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Original article

## Catchment-based water management in the mining industry: Challenges and solutions

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### ABSTRACT

The mining industry's aspirations towards a catchment-based water management approach have similarities with the concept of Integrated Water Resources Management (IWRM) which has been committed to by many governments around the world. However IWRM has proved challenging to implement in practice. This paper considers the question: *Which challenges are mining companies likely to face when implementing a catchment-based approach at a mine site level?* Drawing on lessons from the IWRM literature, it is argued that three coordination challenges must be overcome: fit, horizontal interplay, and vertical interplay. The problem of fit arises because the boundaries of mining leases do not align with water catchments, necessitating collaboration between companies to manage cumulative impacts. Problems of horizontal interplay arise because mining sites are typically one of several water users within a catchment, requiring that they liaise with diverse stakeholders to understand the multiple values provided by water. Problems of vertical interplay arise across organizational levels and require alignment between corporate and site priorities. Drawing on examples from Australia, Mongolia and Germany, each coordination challenge is described, mechanisms for overcoming each challenge are discussed, and the paper concludes with future research directions.

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### 1. Introduction

In 2015, the World Economic Forum ranked water crises as the top global systemic risk in terms of impact (World Economic Forum, 2015). Historically, mining companies had limited engagement in water management and policy, primarily negotiating with governments to secure access to the water needed for operations (Kunz and Moran, 2014). However the responsible use and management of water are now a crucial component of sustainability strategy and a key performance indicator within sustainability reports (BHP Billiton, 2012; Rio Tinto Alcan, 2011).

Most of the water goals currently articulated by mining companies focus on eco-efficiency initiatives within the mine-lease boundary, e.g. reducing the overall volume of freshwater consumed and increasing the use and reuse of low quality water. However, there is growing pressure for companies to adopt a proactive role in addressing water management challenges beyond their operational fence line (Barrett, 2009; Kemp et al., 2010; Kunz and Moran, 2014). This is most recently reflected in ICMM's 2014

Water Stewardship Framework (ICMM, 2014b) which encourages member companies to “Understand the social, cultural, economic and environmental value of water at the catchment scale to identify material water stewardship risks and provide context for corporate and operational water management”. The adoption of a “watershed” or “catchment-based” approach is also promoted by business associations, NGOs and UN agencies beyond the mining industry (IPIECA, 2013; UN Global Compact, 2011; WBCSD, 2013).

While these aspirations represent a positive step towards greater accountability by mining companies on water issues, challenges may be faced when implementing a catchment-based approach at the mine site level. In particular, there are similarities with the concept of Integrated Water Resources Management (IWRM), which has been committed to by many governments around the world (Pollard and du Toit, 2008; Sullivan, 2014). However, despite its international prominence, critics contend that IWRM has not been implemented effectively (Biswas, 2008; Hering and Ingold, 2012; Rahaman and Varis, 2005).

In this paper, I argue that similarities between the mining industry's aspiration towards a catchment-based approach and those of IWRM suggest that analogous coordination challenges could be faced as well as resolved in implementation. An agenda

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for future research is outlined, highlighting key research questions to address.

## 2. Coordination challenges associated with IWRM

The importance of adopting an “integrated” approach to water management was recognized as early as 1977 during the UN Conference on Water in Mar del Plata, Argentina (Rahaman and Varis, 2005). However, it was not until 1992 that IWRM gained prominence in the international community as part of the Rio de Janeiro Summit and the Dublin Conference (Gallego-Ayala, 2013). During the Dublin conference, four guiding principles were developed which strongly influenced the future evolution of the IWRM concept (Rahaman and Varis, 2005):

- Principle one recognized fresh water as a finite, vulnerable, and essential resource, and suggested that water should be managed in an integrated manner.
- Principle two suggested a participatory approach, involving users, planners, and policymakers, at all levels of water development and management.
- Principle three recognized women’s central role in the provision, management, and safeguarding of water.
- Principle four suggested that water should be considered as an economic good.

Today, the most common definition for IWRM is that proposed by the Technical Advisory Committee of the Global Water Partnership – “a process which 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-TAC, 2000) – which was promoted during the Johannesburg World Summit on Sustainable Development in 2002 (Rahaman and Varis, 2005). As a result of these and subsequent international conferences, many governments around the world have strategically incorporated some IWRM concepts as part of their national and regional strategies (Pollard and du Toit, 2008; Sullivan, 2014). However, there have been strong criticisms of the IWRM-based approaches, including their failure to define exactly what needs to be integrated and to establish the scale at which action should focus (Hering and Ingold, 2012; Kunz and Moran, 2014).

To be successful, some have argued that IWRM-based approaches must overcome three coordination challenges (Horlemann and Dombrowsky, 2012; Moss, 2004, 2012): (1) problems of fit (managing water resources within river basins); (2) problems of horizontal interplay (integrating between the different sectors which use water); and (3) problems of vertical interplay (coordinating across administrative levels). These problems are discussed in turn below.

The problem of fit arises because political boundaries rarely align with physiographic features (Bréthaut and Pflieger, 2013; Horlemann and Dombrowsky, 2012; Liefferink et al., 2011; Sullivan, 2014). For example, Mongolia has 29 river basins and the majority transverse provincial borders. Many decisions about water-related issues are made within provincial boundaries leading to fears of negative externalities at the basin scale (Horlemann and Dombrowsky, 2012). “Externalities” arise when an institution causes unintended consequences (either harm or benefit) to others beyond their region of accountability (Moss, 2004). Examples of harm could include water pollution or aquifer depletion; a benefit may entail an increase in water availability due to investment in regional infrastructure. Moss (2012) discusses two models used to address these problems related to fit: (1) a “hard” solution involving the establishment of a new, centralized river basin commission (RBC) with extensive executive power; or

(2) a “soft” solution whereby procedures are developed for already established institutions to reach agreement with one another. An example of the former is the Murray Darling Basin Authority which manages water resources across five states and territories in Australia (MDBA, 2015). An example of the latter is the implementation of the Water Framework Directive (WFD) in Germany wherein river basin management is achieved through a formalized process of negotiation between the country’s 16 state jurisdictions (Moss, 2012). Although these models address some of the problems of fit, they face a challenge because they lack the legitimacy and authority of democratically elected bodies of government, decreasing their ability to achieve effective outcomes (Moss, 2012). In Australia, progressively “harder” institutional responses were implemented in an effort to improve water governance of the Murray Darling Basin. In the 1990s, Australian state and territory governments (via COAG, the Coalition of Australian Governments) negotiated “soft” intergovernmental agreements on water reforms, including commitments to change policies around water trading and pricing (Connell and Grafton, 2011). However the implementation of these reforms was poor, leading to gradually “harder” responses, first through the establishment of the National Water Initiative in 2004, and later by the Water Act in 2007 that explicitly stipulated establishment of a Murray-Darling Basin Plan (Connell and Grafton, 2011).

Problems of horizontal interplay arise between institutions at the same level; for example, between different water-using sectors such as agriculture and industry, or between the administrative offices responsible for water quality and quantity management (Moss, 2012). This is evidenced in Mongolia and Australia. In the former, at least six different ministries have some accountability over water-related issues (Horlemann and Dombrowsky, 2012). To address the problem of horizontal interplay, Mongolia established a National Water Committee (NWC) to coordinate activities between ministries (Horlemann and Dombrowsky, 2012). Similarly, the National Water Commission in Australia led the implementation of water reform on issues of national significance including achieving sustainable water use in over-allocated or water stressed systems, expanding trade in water rights and better managing urban water demands (Australian Government, 2015). However, as with RBCs, water commissions can face challenges to influence the ministries and associated government agencies which hold formal decision making authority (Horlemann and Dombrowsky, 2012). Their effectiveness is further constrained by their reliance on government funding. In Australia, changes in government priorities have resulted in funding cuts to key water and climate change programs, which could intensify water security concerns in future (Hannam, 2016).

Problems of vertical interplay arise across institutional levels – e.g. between local, municipal and national governments (Horlemann and Dombrowsky, 2012). According to the principle of “subsidiarity”, decisions within a political system should be dealt with at the lowest level possible and should only be delegated to higher levels if it will lead to more effective outcomes (Jordan and Jeppesen, 2000). While this appears to be a sensible approach for optimizing the use of resources, implementation is not this straightforward in practice because it can be “difficult to differentiate the costs and benefits of acting at different levels” (Jordan and Jeppesen, 2000). Furthermore, when managing environmental issues such as water systems, there can be a strong argument for delegating responsibilities to high administrative levels in order to avoid “externalities” (i.e. unintended impacts on others beyond their accountability) at the basin scale (Horlemann and Dombrowsky, 2012). One such example is evidenced by the Australian water reforms described earlier that represent a gradual shift of power away from states and territories and towards national government.

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