitable, environmentally sustainable, and economically beneficial. It can be adopted by companies in order to provide water for their employees increase efficiency and reduce pollution of operations, advance collective water management actions and improve dialogue with stakeholders.

According to the available information, water stewardship empowers businesses to identify and manage the many water risks threatening their growth and viability. It also enables them to seize the (ever-growing list of) water opportunities available to their companies. Ultimately stewardship helps companies make (invaluable) contributions to solving the world's water crises, achieving the Sustainable Development Goals, and supporting human rights.

There are initiatives to develop standardised approaches/standards for implementation of international water stewardship, such those of International Water Stewardship Programme (IWaSP) and Alliance for Water Stewardship (AWS).

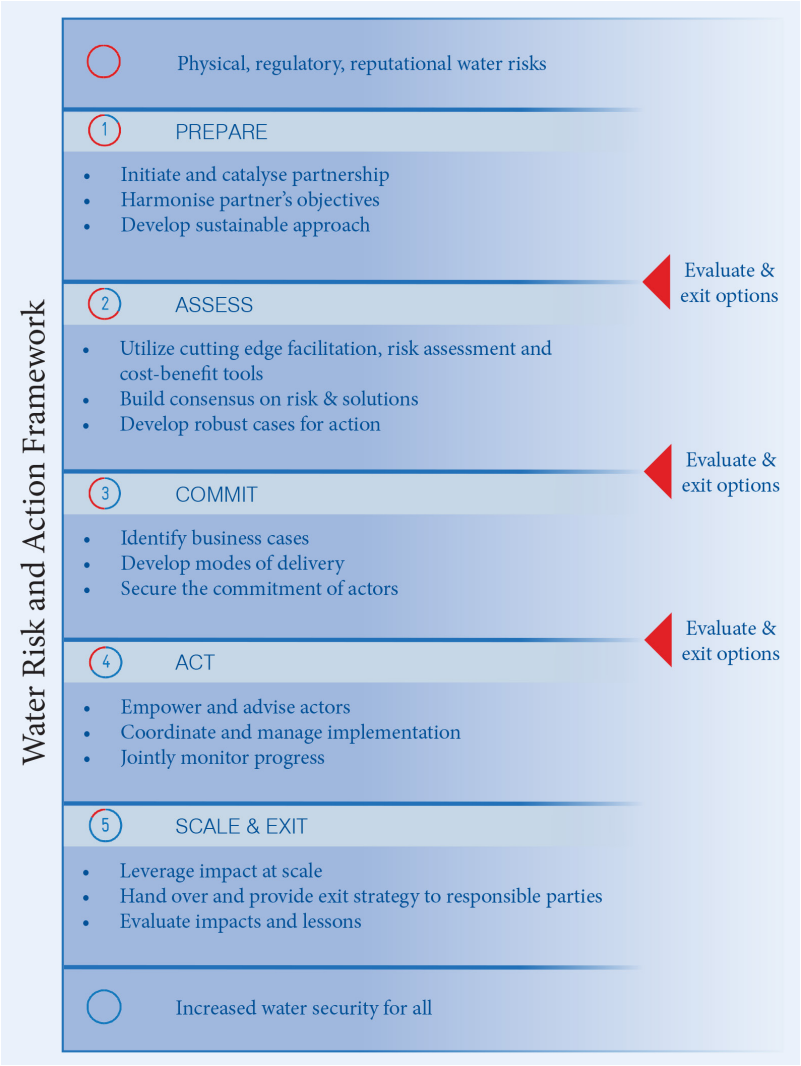

Fig. 3 - IWaSP Water Risk and Action Framework

IWaSP (www.iwasp.org) is a programme set up to facilitate a partnership between the public sector, the private sector and civil society, addressing shared water risks on a catchment scale. IWaSP is based on a Water Risk and Action Framework (fig 3), a holistic approach to tackle shared water risks in a participative manner on watershed level. It is a series of facilitated steps, skills, development measures and tailored tools provided for a whole partnership lifecycle.

The framework is at the governance level, the assessment of the state of the resource is taken as a known input.

Alliance for Water Stewardship (http://a4ws.org) introduced a standard to drive partnership at the site and at the catchment management level. The AWS standard is comprehensive and should have universal applicability. The goals are good water governance, sustainable water balance, good water quality status, expressed in criteria and indicators needed for certification/a global benchmark for responsible water stewardship. Understanding of the groundwater status scores very high, in recognition of complexity of the issue.

Yet, the AWS standard is very broad and - similarly to the IWaSP framework - data gathering and risk analysis are just a fraction of a broad stewardship programme. At the same time, **the success of stewardship relies heavily on the performed risk analysis and data used in the analysis; especially when it comes to invisible groundwater**.

ASSESSING WATER RISK: THE STATE OF GROUNDWATER RESOURCES

Asset managers need to give groundwater increased attention because of the current limited insight into the state of this invisible resource and future trends. The question to start with is whether the company uses groundwater in a production process or if it in any way affects groundwater (e.g. possible discharge of effluents in the ground). Further, the company's Environmental Social Governance (ESG) criteria should be checked; environmental criteria in particular that look at how the company performs as a steward of the natural environment. Does the company have Water Stewardship Programme, is there a record of Water Risk Analysis and which Water Risk Assessment Tools were used are some other initial questions.

However, groundwater risk analysis requires far more comprehensive data sets than those usually provided (if any) through a company's Water Disclosure, including:

- Abstracted groundwater (quantity, quality, frequency of measurements)
- State of the aquifer (quantity, quality, frequency and density of measurements)
- Other users of the groundwater from the same aquifer: domestic, industrial, recreational, agriculture, fishery, wetlands, contribution to the natural flow…
- Long-term resource availability; is the region prone to droughts, affected by climate change…

At this stage, groundwater specialists should advise about need to perform a groundwater assessment/risk study. Further, the ESG should ensure that groundwater is looked at in the broader context, hence **beyond the development/production costs: obviously, these costs do not reflect the full value of groundwater, and in particular its environmental and social value**.

VALUE OF GROUNDWATER

Public goods like groundwater are often prone to market failure because they have elements of both market and not market goods/services. The costs of groundwater developments are not equal to total societal and environmental costs: for example, preservation for future generations and ecological externalities are not compensated via the market mechanism but should count as well. Total Economic Value (TEV) concept has proven as a useful concept when attempting to value a complex resource like groundwater. The diagram below (fig 4) depicts the TEV concept, distinguishing firstly use and non-use value of groundwater.

Table 2 (next page) provides examples of va- rious benefits from groundwater; some of them are obvious and relatively easy to quantify (priced direct use), others are less evident and difficult to express in monetary terms.

The economic validation always refers to the cost of benefit of a change (and never to the absolute value of stock). Therefore, change scenarios need to be prepared that would affect aquifer's quality and/or quantity and cause change in benefits and eventually in change of TEV. Again, only differences between scenarios can be valued, not the absolute value of groundwater.

It should be also mention that the marginal

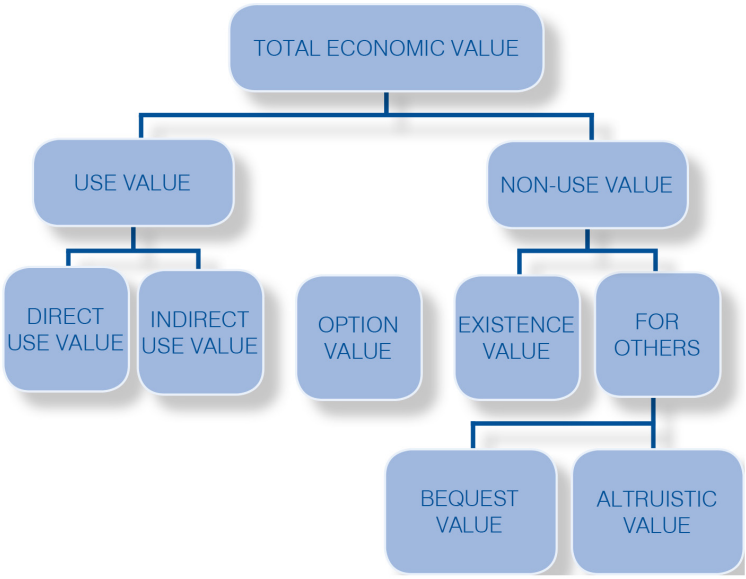

Fig. 4 - TEV Concept: Use and non-use value of groundwater

benefit from a unit change in the resource differs with the state of the resource; whereas the value of a change (fig 5), signified by the area under the curve, might be small when the resource is abundant or in a good condition (green area), the same change might be much more valuable if the resource is limited or in bad condition (red area).

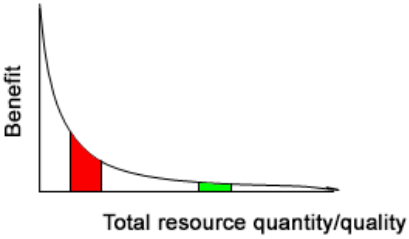

Fig. 5 - Benefits vs. Availability

The evaluation itself requires the adequate valuation methods and estimation of affected benefits. Various valuation techniques are proposed for validation of benefits (see

		VALUE	BENEFITS	SUGGESTED VALUATION TECHNIQUES
TOTAL ECONOMIC VALUE	Use Value	**Direct Use Value** (priced)	Public/private Water Supply	Market price, cost of alternative, cost of substitute, mitigation, stated preferences, hedonic prices
			Agriculture	Production function, cost of alternative
			Industry	Production function, cost of alternative
			Renewable Energy (e.g. Hydropower, Heat Pumps)	Cost of alternative
		(unpriced)	Surface Water Recharge and Consequently Recreation, Fishing, etc.	Contingent methods, travel cost method
		Indirect Use Value	Flood Control	Mitigation, contingent methods
			Carbon Sink	(Knowledge gap)
			Waste Assimilation	(Intermediate benefit – no valuation)
			Prevents Subsidence	Cost of prevention, hedonic pricing
			Supports Ecological Diversity/Habitats	Contingent methods
			Prevents Seawater Intrusion	(Intermediate benefit – no valuation)
		Option Value	Future Direct or Indirect Value	Contingent methods
	Non Use Value	**Existence Value**	Satisfaction from Existence	Contingent methods
			Hypogene species (Unseen Benefits)	Contingent methods
		For Others	Bequest Value	Contingent methods
			Altruistic Value	Contingent methods

Tab. 2 - Use value, benefits and suggested valuation techniques

further: J. Mburu, et al, Economic Valuation and Environmental Assessment – Training Manual, 2006). Selection of the validation method(s) depends of factors such as: type of benefit, data availability and needs for decision making (e.g. short term vs long term). Looking at groundwater benefits, some suggestions can be made regarding the choice of the validation (table 2 on the left).

Apparently, **the value of groundwater is mostly influenced by costs of groundwater development, willingness to pay and availability (and price) of alternatives**.

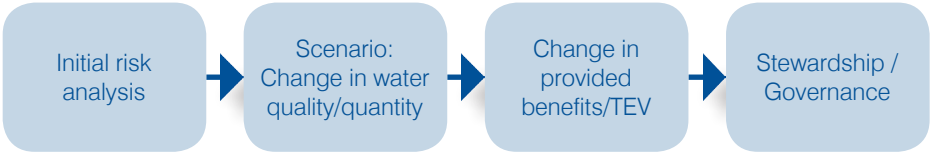

Fig. 6 - Economic validation

Data availability is the main constrain for a successful economic valuation of groundwater-related benefits. Difficulties of obtaining reliable data arise next to methodological issues like determining the population of interest and uncertainties in the analysis.

Additionally, there seems to be some reservations regarding economic concepts – especially monetisation of environmental goods, as well as language barriers due to different terminologies among disciplines (especially between corporate economy and groundwater governance).

Economic valuation has some inherent limitations as well, for example it maximises (total) benefits and does not take in account welfare distribution. Besides, the TEV is an anthropocentric approach and estimation of values is challenging regarding environmental benefits.

Yet, **economic valuation can provide valuable insights in groundwater services, stakeholder preferences and possible changes in benefits/value of groundwater**. While groundwater itself might be a hidden resource, economic benefits humans derive from it are visible and everything but negligible!

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