

Dinar, A.: Advanced Introduction to Water Economics and Policy. Cheltenham–Northampton, Edward Elgar, 2022. 132 p.

Water economics and policy play a crucial role in managing water as a vital resource and addressing its allocation and sustainability. Water scarcity affects billions' lives worldwide, exacerbating competition among agricultural, industrial, and domestic users – even in countries which were considered rich in water for a long time but are increasingly suffering from declining water resources due to climate change, including regions like the Danube–Tisza Interfluvium in Hungary. Hence, the efficient use of water is a critical task for contemporary societies. Efficient use, however, requires effective water economics involving proper pricing that reflects the real value of water and encourage conservation and efficient use, as subsidized water rates can lead to overconsumption, while consumption-based pricing and pricing reforms can reduce waste (DINAR, A. and YARON, D. 1992). These questions are investigated in much detail in the current book, providing a comprehensive and authoritative overview of water economics and policy.

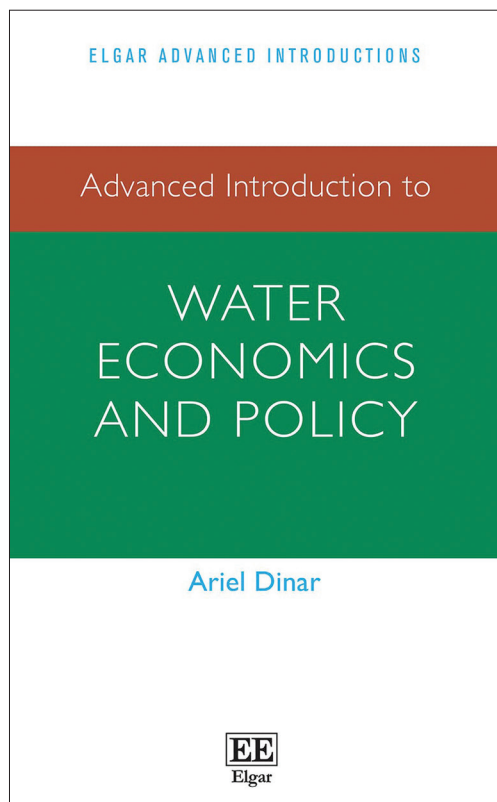
The author of the volume, Ariel DINAR, is a Fulbright Senior Specialist and a Distinguished Professor of Environmental Economics and Policy at the University of California, Riverside (UCR), and School of Public Policy. His book, published in 2022 with Edward Elgar, represents the many years of DINAR's practical and research experience in the field of water economics and management. While exploring water economics and policy, it covers topics like water scarcity, environmental flows, and ecosystem services. It includes examples from different countries (e.g., the United States, Australia, and South Africa) and analyzes the most significant water-using sectors. The volume provides an opportunity for the readers to understand water management from an economic perspective.

The volume contains 10 regular chapters, whereas Chapter 11 provides a summary of the entire book. The book refers to four case studies that exemplify innovative water management strategies and highlight successes, challenges, and lessons for global water governance. The results in the case studies justify the importance of institutional frameworks and governance, market-based allocation and trading, environmental considerations, stakeholder engagement and participation, and transboundary cooperation and agreements.

DINAR addresses the following research questions:

- *Water economic and policy fundamentals*: What are the fundamental principles of water economics? How are water markets and pricing mechanisms functioning? What are the key challenges in water supply and demand management?
- *Water allocation and markets*: How do water allocation mechanisms impact economic efficiency? What are the benefits and limitations of water markets and trading? How do water rights and institutions influence water allocation?
- *Water governance and institutions*: What are the key features of efficient water governance? How do institutions and policies impact water management outcomes? What role do stakeholder participation and engagement play in water governance?
- *International water policy and cooperation*: What are the principles of international water law and cooperation? How do transboundary water agreements impact water security? What are the challenges and opportunities in international water cooperation?

In Chapter 1, DINAR provides a solid foundation for the book, introducing essential concepts and the context of the book under review. The chapter dives deeper into water's economic value and highlights the complexities and nuances involved in evaluating water's value. Considering water, DINAR differentiates between three sorts of economic value. First, the *instrumental value of water*, which reflects water's utility in various economic



activities such as agricultural production, industrial processes, energy generation, municipal and domestic use, etc. Second, he highlights the *intrinsic value of water*, referring to water's inherent worth and importance beyond its utility, economic, or functional value.

In this concept, DINAR acknowledges that water has value in and of itself, regardless of its use or benefits to humans. As he highlights, some aspects of the intrinsic value of water could include water's ecological importance, aesthetic appeal, and cultural and spiritual significance. I believe that recognizing the intrinsic value of water encourages a more holistic and sustainable approach to managing it and conserving it for future generations.

The book also recognizes the *existence value of water*, which directly represents the societal benefits of water such as aesthetic and scenic value, and water's value for biodiversity conservation and climate regulation. DINAR also makes a strong case with regard to the real-world application of valuing and preserving water, where he elucidates on cost-benefit analysis for water infrastructure projects.

In Chapter 2, two countries (Morocco and Israel) are employed as case studies to highlight high levels of water scarcity and abundance. According to DINAR, since 1962, Israel faced a reduction in its water availability from 330 to 90 m³/capita per year, which is nearly 70 percent reduction. In the same period, Morocco faced a decline from 2200 to 850 m³/capita per year, which is nearly 60 percent reduction. The significant reduction in water availability in both countries resulted from various factors such as rapid population growth, intensified agricultural water use (accounting for 88% of overall end-use), over-extraction and inefficient use (including outdated irrigation systems and the lack of water conservation measures), changing precipitation patterns and increased evaporation due to rising temperatures as the result of climate change. In Israel, this shift has resulted in significant economic costs and environmental impacts, including the discharge of concentrated brine into the ocean, which can harm marine life. The situation is not much different in Morocco as reduction has exacerbated water scarcity issues, particularly in rural areas, resulting in significant implications for agriculture, industry, and human consumption, leading to food insecurity and economic losses. Hence, the consequences of reduced water availability in both Morocco and Israel are far-reaching and interconnected, which highlights the need for sustainable water management practices, increased efficiency, and conservation measures to address this critical issue.

DINAR accentuates in Chapter 4 the importance of flexibility in water allocation and water storage solutions, and the importance of stakeholder engagement, a phenomenon that led to a major stride in the successful implementation of California's Water Market and Trading System. California has experienced many droughts over the years. This has led to the introduction of various policies related to water conservation, declaring conservation

a way of life by the California State Legislature (DINAR, A. and TSUR, Y. 2021). Another classic measure is the Australia's Murray-Darling Basin Reform, which is an example of successful water governance through market-based mechanisms, environmental consideration, and collaborative management. These cases illustrate that effective collaboration and stakeholders' engagement are positive ways to ensure sustainable water governance system (GRAFTON, R.Q. *et al.* 2011).

DINAR makes it succinctly clear in Chapter 3 that water scarcity can be addressed through various strategies, such as economic incentives, pricing mechanisms, water markets and trading can improve allocation efficiency.

While water markets can promote efficient water use by allocating water to its most valuable uses (BAUER, C.J. 2004) and serving as a potential tool for managing water resources sustainably, strategic investment in water infrastructure is crucial for economic growth in general (BOSWORTH, B.P. *et al.* 2002). As DINAR highlights in Chapter 9, the impact of, and adaptation to, climate change in the wastewater sector (based on data from China) and the irrigated agricultural sector (according to data from the Júcar River Basin in Spain) are further critical topics, for both sectors are highly vulnerable to climate change and may face irreversible damages if water allocation, investment, and long-time planning are not properly coordinated and implemented.

The hydrological cycle is heavily impacted by climate change due to the fact that altered climatic conditions caused by the increase in atmospheric levels of CO₂ and other greenhouse gases affect the distribution of precipitation, which is the main cause of variability in the water balance both spatially and intertemporal. For instance, the frequency of low water levels is affected primarily by changes in the seasonal distribution of rainfall (FECHT, S. 2019).

In Chapter 5, the author stresses the coordinated relationship between the environment, water interactions, and management. According to DINAR, water serves as an important input to sustain healthy water-dependent ecosystems, which provide valuable services such as recreation. According to WATSON, L. *et al.* (2020), the total value of global ecosystem service is estimated at 1.3 trillion international dollars in 2005 values.

In the same chapter, DINAR highlights the concept of environmental flows, which is the quantity and quality of water that is required to maintain the health and integrity of the ecosystems of a river or stream. These ecosystems encompass the natural flow regime, including the magnitude, frequency, duration, and timing of flows that sustain the aquatic environment and support the wide array of plant and animal species that depend on it (Brisbane Declaration 2007). The importance of environmental flows cannot be underestimated as they play complex roles such as maintaining aquatic habitats, regulating water quality, preventing erosion and sedimentation as well as preserving aesthetic, spiritual, and recreational values of water.

However, there are several threats to environmental flows such as water diversion and extraction, the construction and operation of dams, which alters the natural flow regime and disrupts sediment transport, and climate change, which affects the timing, magnitude, and frequency of flows. It is therefore imperative to advance strategies to mitigate these threats.

Chapter 6 takes the reader to economic and policy considerations in groundwater management. Due to the impact of climate change on the sustainability of groundwater storage, scientists have realized that groundwater level changes correspond to global climate variations (GURDAK, J.J. 2017; RUSSO, T.A. and LALL, U. 2017; THOMAS, B.F. and FAMIGLIANTS, J.S. 2019). DINAR argues that economic considerations become increasingly relevant as the good or resource becomes scarcer. In the case of water, scarcity is determined by the physical amount of water available for use, or by its distribution as affected by climate change, but also by its quality.

The direct and indirect negative effects associated with groundwater depletion and contamination on the environment and humans require regulatory interventions. Policy interventions such as caps on water extractions, taxes on energy used for pumping, and taxes on water extraction aim to regulate groundwater extraction and agricultural production above an aquifer. A remarkable example of intervention policies is the Sustainable Groundwater Management Act in California. Although groundwater in California has not been regulated formally by the state, many proactive measures have been adopted by the people, e.g., digging wells into their land and pumping as much water as they need, which have sustained the people during the long drought periods since 2010.

In Chapter 8, DINAR examines the various institutional frameworks and agreements that govern international water management, highlighting the challenges and opportunities that arise when multiple countries share a common water source. The focus of the chapter is on the economics and policy of international water management. Frameworks such as the Global Water Governance led to the establishment of the Global Water Partnership and the World Water Council, which have facilitated the promotion of global cooperation and knowledge-sharing in water management. Also, formal agreements between riparian states, such as the Treaty of the Nile (1929), and the Indus Waters Treaty (1960), provided a foundation for cooperation and management of transboundary water resources, helping to address conflicts and promote sustainable development. According to DINAR, uncoordinated national development policies (as different countries may have conflicting development goals, which poses a challenge to managing shared water resources), and differences in economic power and interests can also influence cooperation and conflict among riparian states. These complexities highlight

the need for a multidisciplinary approach to managing shared water resources, one that takes into account the economic, political, and social factors at play.

Mechanisms for regulating water pollution (Chapter 7) belong to another group of significant policy mechanisms. Depending on the type of water pollution, the observation is that water pollution is increasing as industrial activities become more intensive (Pacific Institute, 2010). Yet, water pollution can also be the result of household-, agriculture-, and mining-related water use. While each type of pollution has its own unique characteristics and effects on human and ecosystem health, the principles related to their regulation could be quite similar, which regulating mechanisms need to be addressed adequately.

DINAR proposes groups of regulatory mechanisms that can be employed to deal with water pollution. These include (i) Tradeable Discharge Permits (TDP), i.e., an automatic cost-effective abatement mechanism providing strong incentives to polluters to innovate by making their abatement process more effective and efficient, and (ii) emission taxes, which require polluters to pay for their use and abuse of the environmental resources and services. The economic principle behind these mechanisms is that polluters are allowed to emit as much as they want, but they will be charged a fee per each unit of emission.

Based on my reading and subjective review and evaluation, *Advanced Introduction to Water Economics and Policy* offers a unique blend of theoretical foundations, practical applications, and cutting-edge research, making the book an essential resource for scholars, policymakers, and professionals in water economics and policy. Readers new to water economics and policy will find it informative, while experts will appreciate the updated statistics and framework. The volume, published in 2022, builds upon the foundations established in the edited volume by DINAR, A. and SCHWABE, K. (2015) and provides an updated and comprehensive introduction to the topic. It includes significant additional chapters on climate change and water management, which cover the topic of the impact of climate change on water resources, water vulnerability, and risk assessment, as well as climate-resilient water infrastructures.

The book is an essential resource for scholars, policymakers, and professionals seeking to understand the complex interactions between water resources, economics, and policy. It offers a nuanced understanding of water economics and policy, emphasizing the complexities of managing this vital resource. DINAR's book offers some undisputable novelties that must be emphasized. DINAR was able to integrate economics, policy, hydrology, and social sciences to provide a comprehensive understanding of water management. He also takes a global perspective on water issues, paying attention to countries in both the Global North and Global South, by which he highlights remarkable regional differences and similarities.

Thanks to these merits of the volume, readers can draw many lessons from it in economic, policy, and

environmental terms as well. The book also succeeds in accentuating that water economics and policy require interdisciplinary approaches, and efficient governance and institutions are critical for sustainable water management.

However, while the book touches on social and cultural factors, it primarily focuses on economic and policy aspects. Its focus on broader social and cultural aspects is limited. I have also observed some technical complexity as some sections require sound prior knowledge of economics and hydrology, which many potential readers trained in other water management-related disciplines may not possess. In addition to these, although DINAR highlights the effects of climate change on water resources and social welfare in Chapter 9.2, I believe this topic received marginal attention especially if we consider how climate change-induced environmental shifts have become profoundly global, thus, triggering significant social problems for billions of humans worldwide. Another limitation in my view is the limited attention DINAR pays to rural and indigenous communities. The unique water challenges such as water-borne diseases, health and climate change impacts, water scarcity and variability, etc., faced by these communities are rather overlooked, which hinders the proper representation of the actual problems these people are facing due to the lack of access to water, and goes against a fair integration of these people's experiences into the global academic discourse.

Nonetheless, the above limitations highlight new opportunities for future research that may refine and expand the academic and professional discourses of water economics and policy. In my view, it would be especially critical to (i) incorporate climate change impacts and resilience strategies into the analysis in more detail, (ii) explore non-economic values of water by paying more attention to cultural perspectives on water, (iii) meticulously investigate Global South contexts with special attention to challenges rural/indigenous communities are facing, (iv) integrate interdisciplinary insights from social sciences and ecology, and (v) evaluate the efficiency of policy and governance frameworks.

In conclusion, water economics and policy require a multifaceted approach, balancing economic, social, and environmental objectives. By adopting innovative solutions, effective governance, and cooperation, we can ensure sustainable water management for future generations. Therefore, I highly recommend this book to everyone, especially students, researchers, and scholars passionate about policies and governance systems in the water resource sector.

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