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Can integrated water resource management be of value to business, specifically the oil and gas sector?

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Water is an important resource for both business and society; it is a cross-cutting issue and should be managed using an integrated approach. Many businesses, such as oil and gas, have global operations in multiple geographic and climatic contexts across a range of jurisdictions. This paper explores whether the conceptual framework of integrated water resource management (IWRM) is an applicable approach for business to manage water issues. There are currently limited documented experiences of the relationship between business and IWRM. This article summarizes key findings from research that was supported by King’s College London. Findings indicate that although IWRM is a high-level, holistic approach, the principles can be of value.

Keywords: IWRM; oil and gas sector; industry research; business

Introduction

Water scarcity and deteriorating water quality are becoming limiting factors to sustainable development. It is estimated that there will be a 40% global water supply shortage by 2030 (EC, 2012); this is “primarily the result of the heterogeneous distribution of freshwater in space and time which is exacerbated by economic disparities, civil unrest, and failures of institutions” (Hering & Ingold, 2012, p. 1234). Society and business are dependent upon the resilience of water resources and the associated ecosystem services indirectly provided. To ensure the future sustainability of this resource, effective water management solutions should consider the broader context of the economic, social and political landscape – changing demographics, geopolitical aspects, climate change and economic turmoil (UNEP, 2012).

With growing pressure on this scarce resource and acknowledgement of the multifaceted nature of water management, a more integrated and coordinated approach to water resource management at the multi-national, national and basin levels is being encouraged and championed by the United Nations (UN); it is termed ‘integrated water resource management’ (IWRM). The Global Water Partnership (GWP) promotes IWRM as an internationally acknowledged framework for water governance and defines it as a process that “promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems” (GWP, 2000, p. 22).

There is currently limited documented evidence surrounding the successful uptake and application of the IWRM approach within the water strategies of businesses. The objective of this article is to explore the potential value of IWRM for businesses. Findings will be

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presented from research carried out with the support of King’s College London and IPIECA, the global oil and gas industry association for environmental and social issues. The paper explores the value of IWRM for the business sector with findings and lessons learnt drawn from the oil and gas sector.

**Practical implementation and application of IWRM**

The concept of IWRM is based on important principles; however, the practical application and the ‘how-to’ of IWRM are more challenging. There is no universal blueprint. The IWRM process will differ from country to country, because no ‘one size fits all’ (Jonch-Clausen, 2004). Many GWP background papers highlight that when implementing IWRM, the ‘three pillars’ (see Figure 1) need to be developed and strengthened concurrently to ensure success. Providing the right enabling environment, institutional frameworks and management instruments are all important in facilitating the success of IWRM and the end goals of economic efficiency, ecological sustainability and social equity (Jonch-Clausen, 2004).

Progress towards achieving IWRM varies enormously and depends on “the area, capacity, political will, and the understanding of IWRM concepts and their implementation” (UNESCO, 2009, p. 3). For example, the implementation of IWRM in Argentina has been effectively executed across 24 different jurisdictions by building consensus across the country as a result of international commitment. In contrast, in Grenada there has been limited success surrounding the implementation of IWRM. Water resources are over-exploited; there is limited understanding of the issue; and collaborative or integrated management solutions are perceived at best as an irritating complexity (UNEP-DHI, 2007).

The implementation of any new top-down global concept is complex and brings challenges associated with uptake and application in the various jurisdictions as well as buy-in and cooperation from relevant stakeholders. As highlighted by Victor (forthcoming, p. 2), “optimism about IWRM must be tempered by realities about how integration across many different industries and political systems might actually be achieved”.

The global uptake of IWRM is varied, and there is a range of different perspectives on the concept as a whole, generally with more critics than promoters. UN-Water developed a

![Figure 1. General framework of IWRM (GWP, 2012).](image-url)
status report on “The Application of Integrated Approaches to Water Resource Management” (UNEP, 2012). The report states that only half of the countries with IWRM plans report an “advanced state of implementation” (UNEP, 2012, p. 1234). The report itself acknowledges that there has been “slow and even stalled progress in some cases” (UNEP, 2012, p. 76). In the technical community, there are concerns about the usefulness of such a broad concept, with some arguing that it is vague and difficult to implement effectively (Biswas, 2004; Saravanan, McDonald, & Mollinga, 2009; Turton, Hattingh, Claassen, Roux, & Ashton, 2007). A common concern is the feasibility of implementing IWRM across a broad range of disciplines, sectors and regulatory frameworks, then subsequently managing the resultant range of issues in an integrated and holistic manner (Biswas, 2008; Nesheim et al., 2010).

Relevance of IWRM to business

Water is fundamental for the effective functioning of many sectors of society. According to the ‘tragedy of the commons’ concept, each sector seeks to exploit the ‘common’ resource to its maximum benefit, with little regard for the needs of other sectors (UCC-Water, 2007). The concept of IWRM can provide an alternative framework to help various stakeholders understand how to collaboratively manage water resources within a river basin, ultimately ensuring equitable distribution and long-term benefits for all. Water is a shared resource with shared interests; therefore, joint action should result in shared outcomes for all users within a river basin. The CEO Water Mandate (2013a) highlights that any water-related risks should be shared among government entities, businesses and communities and that effective water management within a river basin should be in the form of “collective action”. To facilitate this type of collective action, and ultimately IWRM, it is important to acknowledge that each user or sector within a river basin will value a cubic metre of water differently. “Water is also valued differently depending on when and where it can be obtained and at what quality” (UNESCO, 2009, p. 7). Having this understanding helps with the coordination of water management efforts both across sectors and throughout the river basin, resulting in cross-sectoral integration (Jonch-Clausen, 2004). This type of cross-sectoral approach, encouraged by the concept of IWRM, is exemplified in Figure 2.

Figure 2. IWRM and its relation to subsectors (GWP, 2012).
Business is a necessary and important component of any functioning society, and ultimately water is a crucial resource for businesses; therefore, building the business case for effective water management should be relatively easy. Businesses depend upon access to sufficient water that is of good quality; however, this dependence can potentially impact water sources and subsequently result in a business risk. Impacts need to be effectively managed by businesses to avoid subsequent business risks. These risks can be summarized as:

1. **Financial** – businesses that do not have sound water management processes in place may have restricted access to capital.
2. **Operational** – increasing water scarcity and declining quality can impact operational capabilities and impact production costs.
3. **Reputational** – competition with other water users and negative public perception can impact corporate reputation and threaten a company’s license to operate.
4. **Environmental** – water withdrawals and discharge can impact local ecosystems and ecosystem services.
5. **Regulatory** – increasingly stringent regulations and policies are being placed on businesses (IPIECA, 2010; WBCSD, 2012).

The concept of IWRM can help trigger an integrated way of thinking surrounding these potential risks. IWRM encourages a ‘whole basin’ approach where both land and water management are considered together and upstream and downstream issues are taken into account. To date there is limited documented evidence that the concept and implementation of IWRM is a key consideration for business. Much of the literature surrounding the implementation of IWRM does however reinforce that the participation of all stakeholders is key to the success of IWRM and that the inclusion of the private sector is crucial for the development of legitimate policies with broad support (World Water Council, 2000).

**Relevance of IWRM to oil and gas**

Of the 4000 km³ of fresh water withdrawn annually, about two-thirds are for agriculture, compared with one-ninth for the entire energy industry (Williams & Simmons, 2013). Water consumption in the oil and gas sector is thus comparatively low, although fresh and non-fresh water is a crucial resource, and any constraints on flow might disrupt ‘business as usual’. Water management in the hydrocarbon value chain is a complex issue. In simple terms, there are three critical dimensions of water: “an industrial operation that uses water off-stream, withdraws water from the local water system, consumes part of this and discharges the rest after use” (Schornagel, Niele, Worrell, & Böggemann, 2012, p. 2). Water is an integral part of all oil and gas operations, and the sector is consequently a major local user and a significant local producer of water. Water is a local issue; the social, environmental and economic risks, as well as the opportunities, must therefore be managed at the local level. This is why principles of IWRM could be of value for the oil and gas sector.

Industrial water management practices within the oil and gas sector are evolving rapidly, in response to both current and emerging factors that are resulting in increasing water scarcity and stress at the local level. Companies are increasingly aware of economic water stress and water constraints (Morrison, Schulte, & Schenck, 2009) and being responsive to these challenges. Drivers for effective water management across the oil and gas sector include: increasing pressure on water resources as a result of population growth, industrialization, competing users and variability in supply; regulatory changes;
maturation and development of the industry; the water–energy–carbon nexus; and the impacts of climate change (IPIECA, 2013). If the oil and gas sector wants to maintain its license to operate, it must be responsive to these drivers and manage potential impacts and risks. Throughout operations, there are opportunities to reduce freshwater consumption by replacing freshwater in extraction processes with lower-quality water and reusing process or produced water; new and existing technologies can also be employed, and recycling produced water in the local community is also a possibility (Williams & Simmons, 2013). Many oil and gas companies have already integrated these water efficiency and reuse practices into their operations.

The application of IWRM might be useful for the oil and gas sector because although it is a ‘macro’, high-level concept it has ‘micro’, local-level relevance. To date, the uptake and implementation of IWRM across the sector has not been evident, and there is currently limited guidance on integrated water management approaches for the sector.

Industry research
Research to explore the relevance of IWRM for the oil and gas sector was carried out using social science research methodologies. Qualitative research techniques were employed through 15 company surveys and a total of 10 semi-structured interviews with relevant informants in two separate OECD countries. A range of companies participated in the survey, some with a few global assets and others with numerous global operations; the respondents were corporate representatives – however, their responses cannot be assumed to be representative of the company. Semi-structured interviews were conducted in Australia and Germany, although interviews were limited to one river basin and one oil and gas asset in each country, and therefore perspectives cannot be assumed to be representative of the country or the sector.

Corporate-level relevance and application of IWRM
Across the corporate function of oil and gas companies there was generally a high level of awareness surrounding IWRM, with 80% of the respondents being aware of the concept; however, there was limited understanding of its practical relevance and applicability. Many companies identified that IWRM either has had or is having an impact across their global operations as a driver for local policy changes or new regulation. The EU’s Water Framework Directive (2000), for example, was frequently highlighted as a powerful directive that is impacting operations across Europe with regard to water discharge quality. It has been suggested that the directive is impactful because it is a directive rather than just a framework (Nesheim et al., 2010).

Based upon research outcomes, it was identified that many oil and gas companies have environmental policies, but less frequently do they have a publicly available water management policy or does it reference IWRM. The fact that few companies reference IWRM potentially illustrates a limited level of understanding surrounding the concept as well as a lack of ownership. “IWRM is implemented by regulatory authorities and oil and gas are participants in such situations. . . . Companies do not therefore implement IWRM but support it in those basins where operating” (Company A). This perspective suggests that the implementation and the uptake of IWRM should not be the responsibility of companies and that legislation could help facilitate uptake. This raises the question surrounding whose responsibility it is to be driving change and whether industry could or should play a role.
Some key factors limiting the implementation of IWRM were identified by the corporate function of the oil and gas companies. The limiting factors include: IWRM not being clearly defined or understood; insufficient government capacity to manage and effectively implement IWRM; local regulation being an inhibitor; stakeholder relationships; and public perception surrounding the reuse of water. Several oil and gas sector examples were used to illustrate the regulatory challenges surrounding water sourcing and discharge. The local legislation in Spain and France was highlighted as enforcing the use of a certain water quality regardless of the use, whilst also inhibiting reuse between sectors. Treated water discharge targets were also highlighted as not being physically achievable even when applying ‘best available technology’. These examples emphasize that policy is often prescriptive, and collaborative solutions across industries and space are not enabled (Victor, forthcoming). The main challenge to the implementation of IWRM that was identified by the corporate function of the oil and gas companies was the lack of capacity within companies to understand IWRM, and within governments to implement it. The perceived lack of capacity to understand and implement IWRM was highlighted by over 50% of the respondents.

Relevance and application of IWRM at the asset level
The local-level relevance of IWRM for an oil and gas company was explored at two oil refineries, one in Australia and the other in Germany. The research produced the following findings of relevance to the local level: the importance of understanding the local context and regulatory framework; the disconnect between the corporate level and the asset level; the limited relevance of a conceptual framework such as IWRM at the site level; and the fact that, compared to a conceptual framework, tangible issues like financial costs or a water crisis are more realistic drivers for action at the site level.

The importance of the local context became very apparent when assessing the relevance of IWRM for a particular asset. Water quality and availability, as well as the other water users and the regulatory framework, were all key factors when considering the relevance of IWRM. In Germany, for example, there is, on average, sufficient water availability and very little competition from other water users within the river basin of interest; therefore, the importance of IWRM in this context is limited. In contrast, in West Australia, where the refinery is situated, there is unsustainable water availability and a range of competing users posing a potential business risk. In this particular context, the principles of IWRM were applied, although probably unwittingly: industries in the area worked collaboratively to find a water sourcing and water management solution to ensure business continuity. The drivers for action in this situation came from business rather than from the regulator. This example illustrates that although IWRM is acknowledged at the federal level, application is inconsistent across the Australian states. “To date, the West Australia government has not been sufficiently courageous in identifying water problems and communicating them” (Interview 1); there are opportunities for greater alignment in federal and state water regulation.

At the assets in both Australia and Germany there was no awareness of the corporate-level water strategy for the company, and the relevance of IWRM was not clearly understood: “it is a conceptual framework at the policy level” (Company B). IWRM was regarded as a theoretical concept (high-level and holistic) at both assets and was perceived to be neither tangible nor measurable at the local level; this perspective supports the views of the IWRM critics (Biswas, 2004; Saravanan et al., 2009; Turton et al., 2007). It was however acknowledged by one informant that it would “not be realistic to have a company
uniform standard because water is a local issue and there are different country contexts” (Company B). Research findings indicated that if and when local regulation was underpinned by IWRM principles, there was potentially greater awareness of the concept at the local level and certainly greater alignment of practical, on-the-ground action with IWRM principles. In West Australia, for example, where there was limited application of IWRM, state water law appeared to be out of date, not very innovative and poorly aligned with the National Water Initiative, let alone IWRM. Another challenge in the Australian context was that in West Australia, multiple departments administer different acts potentially relating to the same topic: “there is no coordinated state water policy – any activity is happening in silos and water is not managed as a single unit” (Company A). Conversely, in Germany, there was greater understanding and application of IWRM, potentially because water policy and regulation is guided by the Water Framework Directive, which is aligned with and inspired by IWRM (Theesfeld & Schleyer, 2013). The directive is also well integrated into German federal and consequently state law; therefore, there is clear alignment.

The findings indicated that the driving factors for effective water management practices at the asset level were the more tangible and immediate issues, rather than an institutional framework, although it can help. As emphasized by one informant, “IWRM doesn’t seem that relevant for site-level interests that are more specific and immediate, e.g. water sources and effluent. . . . Success is down to human energy and creativity rather than institutional frameworks” (Company B). Compliance with legislation, as well as operating in accordance with permits and company reputation, are ongoing factors driving more efficient water management; however, some factors drive more immediate action, for example losing a water source. At an asset level, the decisions surrounding water management come down to costs versus benefits; the balance between the level of financial investment and subsequent benefit is the deciding factor at the site level. Determining the optimal solution – balancing the technical challenges and applicability restrictions for any potential solution – is important. At each site, the optimal solution needs to be determined based upon the local context. A water management plan needs to be tailor-made; hence, the value of IWRM at the local level was questioned.

If IWRM is indeed the right framework for the sector to adopt, then there is a need for capacity building on application of the concept and more effective connection between the corporate function and business units.

Potential value and feasibility of IWRM for business

Across the oil and gas sector, IWRM was perceived to be a theoretical approach whose value is not immediately obvious. It is likely that findings would be similar across other comparable business sectors. Interview findings did however indicate examples of cross-sectoral water management solutions – they are not currently documented, but this does suggest signs of progress. These practical examples reinforce the viability of cross-sectoral integration.

The idea of considering water management solutions beyond the ‘fence line’ is an important concept for all industry sectors to embrace. The process of considering other stakeholders and forming collaborative partnerships within a river basin will become increasingly important, especially if water availability becomes a limiting factor to operations in the future. The concept of ‘collective action’ promotes this type of thinking – users in a river basin having shared risk, leading to the need for joint action and joint solutions (CEO Water Mandate, 2013a). Although practical business tools and guidance for
implementing IWRM do not exist, the ‘three pillars’ (GWP, 2000) do provide a valuable starting point, and the theoretical basis needs to be further tested. There is evidence to suggest that those oil and gas companies that have embraced a more holistic way of managing water and thinking beyond conventional water management solutions do have good examples to share.

The feasibility of implementing IWRM is dependent upon many different factors. There are both enablers and constraints to the application of IWRM both at the country level – e.g. legislation, policy and government – and within companies. When there is alignment in regional, federal and state legislation, the uptake and implementation of top-down (UN) concepts can be effective. The Water Framework Directive provides a good example of a regional directive having an impact on water management policy across Europe, and at the state level in many instances. Whilst regulation can encourage more effective water management, it can also be a limiting factor in the implementation of integrated water management solutions – “policy instruments are prescriptive and not flexible” (Victor, forthcoming, p. 2). Local contexts, as well as the capacity of civic society and government to implement IWRM, are factors that can either enable or constrain the delivery of IWRM.

Given the global scale of oil and gas, and other multinational sector operations across a range of different jurisdictions, the enablers and constraints for implementing IWRM vary. There are however some common enablers that can be identified to help implement change across businesses: a crisis; having a local-level champion driving change; high capital investment; and awareness of water management challenges. Research has also shown that having corporate-level leadership helps both champion and drive change across businesses. The idea of senior-level support leading to more proactive and positive water management outcomes is a concept promoted by the CEO Water Mandate (2013b).

It can be concluded that there are various enablers and constraints to the application of IWRM and that feasibility often depends not only on the driver of change but also the local enabling environment, as well as the site-level context.

**Good practices and lessons learnt**

There are not yet ‘good practices’ that can be shared surrounding the implementation of IWRM across the industry; however, there are many lessons learnt which could, over time, evolve into ‘good practices’. The following lessons can be taken from the research:

1. Education and capacity building surrounding the concept of IWRM and the associated challenges are likely to lead to increased awareness, uptake and effective implementation.
2. Corporate-level leadership coupled with a public water management policy (including attributes of IWRM) is more likely to result in effective water management at the site level, and integrated water management solutions where appropriate.
3. Local-level champions at the site level can help drive responsible water management and integrated solutions; this coupled with a corporate mandate is powerful.
4. There needs to be a willingness across a company to adopt principles of IWRM, think beyond the ‘fence line’ of operations, and acknowledge the value of such an approach.
5. Applying the holistic principles of IWRM to determine water management...
solutions within a river basin can help identify cross-sector or public–private partnership solutions.

(6) Although the role of the different stakeholders in the uptake and implementation of IWRM is unclear, all business sectors should be proactive and plan for the future; companies should move beyond compliance towards a stewardship model.

Although capacity building within the business sector is needed, and business should help drive change, good governance and the right enabling environment are crucial in facilitating change. The role of government and water policy is important: “governance comprises the core elements of water policy, water laws, water pricing mechanisms, river basin organizations and international and intra-national agreements” (Hooper, 2006, p. 1). A big factor contributing to the successful implementation of IWRM is having good in-country water governance.

Conclusion
Decreasing water availability and growing water quality issues are increasingly likely to impact future business continuity. Therefore, the application of concepts like IWRM could become ‘good practice’ for business. Although IWRM is not widely recognized across business, and specifically in the oil and gas sector, the application of this approach could help companies manage potential business risks whilst pushing the company beyond compliance and towards stewardship. A progressive and proactive approach to the integration of IWRM concepts within businesses, both vertically and horizontally (GWP, 2009), could help ensure long-term viability and a continued license to operate.

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