Jumpstarting post-conflict strategic water resources protection from a changing global perspective: Gaps and prospects in Afghanistan

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\textbf{Abstract}

Notwithstanding ambiguities, long-term economic resurgence in Afghanistan amidst water insecurity exacerbated by climate change decisively requires a water protection strategy that will complement a multitude of agroindustrial and socioeconomic activities in an environmentally sustainable and climate resilient manner. In this paper, we begin with a perspective on institutions, legislation, and key issues in the water sector of Afghanistan. We then embark on linking the integrated water resources management (IWRM) and strategic environmental assessment (SEA) approaches as a novel framework for strategic water management and subsequently propose a strategy for post-conflict water protection based on the coalesced IWRM and SEA. Context relevant good practices worldwide are presented to provide empirical evidence for this approach whereas perceived opportunities and vulnerabilities in the Afghan context are discussed. Examination of post-conflict water sector initiatives in Afghanistan reveals the critical role of foreign assistance in both water infrastructure rehabilitation and modernization of the institutional aspect of water management. The introduction of IWRM as the basis for a progressive water sector strategy has been seen as a major milestone which is detrimentally matched by substantial deficiency in national capacity for implementation. Concurrently, the role of extra-national actors in relevant policy interventions has been considered catalytic despite criticisms of proposed regulations as being anachronistic to field realities. Therefore the view is maintained to practicable policies by accelerating policy learning in the country’s water and environment sectors to encourage homegrown water strategy innovations. Demonstratively, mainstreaming IWRM-SEA coalescence will bridge institutional gaps for better feedback between local and national water stakeholders, providing a venue for improved delivery of water services to sustain post-conflict socioeconomic recovery and promote environmental stewardship.

\section{1. Introduction}

Although water distribution is significantly uneven across the country, it is widely believed that Afghanistan maybe considerably endowed in water resources given the average nationwide water availability of 2775 m$^3$/cap.yr, ranging from 676 m$^3$/cap.yr in the Northern Basin to 7412 m$^3$/cap.yr in the Panj-Amu basin (Favre and Kamal, 2004). However, the country could be considered water insecure and increasingly water stressed in the sense that its mis-managed land and water resources has led to a general decline of water quality and availability. This is worsened by a combination of climate change and spatio-temporally unequal water distribution which causes floods and droughts (Beekma and Fiddes, 2011), exacerbating the mainly agriculture based populations’ vulnerability to poverty.

The socio-politics of water distribution and use in Afghanistan is also complicated as water among its five river basins cross geographical boundaries via the riverine systems, frequently
leading to transboundary contentions in water access and ownership (Yamin et al., 2008). There is however a clear recognition among Afghan policy makers of the potential negative impacts of Afghan water development to neighboring countries (Klemm and Shohair, 2010; CPHD, 2011; UNEP, 2011). With the apprehension that Afghanistan might regress from regional cooperation toward tackling transboundary water issues, the development of clearly defined national water strategy which entails improved hydro-technical knowledge and capacity earned foremost consideration (King and Sturtewagen, 2010).

Concurrently, the dire state of the country’s environment which intricately relates to water quality, water quantity, livelihoods, and human well-being also demands serious attention. Generally decreasing biodiversity in Afghanistan has already drawn early recognition of the benefits of conservation and sustainable use of natural resources (Adil, 2001). Noting the drying wetlands which negatively impacts on wildlife and the increasing vulnerability of communities to drought, UNEP’s post-conflict assessment in Afghanistan highlighted the need for improved water resource management as an essential first step towards rebuilding rural communities and improved human health (UNEP, 2003a,b). A major policy milestone, the Afghanistan National Development Strategy details on a framework that reflects the crucial role of conservation, protection, and improvement of the country’s environment in achieving national socioeconomic development (GoA, 2008a,b).

The three decades of conflict and instability in Afghanistan brought a shortage of efficient institutions to address these concerns. In the case of its water sector, overlapping water management mandates between institutions led to poor coordination of urgent interventions (Mahmoodi, 2008). With institutional memory left in the hands of only few people, the legacy of weak or nonexistent institutions presented a major hurdle to achieving strategic objectives while the very same impediment should be confronted as water management policies are being established (Wegerich, 2009). The Afghan people nevertheless showed a remarkable resilience to ensuring difficulties and hardships, whereas the will and knowledge necessary to meet the enormous environmental challenges exists across the country (UNEP, 2003a,b).

Post-conflict development in Afghanistan critically requires strategic planning for long-term multi-sector water use given the increasing demand for sustainable water supply to complement agroindustrial production, reconstruction, and general economic recovery. The immediate concern though is to halve the 75% of population without access to safe drinking water which will not likely be met in two decades beyond the 2020 deadline of the Millennium Development Goals, not to mention the inequalities in access to water and livelihood opportunities (CPHD, 2011). Nevertheless, early stages of national-level planning for water development provide an opportunity to incorporate strategic measures to counterbalance the negative impacts it will likely cause to ecosystems, natural resources, and society as strategic plans translate into action plans and ultimately local-level projects.

The multi-decade global experience in water strategy innovations provides a compendium of lessons and best practices from which water stakeholders can learn to accelerate desired reforms. Motivated by this belief, we promote the coalesced elements of IWRM and SEA approaches as key to strategic water management during post-conflict. Originally from different domains of practice, IWRM tackles the socioeconomic and environmental sustainability aspects of water management whereas SEA deals with an anticipatory appraisal of environmental impacts of policies, plans, and programs at the strategic level (see Sections 3.1–3.3). Complementation of IWRM and SEA was previously proposed for the identification of appropriate adaptation measures in farming systems to cope with climate change (Slootweg, 2008). Multilateral investors apply SEA in water sector programs as proper practice benchmark (Hirji and Davis, 2009a,b). Presently, the crucial role of coalesced IWRM and SEA in strengthening water institutions of a country at post-conflict like Afghanistan is presented for the first time. The subsequently proposed strategy design for water protection highlights a feedback loop mechanism wherein local water actors inform strategic water planning at the national level. The institutional implications of this innovation in Afghanistan as well as factors mediating relevant processes are discussed.

2. Afghanistan in perspective: water sector

2.1. Physiography and climate

A landlocked mountainous country, Afghanistan features a diversity of climatic regions ranging from the glacial landscapes of the northeast and hot lowland deserts of the southwest (Fig. 1a). The country also features extremes of temperature, ranging from ~50 °C on mountain peaks during winter and +50 °C across its deserts during summer (Azizi, 2002). Among the reasons for this extreme temperature range is the absence of large water bodies that could have ensured a more constant temperature through heat exchange and is amplified by the correlation between decline in temperature and incline in elevation (Pedersen, 2009). On average, Afghanistan has sky cloud cover of 0–0.13 in summer and 0.5–0.63 in winter, average annual precipitation of 52 mm at Zaranj in southwest and 992 mm at North Salang in northeast, 10–30 days per year with snowfall in mountain valleys, average fog occurrence of 0 days per month in summer (June–September) and 4 days per month in winter (October–April), and average occurrence of blowing dust/sand of 1–2 days in winter and 6 days in July (NOAA, 2012).

As the basis for the IWRM initiative of Afghanistan Information Management Services (AIMS) and Food and Agriculture Organization (FAO), the national water atlas was edited in terms of hydrologically dividing the country into five river basins (Fig. 1a). The proposed hydrological division shows the Paj-Amu and Kabul basins as the most water endowed during the drought frequent years of 2001–2004 (Fig. 1b) and hydrometeorologically fluctuating years of 2008–2011 (Fig. 1c). Nationwide snow water equivalent (SWE) profiles for April of 2010 (Fig. 1d) and 2011 (Fig. 1e) show highest density of snow water along the Panj-Amu basin and northern tip of the Kabul basin. The profiles highlight the strong 2010–2011 interannual SWE variability. The map is computed from a distributed, physically based balanced model (Tarboton and Luce, 1996) which inputs downscaled regional climatology and daily gridded precipitation data (Xie and Arkin, 1997). Although rainfall estimates are not calibrated from rain gauges on ground, the models provide imagery that are useful for interannual comparisons.

Most of the precipitation in Afghanistan occur during winter months and snow accumulates in the high mountains. Water becomes available during the snow-melt in April–August in different parts of the country which also coincides with a portion of highest water demand period (Beekma and Fiddes, 2011). An International Water Management Institute (IWMI) report on water resources in Afghanistan indicated that the country has 55 km³ of surface water and 20 km³ of groundwater while water availability is about 2500 m³/cap.yr. The 20 km³ annual water volume for irrigation accounts for 99% of total water use. About 15% of annual water use comes from groundwater aquifers and springs and 85% comes from rivers and streams. Recent groundwater use is around 3 km³ and could increase to 8 km³ in a decade time due to an increase of irrigation and domestic water demand (Qureshi, 2002).
Fig. 1. Afghanistan’s (a) climate regions among watersheds (updated from GEOKART, 1984; Kamal, 2004); (b) mean annual precipitation, 2001–2004; (c) mean annual precipitation, 2008–2011; and (d) snow water equivalent, April 2010; and (e) snow water equivalent, April 2011. Sources: ERA reanalysis (Dee et al., 2011) for precipitation, FEWS NET (Tarboton and Luce, 1996; Xie and Arkin, 1997) for snow water equivalent.
The Hindu Kush mountains which run across the country’s northeast to southwest divide Afghanistan into three main regions, namely the central highlands (60% of area) as part of Himalayas, southwestern plateau (25% of area), and fertile northern plains which form part of the Amu Darya Basin. Afghanistan is characterized by steeplands (56% of area) and slope inclinations (12% of area) (FAO, 2003), making agricultural cultivation challenging due to the difficulty to irrigate and high susceptibility to soil erosion in steep slopes (ICARDA, 2002). Soil quality ranges from fertile loess-like soil in the northern plains to infertile sandy desert soil in southern plateau. Rivers in the southwest are rich in alluvial deposits which provide fertilization in riparian agriculture but are prone to frequent erosion in the steeplands (Azizi, 2002; ICARDA, 2002). Without the use of irrigation and fertilizers, Afghanistan has generally low potential for agriculture given the environmental constraints whereas the high dependency of irrigation to precipitation fluxes makes crop cycles very susceptible to irrigation system failures (Pedersen, 2009).

2.2. Water institutions and legislation

Traditional water organizations in Afghanistan generally relate to the size of surface water system wherein management is tiered with canal size (Rout, 2008). In Panj-Amu, Harirod-Murghab, and Northern basins, system management is led by a wakil or mirab bashi whereas operation and maintenance of canals and downstream secondary canals to farm turnouts is handled by a mirab or chak bashi (Lee, 2006). A wakil or mirab bashi is typically a landowner with system experience and influence to local government. A mirab or chak bashi is a landless sharecropper who has the know-how of system operation and maintenance. This water institution, called the water system, follow centuries-old arrangements on representative election, service payment, and system maintenance contributions (Rout, 2008). Factors identified to influence the performance of this system include the scale of irrigation system (i.e. more demanding operation for main canals than sub-canals), type of infrastructure (i.e. more challenging operation in traditional than modern irrigation infrastructure), water scarcity (i.e. cooperation is triggered by water shortages), ethnic diversity and tension (i.e. competing mirab representation and composition), and proximity to government and other actors (i.e. formal or informal links between water management institutions and external power brokers) (CPHD, 2011).

Although the mirab system share common features among the canal areas in different basins, the non-existence of single model for this system reflects a rarity of firm social structure for water management in Afghanistan (Rout, 2008; Thomas and Ahmad, 2009). This however underscores the opportunity for the system to transform in response to the rapidly shifting contexts (Lee, 2003, 2006; Chokkakula, 2009; Thomas and Ahmad, 2009). For example, parallel government-led engagements at the national level and interactions among water users and mirab associations at the local level will forge a stronger community of water stakeholders whereby inclusiveness will serve to catalyze institutional reforms in the water sector. While old challenges remain and new ones emerge during the course of transformation (CPHD, 2011), the much anticipated institutional readiness will provide venue for knowledge transfer, capacity building, and resolution of inequity issues. However, despite the fact that the mirab system is diverse, complex, and under-researched, no future research on the system is called for by the Afghan government. Fundamental and long-term research on the mirab system could enhance the involvement of a range of stakeholders and facilitate the much needed water sector interventions.

The Afghanistan human development report (CPHD, 2011) highlights that the national water shortage is not driven by insufficient water resources but rather by inefficient services due to decades of political and socioeconomic disruptions. As Table S1 shows (see Supplementary Information), the first wave of initiatives on water institution, legislation, and investments occurred during the 1970–80s (pre-2000 Water Law era), coinciding with the sugar and cotton boom at that time. After a major interruption during the 1990s, a second wave of initiatives with remarkable outpouring of foreign funding occurred after 2000. On the other hand, although the latest Water Law and Water Sector Strategy employ modern approaches to water resources management, there is an outstanding need to address the ambitious vision as incompatible to the deficient water infrastructure, management capacity, and information capability. Hindered progress on several fronts has been attributed in part to the lack of adequate, predictable, and sustained investment as well as absence of mechanisms to promote aid effectiveness (CPHD, 2011).

2.3. Environmental issues

2.3.1. Then and now

Following the formation of interim administration in Afghanistan during the 2001 Bonn negotiations, initiatives led by the United Nations Environment Program (UNEP) and Global Environmental Facility (GEF) carried out a nationwide assessment of the country’s post-conflict state of environment and biodiversity. Although the focus at that time was on war related damage, long-term environmental degradation due to the collapse of governance was of major concern. Assessments held between September of 2001 and 2002 covered air, soil, water, and biodiversity status. However, many locations of interest were inaccessible due to pockets of armed conflict. A compendium of remote sensing data was therefore crucial in investigating the extent of wetland degradation, desertification, and deforestation. Among a multitude of findings (Adil, 2001; UNEP, 2003a,b), the environmental and biodiversity assessment of 2001–2002 noted the severe impact of drought and unmanaged extraction to water resources and supported ecosystems as well as widespread threat of contamination and overexploitation of natural resources. Several wetlands dried out to the detriment of wildlife and decline of agricultural inputs. Loss of forests and vegetation due to excessive grazing and dry land cultivation led to soil erosion by wind and rain. Loss of stabilizing vegetation along riverbanks also increased flood risk. In urban areas, poor waste and sewage management and lack of proper sanitation are outstanding issues. In hinterlands, pervasive hunting for bushmeat and fur as well as exploitative logging for timber and fuelwood worsened the already precarious situation of wildlife and ecology. Overall, there was a remarkable decline of water quality and quantity, agricultural productivity, wildlife populations, forests and vegetation, and well-being of Afghan populace.

Recently Afghanistan has reached another milestone in that its National Assembly has approved the Environmental Law (GoA, 2007). With the support of UNEP, the newly-established National Environmental Protection Agency (NEPA) was tasked to urgently promulgate The Law of 2007 which outlines the framework for progressive improvement of governance for effective environmental management in the country. In the 2009 national report to the Convention on Biological Diversity, the Afghan government highlighted the ever-accelerating rate of national biodiversity loss which is difficult to accurately assess when assessments rely mainly on opportunistic measurements, remote sensing, published statistics, intuitive interpretations, and anecdotal information (GoA, 2009a). Concurrently, foreign aid has played a major in addressing the environment as a theme that cuts across security,
governance, democratization, and socioeconomic development (Nixon, 2007; Tarnoff, 2010; CFR-USS, 2011). It was however pointed out that foreign development assistance must cater to home-grown initiatives and move beyond relief and aid (Goodhand, 2002; WP-EFF, 2008). There was substantial legislative progress in conjunction with government spending and foreign aid in the past decade which brought gains in health, education, and living standards in Afghanistan (CPHD, 2011). Despite that, major environmental challenges still remain including unequal distribution of water, continued deforestation and land degradation, desertification due to livestock grazing and water scarcity, reduced soil fertility and other ecosystem services, and continued chemical contamination of environmental matrices which threaten health and productivity of the Afghan workforce (UNEP, 2006; UNEP, 2007; CPHD, 2011).

2.3.2. The northern basins

There are two river basins in the Northern Afghanistan. First is the Panj-Amu river basin in the Northeast that has tributary Kokcha and Kunduz rivers draining towards Amu Darya. Second is the Northern river basin with the ‘blind rivers’ of Khulum, Balkhab, Sar-e Pul, and Shirin Tagab which discharge into Dasht-e Shortepa thereby not reaching Amu Darya. Hydrographically, these two river basins are part of the Amu Darya basin which is separated from other rivers either to Caspian or to Aral sea with the latter drying up regularly. Gumilev (1987) explained the phenomenon by heterochrony in humidification of Eurasia due to the changing pathways of Atlantic cyclones. On the other hand, Soviet Union experts has warned on the future disastrous effects of the rapid and massive development of cotton monoculture in Central Asia (UNEP, 2011) which requires enormous water demand.

Amu Darya is the lifeline and source of prosperity for over 25 million people living in Afghanistan, Tajikistan, Uzbekistan and Turkmenistan, and depending on its water for crop irrigation on over 6 million hectares of land. It is undisputed that the upper Amu Darya Basin urgently needs an investment program to restore ecological equilibrium to the Pamirs in Kyrgyzstan, Tajikistan, and Afghanistan (Klemm and Shobair, 2010). Before the implementation of large-scale irrigation system, the normal flow in the Amu Darya delta was 38 km³/yr at Nukus area. Irrigation development from 1950s to 1980s caused serious effects on water availability, especially in the downstream areas. Average specific water use was as high as 7000–12,000 m³/ha and there were areas where usage was twice as high (UNEP, 2011).

The latest wave of Afghan initiatives into new irrigation infrastructure and rehabilitation of old ones (ca. 2004) was anticipated to even exacerbate the dire state of water availability in both Amu Darya and tributary rivers within Afghanistan (i.e. Kokcha, Kunduz rivers). Geospatial analysis of vegetation in the Panj-Amu basin in Northern Afghanistan indicated spatially distinct vegetation patterns before (Fig. 3a) and during (Fig. 3b) the course of implementing the latest irrigation programs (e.g. Panj-Amu River Basin Program, etc.). Although the average annual precipitation (Fig. 3c–e) and snow cover (Fig. 3f–h) did not change significantly, vegetation in Ab-e-Rustaq and central Kunduz has conspicuously increased whereas a wider expanse of vegetation cover in the northern parts of Kokcha, Khanabad, and Kunduz has attenuated. The increase of vegetation cover in some areas is strongly linked to the diffusion of irrigational infrastructure and agricultural intensification, while decrease in other areas could be diagnostic of environmental degradation of anthropogenic nature. Water flows for the environment, nevertheless, must be a major concern in water development planning both within Afghanistan and neighboring countries along Amu Darya.

Experts have been arguing that it is unnecessary to involve Afghanistan in post-Soviet water sharing agreements because its past and upcoming water demands have been modest (Dukhovny and Sokolov, 2003; Ahmad and Wasiq, 2004; Horsman, 2008). However, the development of irrigation schemes particularly in Lower Qelagay, Lower Panj, and Kokcha will cause pressure on Amu
Fig. 2. (a) Changes in crop profiles along Jangharoq canal (based on Thomas and Ahmad, 2009; Wegerich, 2010; CPHD, 2011) and (b) flow rates in upstream (Qelagai Weir) and downstream (Jangharoq Weir, Jangharoq Canal) Baghlan River in 2008–2012 and log10 transformations of data in select periods. Source: Panj-Amu River Basin Program.
Fig. 3. Panj-Amu basin’s (a) normalized difference vegetation index, 2001–2004; (b) normalized difference vegetation index, 2008–2011; (c) mean annual precipitation, 2001–2004; (d) mean annual precipitation, 2008–2011; (e) difference between (d) and (c); (f) snow covered area (% of days with snow cover), 2001–2004; (g) snow covered area, 2008–2011; (h) difference between (g) and (f). Sources: MODIS for vegetation index and snow covered area, ERA reanalysis (Dee et al., 2011) for precipitation.
Darya and increase water demand in Northern Afghanistan. At present, water from the Balkh, Khulm, Shirin Tagab, and Sar-e Pol rivers is used for irrigation to full extent. It is estimated that by 2020, three major planned irrigation projects will comprise an additional irrigated area of 200,000 ha. This will result in a total irrigated area in the Afghan part of the Amu Darya Basin (without the Northern Basin rivers not contributing water to Amu Darya) of around 600,000 ha, corresponding to an annual maximum of 6000 million m³ water withdrawn from Panj, Amu Darya proper, and major ‘boundary’ rivers of Kokcha and Kunduz (Klemm and Shohair, 2010). Although the water use from Amu Darya by the neighboring states far surpasses that of Afghanistan, collaboration and formalized regional cooperation of the five riparian countries would pave the way for joint sustainable management of shared water resources and climate adaptation strategies.

2.3.4. Benchmarking Amu Darya

All arid regions are alike to a great extent, even in such countries of different history and socioeconomic as USA and Afghanistan. Offering surprising insights into relationships of man and water whilst cruelly mediated by human development, the Colorado River basin story (Medellín-Azuara et al., 2007; Wheeler et al., 2007; Umoff, 2008) is nearly as ecologically poignant as the Aral’s, although much less publicized. Agricultural and urban land use patterns in the Colorado River basin have dramatically changed over the last decades. Driven to some extent by urban areas growing over farmland and industrial activities, there has been a general reduction in agriculture, deterioration of water quality, and ecological impacts. Still the largest water user in the basin, agriculture is a natural partner for the municipal sector to court in developing new water supplies. Similarly, water supply in the Amu Darya basin is not keeping pace with agricultural intensification and population growth. The clearing of riparian bushland along the northeastern Afghan stretch of Amu Darya for agriculture and livestock has been linked to loss of habitat for rare avifauna of wide migratory range stretching as far as Thailand, calling for urgent protection measures (Timmins et al., 2009).

Most of ecosystems in the Amu Darya basin also prominently feature salt cedar (genus Tamarix), an integral part of the Aral ecosystem where it plays a major role in stabilizing sand and salt of the dried seabed. Ironically, once transplanted to the U.S. Southwest for sand erosion control, Tamarix unexpectedly turned out to be a noxious weed, inflicting severe ecological imbalance and water loss.

Although each of the river basin’s circumstance is unique, a comparison of strategic issues relative to geographic features (Table S2, see Supplementary Information) could yield interesting insights. It can straightforwardly be generalized that both the river basins, even situated at the extremes of governance and socioeconomic spectrum, share very similar predicaments. Common denominators in both basins such as increasing water salinity and turbidity from a variety of runoffs, biodiversity threat from invasive animal and plant species, role of industries in changing patterns of water abstraction, water loss due to evaporation, and weak recognition of transboundary water issues are closely intertwined with other global issues (e.g. environmental accountability, drug trafficking, etc.). The Colorado situation is clearly more advanced in terms of water management, level of technology, decision making mechanisms with respect to planned development, and strategy for water protection relative to water supply and demand scenarios. A later section highlights recent initiative for strategic water management in the Colorado River Basin as a point of reference for the state-of-the-art water governance in the typically arid Afghanistan and countries of similar circumstance.

3. Strategic protection of Afghan water

3.1. On sustainability: linking IWRM and SEA

Sustainability is closely associated with the concept of carrying capacity, understood as environment’s maximum persistently supportable load (Catton, 1986). A concept in close association with sustainability is sustainable development. Since the UN General Assembly’s acceptance of the Brundtland Report (WCED, 1987) and subsequent elaborations during the Rio Summit (UNCED, 1992), sustainable development has proven yet too amorphous to be clearly defined (Drexhage and Murphy, 2010). A number of contextual interpretations reflect common guiding principles including a critical recognition of the environmental costs of development, poverty reduction and human development, and a commitment to intergenerational equity and fairness (WCED, 1987; Daly, 1990, 2002; WWF, 1993, 2006; Bauer and Olsson, 2008). It is widely recognized that sustainability has three confluent domains: environmental, social, and economic. The environmental domain has been gaining prominence since prior works on environmental economics and management (Norton, 1992; Page, 1992; Pearce and Watford, 1993; Solow, 1993, etc.). Environmental sustainability (ES) is defined as the maintenance of natural capital (Goodland, 1995). Natural capital is a stock of natural assets that yields a flow of valuable goods (e.g. water, soil, forest, etc.) and services (e.g. wetlands’ waste assimilation, catchments’ water supply) into the future (Constanza and Daly, 1987).

IWRM promotes the coordination of development and management of water, and related resources as to maximize the resultant socio-economic welfare without compromising the sustainability of vital ecosystems and the ability of the future generations to meet their water needs (GWP, 2004; Sloatweg, 2008). As such, IWRM addresses the three domains of sustainability. Recognized as the best approach to maging water impacts of climate change (GWP, 2007), IWRM uses a multisectoral approach to water management, optimistically seeks stakeholder contribution and devolution of responsibility, and utilizes economic mechanisms including private sector participation (ICWE, 1992; GWP, 2000; Hirji and Davis, 2009a). IWRM has also been the accepted paradigm for sustainable management of water resources (i.e. river basin planning) since the 1990s, although implemented in a disjointed manner among developing countries while its environmental water management area is in general addressed in an advertisement approach (Sloatweg, 2008; Hirji and Davis, 2009a). In principle however, environmental water allocation (i.e. environmental flows) should be accounted for under state-of-the-art IWRM (Fig. 4), along with other consumptive and non-consumptive water uses (see Kashigilii et al., 2005; Korsgaard, 2006; WB, 2007; Bauer and Olsson, 2008; Berge et al., 2008).

Reportedly first used in the draft report to the European Commission, SEA is a terminology employed to describe a systematic and anticipatory process for environmental assessment (EA) at the strategic level (Wood and Djedjoud, 1989, 1992) such as those of policies, plans, and programs (PPPs). SEA has been practiced in an ad hoc manner (Marsden, 2008), in some cases a legislative requirement, until the introduction of the legal frameworks in Europe between 2001 and 2003 in the forms of SEA Directive and SEA Protocol (EU, 2001; UNECE, 2003; ODPM, 2005). Based on the European Directive, the SEA Protocol has been open to signatory countries beyond the UNECE region and could catalyze the establishment of multilateral frameworks in other regions (Dalal-Clayton and Sadler, 2005). Given the evolving nature of EA and appraisal, SEA is perceived as a second-generation paradigm (Dalal-Clayton and Sadler, 1999) which applies the principles of project-level environmental impact assessment (EIA) but rather advantageous...
in that it is carried out upstream of the decision making process (Partidario, 1996, 2000; Sheate et al., 2003; Therivel, 2004; Dalal-Clayton and Sadler, 2005; OECD, 2006a; Marsden, 2008; OECD, 2012). Differences also exist regarding the nature and scope of SEA. While there is consensus on the lack of ‘blueprint’ approach to SEA, some practitioners advocate that SEA should focus on environmental concerns while others point that it should cover both socio-economic and environmental concerns (Chaker et al., 2006).

In pursuing policy reform across development sectors, there is considerable drive worldwide to go beyond complying with standards and rather integrate environmental, sustainability, and climate change considerations. Within the water sector, there is increasing acceptance of IWRM at the national policy and strategy levels, although implemented independently to suit requirements and not being practiced in a comprehensive manner (Hirji and Davis, 2009a,b). As limited information suggests that provision of water for environmental purposes has not been widely practiced in developing countries, the application of SEA in the water sector will provide additional mechanisms to mainstream environmental concerns in water resources management to anticipate and manage the environmental impacts of water development (WB, 2007). Potential opportunities that SEA can offer include developing a national or sector water policy, enacting water legislation, drawing up river basin plans, establishing a river basin institution, formulating and implementing a national water supply, and irrigation or energy master plan, among others (Hirji and Davis, 2009b; Larsen and Kørnøv, 2009). Although SEA and IWRM originated from different professional interests, SEA can provide a legal vehicle and more structured approach towards the practical implementation of IWRM principles whereas IWRM can provide a comprehensive and integrated understanding of water-sector issues for SEA to inform decision-making (Slootweg, 2008; Hirji and Davis, 2009a). Fig. 5 illustrates the conceptual marriage of IWRM and SEA for strategic protection of water resources in Afghanistan.

3.2. Gleaning from global practice

3.2.1. Actual cases of IWRM-SEA synergy

The use of SEA in water sector initiatives has mainly been an ‘environmental safety’ measure which multilateral investors adopt as a point of good practice (Annandale et al., 2001; Goodland, 2005) whilst not a constitutional requirement in many countries. In the early half of last decade, SEA became mandatory in the European Union (EU), non-statutory in Canada, and being piloted in both developed and developing countries (Dalal-Clayton and Sadler, 2005; Marsden, 2008). The SEA Directive of the EU requires that plans and programs that could impact on water must be assessed by SEA which is closely related to the Water Framework Directive (Carter and Howe, 2006). These cases highlight the interplay of IWRM and SEA (Slootweg, 2008; Hirji and Davis, 2009b), among others: (i) the EU SEA Directive contains many IWRM principles including managing water quantity and quality for surface and groundwater, treating water as having an economic value, and enhancing consultation and participation; (ii) SEA concepts have been influential in guiding IWRM (i.e. catchment management and planning) in South Africa with the introduction of the National Water Act of 1998 which entails a need for wider information frame

Fig. 4. Integrated water resources management scheme of South Africa (updated from MacKay, 2000) featuring the inter-linkages of water use regulation (SDC) and water resource protection (RDM) which integrate environmental flows.

Fig. 5. Conceptual framework for strategic water protection in Afghanistan and beyond (updated from Hirji and Davis, 2009a). Details on the IWRM-SEA integration and Afghan river basin institutions can be found in Figs. 6 and 7, respectively.
among decision-makers; and (iii) a SEA pilot study in Indian Palar Basin proved successful in developing an IWRM framework which was extended to sub-basins in the State of Tamil Nadu. Table S3 (see Supplementary Information) lists a number of other cases among the arid countries and regions. So far, key SEA-IWRM synergies were into river basin management plans as well as programs for water infrastructure development (e.g. irrigation, hydropower, etc.) while water policy and legislation are hinged on the tenets of IWRM with major considerations for environmental flows. Due to the complexity of water development with respect to water supply scenarios, multi-sectoral water demand, and portfolio of other stakeholder uses, the application of SEA toolkit into IWRM tend to focus more on overall environmental impacts than exhaustive evaluations of multi-part plans and detailed schemes (WB, 2007; Hirji and Davis, 2009a,b).

3.2.2. IWRM-SEA synergy in an arid milieu: the CRB study

The Colorado River Basin (CRB) and its tributaries supply water to municipalities (30 million population equivalent), irrigation (4 million acres), and hydropower infrastructure (4.2 GW) in parts of Arizona, California, Colorado, New Mexico, Nevada, Utah, and Wyoming (i.e. Basin States). Water supply and demand imbalances in some CRB geographic areas are projected to increase due to climate change with water and ecological quality in CRB has been deteriorating (Hinck et al., 2007; Lellouch et al., 2007; Marshall et al., 2010; Judkins and Myint, 2012; Manghi et al., 2012). Water demands during long drought including the recent one were met by the capacity of CRB to store about four times the average inflow. Increasing demands with decreasing supplies given the fast growing urban and industrial areas in CRB will exacerbate imbalances in the future (USDI-Br, 2010; USDI-Br, 2012a). Authorized by the Secure Water Act of 2009, the U.S. Department of Interior initiated the WaterSMART Program to address the challenges to water supply in the 21st century including population growth, growing competition for finite water supplies, and climate change (USDI-Br, 2010). Under this scheme, the federal water and science agencies collaborate with state and local water managers for the CRB Water Supply and Demand Study (Study) in a bid to plan and take action toward secure water resources (USDI-Br, 2011).

Case analysis of the Study indicated that it possesses the features IWRM and SEA. As a case of IWRM, the Study assessed the future water supplies and demands in the CRB and the adjacent areas of the Basin States that receive Colorado River water through 2060 (USDI-Br, 2012b–d) as well as develop and evaluate adaptation and mitigation strategies to address future water supply and demand imbalances. As a case of SEA, the Study assessed the reliability of the Colorado River system to meet the needs of Basin resources such as water allocations and deliveries consistent with the apportionments under the Law of the River, hydroelectric power generation, recreation, fauna and their habitats, water quality, flow and water dependent ecological systems, and flood control (USDI-Br, 2012e). The Study anticipates that the likely options to address future water supply and demand imbalances will include increased supply through importation, desalination, reuse, etc.; reduced demand via municipal and industrial conservation, agricultural water conservation, increase use efficiency in energy sector, etc.; operations modification including groundwater storage, hydropower optimization, basin-wide water banking, etc.; and governance interventions such as control of development growth, funding of basin-wide programs, enhanced data and information sharing, tribal water use and transfers, etc. (USDI-Br, 2012f,g). Meanwhile, a SEA-type procedure has been long-practiced in the U.S. in the form of programmatic EA (e.g. USDI, 2003, 2009).

The generalized approaches can be applied in arid countries such as Afghanistan but would require policy, institutional, and technological readiness which intimately intertwine with the country’s biophysical and socioeconomic fundamentals. The Study also recognizes the critical role of environmental organizations, tribes, government, industrial, and municipal stakeholders as environmental stewards and sources of crucial information at the ground level. As such, prime importance has been assigned on consultations with these entities in drawing options to strategically address future supply and demand imbalances. A major difference between the CRB stakeholders and those in Afghanistan is the level of capacity for policy learning, institutional management, and technical know-how which impacts the extent of involvement. Capacity building to bridge these gaps must be a priority in Afghanistan. Appropriate entry points for trainings include the local water actors (mirabs, etc.), government recognized WUAs, etc. Regarding the applicability of targeted interventions for CB (USDI-Br, 2012c,d) in Afghanistan, practically all of the identified interventions are believed applicable as predicaments are similar. Cost-effective counterparts must be explored though given the ground realities in Afghanistan. The Study, however, did not strongly emphasize the transboundary water concerns shared with Mexico which is critically important to biodiversity in ecosystems downstream (IBWC, 2001; Varady et al., 2001; IOA, 2002; Judkins and Larson, 2010; Maddock et al., 2010). Afghanistan can learn from this deficiency and rather must address the likely impacts of its water development initiatives to ecosystems in neighboring riparian countries as all of its major rivers are transboundary.

3.3. Models and strategy design for Afghan water protection

3.3.1. IWRM: the South African approach

Water resources management in South Africa (see Figs. 4 and 6) is based on the sustainability of use principle — by protecting the ecological integrity of the resource, the level of utilization of the water resource can be indefinitely sustained (DWF, 1999). Basin management strategy starts with visioning which provides an understanding of the current and projected situation, serving as the foundation for strategic action. The vision addresses the interrelated objectives of sustainability and equity being the desired objectives of subsequent strategies (DWF, 2004a). The vision is usually set by a water management agency (WMA) which is tasked to achieve these objectives for a river basin. To achieve the vision, complementary key strategic areas of resource directed measures (RDM) and source directed controls (SDC) are then identified which embody the South African IWRM strategies (DWF, 2003a,b; DWF, 2004a,b; DWF, 2005a,b; DWF, 2006a,b). RDM comprises classification, the reserve, and resource quality objectives. These are directed at protecting the water resources base by setting objectives for the desired condition of resources. The overall condition of the water resource (including quantity and quality) of in-stream and riparian habitats and aquatic biota is referred to as resource quality. SDC are measures to control water use to limit the impacts to acceptable levels and cannot be undertaken without RDM. The facilitating strategies (DWF, 2003a; DWF, 2006b; du Toit and Pollard, 2008) including plans for stakeholder engagement and communication, information management and monitoring, and finance help achieve the IWRM objectives. Multiple institutions, public and private, are directly and indirectly involved in these interlinked processes (DWF, 2003b). Some processes align with relevant municipal water planning processes while other processes cut across water management areas, provincial jurisdictions, and also other sectors (e.g. mining, development, etc.).

3.3.2. SEA: the Canadian approach

It was pointed out that SEA in Canada is detached from regional planning and downstream project-level EA, providing limited
methodological guidance to take into account cumulative environmental effects (Gunn, 2009). Cumulative effects (CEs) generally refer to impacts that are additive or interactive in nature (i.e. synergistic) and result from multiple activities over time, including the project being assessed (ADB, 2003). CEs are defined as impacts on the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions (US-CEQ, 1997). CEs are best considered at the level of PPPs where decisions about future developments are made (Duinker and Greig, 2006; Harriman and Noble, 2008) and can be appropriately analyzed by SEA as these occur at the temporal and geographical scales (Sadler, 1996). Earlier, some workers noted that CEs should be integrated for SEA to be effective (Cooper and Sheate, 2004), whereas other workers suggest that cumulative effects assessment (CEA) maybe practiced more effectively in the context of regional or sectoral application SEA (see Collett, 1991; Dubé, 2003; Noble, 2008; Noble and Harriman, 2008). In 2008, the Canadian federal government moved to consider and further develop the concept of regional strategic environmental assessment (R-SEA) as a re-conceptualization of SEA that incorporates the assessment of CEs (i.e. integrated SEA and CEA; see Noble and Harriman, 2008). As a process, R-SEA is designed to systematically assess potential and cumulative environmental effects of PPPs upon valued ecosystem components (VECs) for a particular region. The spatial limits of a region are defined by natural or ethnocentric boundaries (Gunn, 2009; Gunn and Noble, 2009a, 2009b). While work on the methodological aspect of R-SEA continually progress despite the challenges (Sadler and Verheem, 1996; Duinker and Greig, 2006; Noble, 2008; Gunn and Noble, 2011), there is tremendous potential for a more strategic protection of water resources via the application of R-SEA on river basin IWRM plans particularly in arid regions.

3.3.3. Proposed Afghan river basin management strategy

The proposed Afghan water strategy in Fig. 6 heavily subscribes from the South African IWRM (du Toit and Pollard, 2008; Pollard, 2008) and Canadian R-SEA (Noble, 2008; Noble and Harriman, 2008a; CCME, 2009; Gunn and Noble, 2009a,b; Ketilson, 2011) approaches as external models which could serve to facilitate necessary institutional changes (Evans, 2004) despite the uniqueness, complexities, and uncertainties of the Afghan setting. The combination of this two approaches arguably embodies the institutional design principles articulated elsewhere (Ostrom, 1990; Huntjens et al., 2012) in the critically acclaimed work on the management of common-pool resources such as water. The design principles include clearly defined boundaries, proportional equivalence between benefits and costs, collective choice arrangements, monitoring, graduated sanctions, and conflict-resolution mechanisms, among others.

Extrapolating from benefits derived on the use of R-SEA in integrated land management (Noble and Gunn, 2010) and international innovations on natural resources management for sustainable development (Pollard, 2008; Gunn and Noble, 2009b; Sadler, 2010; Seitz et al., 2011; etc.), the ‘marriage’ of R-SEA and IWRM is anticipated to yield the following benefits:

- structured yet flexible analysis of trade-offs among identified water use scenarios and targets which guarantee that decisions are based on explicit set of rules while addressing ambiguities at the regional and strategic levels;
- emphasis on vertical integration of management and assessment, that of regional to local tiers vice versa, in addition to horizontal integration and coordination among development sectors;
- broader environmental, social, and economic objectives inform water development planning and assessment such that the identified plan of action represents the most sustainable course;
provision of the opportunity for public debate on regional goals, policies, alternative development options at the onset of R-SEA to minimize conflict in subsequent project-based assessments;
assessment of cumulative effects at the most suitable level such that measures are built in to IWRM plans to avoid or minimize potentially adverse cumulative environmental change;
obtained targets and thresholds during the R-SEA process as inputs to project-based impact assessment and benchmarks against which the environmental performance of water development can be evaluated and monitored; and
better chance for data sharing on common indicators (i.e. on transboundary river basins) and maintenance of the updated baseline information through shared regional and project-based environmental monitoring initiatives.

Within Afghanistan, R-SEA potentially offers complementary measures to IWRM to:
integrate decentralization of water resources management functions to basin councils to accommodate a range of socio-cultural peculiarities among basin areas and clarify the ownership of water related decision-making process which underpin democratization,
couple well-studied water use licensing scheme with the creation of water finance system which caters to the modernization of water infrastructure and incentivizes good practices in water delivery,
build capacity among local water stakeholders on environmental stewardship as well remunerate for mainstreaming environmental objectives in both consumptive and non-consumptive water uses,
provide financial and physical assistance to women for better involvement in upholding ecological objectives through appropriate agricultural practices,
enhance the representation of traditional water actors in basin councils, and
encourage cyclical feedback solicitation from the grassroots on the effectiveness and efficiency of interventions so far undertaken.

Externally, the strategy should trigger intensified engagement among neighboring states to decisively address water sharing and management issues. The strategy can be a basis for creating a platform of shared and coordinated water sector interventions aiming at environmental, social, and economic sustainability at the regional level. The emphasis on regional cumulative effects from water development will all the more compel concerned parties to mobilize resources toward this end.

4. Opportunities and challenges

Like many developing countries, Afghanistan has also adopted IWRM as a new approach in setting up the institutional component in water management in conjunction with water infrastructure rehabilitation and development. The critical role of IWRM as platform for a progressive national water strategy is provided for by the Afghan Water Law (GoA, 2009b) and articulated in the Water Sector Strategy (GoA, 2008b). The development of the river basin management approach by the Ministry of Energy and Water (MEW) is a first step towards IWRM. In implementing the strategy, MEW is tasked to administer on-going and planned projects which are clustered into four programs: institutional building and capacity building, national river basin management, emergency irrigation rehabilitation, and national water resources programs. These programs address both the institutional (i.e. remodeling and modernizing institutions) and technological (i.e. rehabilitating and improving infrastructure) aspects envisioned appropriate for the water sector. In the execution of the projects, ownership by all stakeholders through involvement in planning, design, and implementation of the projects and also participation in new institutional set-up within the water sector is of central importance. Meanwhile, Afghanistan has a traditional system for managing irrigation administered by mirabs (see Section 2.2). However, mirabs do not have the mandate to carry out marketing and operations and management (O&M) activities to enhance their financial capability. In contrast, the WUAs which are established by the water users themselves serve as independent and legal entity which has full autonomy and authority with respect to O&M activities. Nevertheless, a study suggested that the existing mirab system can be transformed into a legal entity and formal institution with greater efficiency and organizational capability (DAI, 2006). The tiered interrelationships of actors involved in proposed Afghan river basin organizational structure for IWRM is illustrated in Fig. 7. There have been a number of IWRM related initiatives in Afghanistan with foreign assistance (see ADB, 2004; ADB, 2005; ADB, 2008). Significant effort and resources were invested into water infrastructure and training for institutional building and strengthening with emphasis on the involvement of traditional community-based water institutions (i.e. mirab system) concomitant to the promotion of WUAs.

Implementation of IWRM globally is beset by challenges. In Afghanistan, it has proven daunting. The Afghan Water Sector Strategy itself acknowledges the lack of institutional and financial resources to meet the required water services to populations; absence of water use regulation mechanism for irrigation, water supply, sanitation, and hydropower purposes; and lack of integrated water sector governance (GoA, 2008b). As regards implementing IWRM in river basins, Varzi and Wegerich (2008) noted a number of hindrances to the practicability from the Panj-Amu River Basin Program (PARBP) experience including the low interest and priority on institutional change, lack of data and measurement infrastructure, limited enforcement of rules, and questionable stakeholder representation in river basin working groups. Analysis of the recent Afghan WSS and irrigation sector initiatives also offered a number of valuable insights that are very much in line with the findings of other workers (see Wegerich, 2009; Thomas, 2012). Foremost is the fact that local water institutions still function in a traditional way such that catering to the needs of individual canal communities on locally agreeable rules as facilitated by the government could be more effective than adopting a new system based on WUAs which entails huge investment. There is also a potential conflict of interest between basin organizations and canal-level administration on water allocation given the basin right-of-way clause in the 2008 Water Law draft, necessitating dialog between government and canal-level administrators as crucial to pursuing the basin approach. As regards the emphasis of the draft Water Law on water permits, absence of water gauging stations points to the irrelevance of permits until the technology has been field deployed. On water works supported by foreign funding, the government must mediate on future sharing of water and maintenance tasks to prevent the weakening of collective action in canal communities and avoid the increase of existing requirements for maintenance work. Recurring concerns in literature on the adoption of IWRM in Afghanistan include the non-implementability of the permit scheme on traditional irrigation systems, limited enforcement capacity, and need for more flexible sub-basin decision-making platforms other than the fixed sub-river basin councils (see Wegerich, 2010; Thomas et al., 2011, 2012; Thomas, 2012).
Last decade's initiatives into environmental assessment in Afghanistan such as those in impact of human population on natural environment in Wakhan (UNEP and FAO, 2003), nationwide post-conflict environment (UNEP, 2003a,b), and ground contamination in the Astana military waste storage (UNEP, 2006) were facilitated mainly by international agencies. The coming into force of the Environmental Law in 2007 was pivotal for Afghanistan in terms of a progressive and binding governance for environmental management, creating a regulatory framework for sustainable use of natural resources as well as providing for conservation and rehabilitation of the environment (GoA, 2007; UNEP, 2007). As provided for under the same Law, a set of regulations was released in 2008, governing the EIA process (GoA, 2008c). The EIA policy visions at that time were to protect the environment and community well-being by providing assistance for sustainable development. EIA objectives include (i) the incorporation of environmental considerations into the development decision making process; (ii) anticipation, avoidance, minimization or offsetting the adverse significant biophysical, social and other relevant effects of development proposals; (iii) protection of the productivity and capacity of natural systems and the ecological processes which maintain their functions; and (iv) promotion of development that is sustainable and optimizes resource use and management opportunities. Notable water-sector EIA and EIA-related initiatives include those on the feasibility study for the Qelagai storage dam project, feasibility study for the irrigation and hydropower project in Lower Kokcha, environmental screening of irrigation projects in the Kunduz River Basin Program, barrage and irrigation schemes rehabilitation in Khabad, agricultural and irrigation development in Mazar, etc. (also see Section 2.3.2). Despite the weak technical understanding and implementation capacity, EIA has been implemented in Afghanistan and allowed chance to organically develop into a country-level capacity. Accumulated experience in this area is desired to catalyze initiatives for SEA in the country. On the other hand, post-conflict rehabilitation is characterized by ‘hyper-development’ which can lead to severe environmental impacts (OECD, 2010). As true for Afghanistan, there is scope for SEA for both post-conflict PPPs and longer term national development. Since post-conflict development should endeavor to reduce state fragility, SEA can help improve service delivery systems and promote the wise management of natural resources as crucial for sustained recovery (OECD, 2006b, 2010).

5. Concluding remarks

Whilst gearing toward post-conflict development, Afghanistan's biophysical situation can be aptly characterized by water insecurity and environmental stress. More often, the focus in the early stages of post-conflict development when institutions are yet to gain strength is country-level programming (OECD, 2010). This is currently occurring in Afghanistan as championed by the government with strong international support. We believe this phase unprecedentedly provides an opportunity for Afghanistan's environment sector to reflect and learn from the best of practices and outcomes in global water strategy innovations. Gleaning lessons from most recent global paradigm shift in water resources management is anticipated to integrate suitable coping mechanisms into water governance approach in the face of uncertainty and complexity (Pahl-Wostl et al., 2007a,b) and allow for experimentation on allied strategies (Huntjens et al., 2012) as multi-sector development processes gain traction.

Afghanistan has recently adopted a modernistic water sector strategy based on the tenets of IWRM, although the government has to address deficiencies in water infrastructure, capacity to manage, capacity to enforce, and reliable information. While capacity gaps are being addressed at the time when various water actors (water users, irrigators, mirab association etc.) are increasingly involved in water governance structure building, the circumstance is believed to be opportune for the adoption of SEA support to IWRM to effect a process whereby SEA facilitates strategic decision-making in the water sector with in-depth sector knowledge provided by IWRM (Slootweg, 2008). The near-term outcome should be the strategic minimization if not avoidance of impacts on overstretched water resources and water related ecology as water development gradually achieves spread. The long-term objective would be to mainstream the renowned and globally applicable institutional design principles for the management of competing uses of common-pool resources such as water.
(Ostrom, 1990). These, we believe, are crucial to the future of water governance and promotion of environmental stewardship in the water sector of Afghanistan.

A major advance in the present work is the proposal to complement the South African approach on IWRM, featuring measures for water resource protection (i.e. classification, the reserve, etc.) and water use regulation (i.e. license application, water use licensing, etc.), and the Canadian R-SEA which integrate cumulative effects from development activities in the application of SEA at the regional level. Although some workers (see Thomas et al., 2011; Thomas et al., 2012; Wegerich, 2009, 2010) have observed a sharp contrast between foreign models which are integrated into Afghan Water Law (i.e. IWRM, river basin management, multiple stakeholder platforms) and actual water governance practices in Afghanistan (i.e. in some instances incompatible and non-implementable), these predicaments could be viewed as ‘transitional hiccups’ in a system beset by competing interests which could resolve by itself but can fall prey to the fluctuating socio-political milieu. As regards assessing cumulative effects in the framework of SEA, some amount of confusion exist regarding the nature of the milieu. As regards assessing cumulative effects in the framework of SEA, some amount of confusion exist regarding the nature of the issues which are dealt with (Howlett and Noble, 2011). It was also pointed out that SEA in a developed basis and methodological framework for coupled IWRM and R-SEA strategic water protection articulated herein. There certainly is involved in, and nature of the issues which are dealt with (Howlett and Noble, 2011).

The prevailing situation in Afghanistan or setbacks in the application of IWRM and R-SEA do not nullify the innovation for strategic water protection articulated herein. There certainly is scope for fundamental research to further elaborate the conceptual basis and methodological framework for coupled IWRM and R-SEA in post-conflict water sector development. Nevertheless, this requires dialogue, education, and mindset broadening among stakeholders. Alongside, environmental policy actors and practitioners in Afghanistan can embark on transnational and inter-jurisdictional learning by themselves but that will depend on their policy analytical capacities, the policy processes they are involved in, and nature of the issues which are dealt with (Howlett and Joshi-Koop, 2011). Eventual adoption of this innovation should ideally result from the convergence of efforts by interest groups, the government, and the civil society.

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Appendix A. Supplementary data

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References
