Rural water systems for multiple uses and livelihood security, edited by M. Dinesh Kumar, A. J. James and Yusuf Kabir, Elsevier, Amsterdam, Netherlands, 2016, 324 pp., ISBN 9780128041383 (ebook); 9780128041321 (pbk)

Water security is central to addressing poverty and livelihoods. It is also critical to achieving the UN Sustainable Development Goals. The efforts of governments to reach these targets often face many challenges, as these efforts are neither comprehensive nor scientific. Despite huge investments in the sector in India, the objective of water security for the entire population has remained elusive. According to the government, 94% of the rural population of 741 million (GoI, 2001) has access to safe drinking water through 4 million hand-pumps and 0.2 million piped water schemes. However, the systems often provide irregular and scanty water supplies (GoI, 2008). In the absence of adequate and high-quality services, waterborne diseases affect 37.7 million Indians annually: 1.5 million children are estimated to die of diarrhoea alone, and 73 million working days are lost to waterborne diseases each year. The estimated annual economic burden is about USD 600 million a year, which is more than the annual expenditure (USD 460 million) of the sector (World Bank, 2008).

While India has achieved almost full coverage (rural and urban) in terms of water supply infrastructure provision, the sustainability of service delivery is not maintained (GoI, 2008). Due to this, water supply coverage of habitations has become uncertain and habitations move in and out of full coverage. In terms of service delivery, some systems start slipping almost immediately from the moment they are installed, while others are fine for a while before they start to slip. Some systems slip rapidly initially and then the rate declines, and so on. A whole range of factors – such as geohydrological, agro-climatic, socio-economic and water governance – influence slippage. But these aspects are not taken into consideration in planning water security, which is often done at the village level. Water security at the village level is a misnomer in the absence of integrating the hydrogeological features of the region at an appropriate scale into the design of the schemes. Water security at the village level is being promoted under the guise of decentralization.

In India, households use multiple sources (formal as well as informal) of water to meet their multiple water requirements. This is mainly because no single source meets household demand. Policy makers have conveniently accepted both formal (taps, hand pumps, etc.) and informal (streams, ponds, private wells, etc.) sources of water to meet the objective of water security. Often, quality aspects of informal sources are ignored, to boost coverage and access figures. And the multiple needs of the households are not taken into account in provisioning water. Water demand estimates are usually limited to household water requirements of drinking, cooking, cleaning, bathing and washing. The livelihood water requirements of the households, such as kitchen garden, dairy, poultry, pigs, etc., are not given due consideration in estimating the household water demand. While livestock demand is sometimes included, it is limited to some regions, like Rajasthan, where the density of livestock is high. This mismatch between supply and demand not only affects livelihoods adversely but also puts pressure on the existing sources.

The policy reaction to source failure at the local level is to move towards centralized multi-village schemes with heavy dependence on external water sources (LNRMI, IRC, CESS & WASSAN, 2013). These centralized schemes often create governance conflicts (scheme level versus village level). In order to achieve sustainable water security, the design and implementation of such schemes need to integrate scientific aspects like hydrogeology along with multiple uses and sources. Besides, there is growing recognition that multiple-use systems improve livelihoods related to water (food production and income). In this context, it is argued that even a marginal improvement in drinking water supply infrastructure through retrofitting and a marginal increase in the volume of water supplied could result in a remarkable increase in the social and economic value of the water supplied.

The book under review is one of the very few books that provide a comprehensive and scientific approach to understanding multiple-use systems and their links to livelihoods and water security. This book deals with technological, institutional and policy choices for building multiple-use rural water supply systems in developing countries like India which are sustainable from the physical, economic and ecological points of view. The focus of the book is on poor rural households. The book has 12 chapters (including an introduction). The introductory chapter provides the rationale and approach, and an overview of the book. Chapter 2 uses global data-sets on water security (sustainable water use index), progress in human development (human development index), economic conditions (per capita GDP), income inequality, and human poverty (poverty index) of nations to show that improving water security for all improves the general welfare of nations. This is often achieved through the human development route, with its positive impact on poverty reduction and income inequality.

A detailed empirical analysis of the multiple water needs of rural households is presented for three agro-ecological zones in Chapter 3. The authors test the hypothesis and provide evidence that rural households have multiple water needs beyond domestic requirements. Rural households also use water for livelihoods, as well as productive purposes. It is argued that the existing public water supply schemes are not geared to meet these needs, and as a result rural communities are forced to depend on multiple sources, spending significant amounts of time and labour. Many groundwater-based rural water supply schemes, especially in hard-rock areas, fail due to poor yield resulting from resource depletion and water quality deterioration. One of the reasons for this is lack of proper maintenance of the system. It is observed that the cost norms for building rural water supply schemes do not include capital maintenance, planning and design, and resource protection costs. The lopsided allocations often adversely impact the actual life of the infrastructure (LNRMI, IRC, CESS & WASSAN, 2013). It is argued that a 'life cycle cost' approach to investment decisions in water supply infrastructure could favour investments in technologies that are more sustainable, rather than those which appear to be of 'least cost', purely in terms of capital expenditure.

Chapter 4 presents a techno-institutional model for multiple-use water systems, based on analysis of different agro-ecological and socio-economic settings (from high-rainfall, hilly areas to low-rainfall, drought-prone areas) in Maharashtra. The analysis shows that adoption of appropriate technologies could augment the supplies of public water supply systems, even in the most water-scarce regions. The potential is large enough to meet the multiple water needs of rural households, even in peak summer months. It also describes the kind of retrofitting required and the institutional model for implementing multiple-use water systems at the village level. It is argued that multiple-use water systems can reduce the water-related vulnerability of rural households even during summer months, including in drought years.

Using an empirical study of different types of rural water supply schemes, Chapter 5 reasons that the existing techno-institutional models, in the guise of decentralized governance and management, fail to meet dependability and sustainability criteria. In contrast, techno-institutional models which are more dependable and sustainable are not being promoted. This is attributed to lack of capacity at the community level, which could be enhanced. Based on the management performance of different types of water supply schemes – from single-village schemes based on groundwater to regional schemes based on surface reservoirs – this chapter explodes the myth that regional water supply schemes are technically unviable and unsustainable from an economic perspective.

Case studies from two different agro-ecological regions of the south Indian Peninsula, Tamil Nadu and erstwhile Andhra Pradesh (presented in Chapters 6 and 7), show that well-maintained tanks that are primarily used for irrigation serve multiple water needs of rural households (irrigation, domestic, livestock and recreation) and also serve ecological purposes such as groundwater recharge. The study from Tamil Nadu examined how these multiple functions performed by the tanks change with climate variability. Efforts to revive traditional water systems such as tanks have focused solely on engineering measures of capacity enhancement (desilting, embankment stabilization) and on creating water users' associations to manage them. Such measures may have only limited success and result in a waste of public money, as revealed in the case of erstwhile Andhra Pradesh. It is argued that hydrological and socio-economic characteristics of the catchment are critical factors that determine the success of rehabilitation efforts. While droughts magnify problems of water insecurity, especially in hard-rock areas with poor groundwater endowment, predicting this phenomenon is extremely important to mitigate their social impacts. Even the recent attempts to revive traditional bodies in some of these states continue to be oblivious to these biophysical features of the regions.

Chapter 8 provides a methodology for predicting meteorological droughts, the likely impacts of rainfall variability on groundwater availability (water level fluctuations and recharge) and the drinking water situation in hard-rock regions. This chapter demonstrates the methodology by analyzing the probability and frequency of occurrence of meteorological droughts (and their probable intensity), how these droughts impact water level changes in wells in hard-rock regions in different seasons, and the utilizable monsoon recharge of groundwater in the context of Maharashtra. The model also predicts outcomes in terms of changes in cropping intensity and water levels in wells during summer months in such areas.

Good-quality water for drinking continues to be a public health challenge in many semi-arid and arid parts of India. While pathogenic contamination of surface water and water from shallow aquifers was often dealt through massive tubewell drilling programs in the 1980s and 1990s, chemical contamination of water in aquifers – from fluorides, chlorides, nitrates, bicarbonates, arsenic and TDS – is now a widespread problem, often causing irreversible public health damage. Increasing dependence on groundwater for irrigation, coupled with agricultural intensification, is resulting in a vicious circle of deteriorating groundwater quality, which adversely affects human as well as soil health. Access to safe drinking water is largely seen as a government responsibility. Though government policies are still focused on finding alternative safe sources, there is growing realization of the need to improve the locally available water quality for domestic consumption in rural areas.

Large-scale rural drinking water schemes with better-quality, dependable and sustainable regional sources have not materialized, especially in the water-scarce regions of India, barring Gujarat and the recent initiatives in states like Telangana. Decentralized solutions face challenges of appropriate technology, management capacity, financing options and environmental impacts. As a response, models of public–private partnerships, community-managed systems and social enterprises have emerged. Chapter 9 explores these models with the help of case studies to understand what needs to be done and by whom, for a sustainable and scalable solution.

Starting with a review of global experience, Chapter 10 uses the analysis of a large multipurpose water resources project in India (Sardar Sarovar), built to meet irrigation, domestic and industrial water needs in the arid and semi-arid regions of Gujarat, to illustrate the role of large surface water systems in ensuring a sustainable water supply in regions of high climatic variability and severe droughts. The analysis shows that gravity irrigation from the project had impacts far beyond the intended benefits of enhanced agricultural production. It resulted in benefits such as improved sustainability of drinking water sources in rural and urban areas, thereby reducing the cost of water supply, improving well yields and checking the incidence of well failures, and reducing energy use in groundwater pumping. This in turn resulted in higher income for well irrigators and higher wages for farm labourers in canal-irrigated areas.

In an attempt to provide policy directions, Chapter 11 provides a sketch of what a resilient and sustainable system might look like. The analysis suggests how it may be achieved. It illustrates the multidimensional nature of the strategies required to build resilient and sustainable rural water supply systems – in contrast to limited approaches that are either partial, economically unviable, institutionally weak or technology-driven. The analysis and policy suggestions presented here are vital for developing economies that are looking for a clear, multidimensional and sustainable goal of providing adequate, clean and sustainable rural water supply services.

The final chapter pulls together the analysis from the preceding chapters and summarizes the main observations. It lays out the conditions that threaten the sustainability of rural water systems. Important among them are: (1) the variations in hydrogeological conditions across regions that influence water supply as well as demand; (2) lack of (or non-use) of scientific data on water resources (aquifers); and (3) the hydraulic links between water systems. To achieve sustainable water security, water system design needs to take the local resources at scale, i.e. hydrologically appropriate, and take account of the multiple water demands (and priorities) of households in the given socio-economic context. Appropriate technologies are necessary to suit the local conditions (resource quantity and quality) rather than adopting common ones. Suitable institutional arrangements and modalities need to be promoted in order to manage and sustain the technologies and systems.

Overall, this book is a good-value addition to the limited literature on the subject. Its approach is comprehensive and scientific, which is not only rare but also desirable in the context of policy failures despite huge investments in the sector. The main reason for this is the absence of scientific approach and planning at the basin scale. This book clearly emphasizes the effectiveness of and need for such an approach. Though the case studies presented were not carried out at the basin level, they demonstrate the drawbacks of not adopting such an approach. The analysis highlights the need for a comprehensive approach in the future research in the sector. Thus, this collection of cases provides good insights for researchers, policy makers, development practitioners and funding agencies.

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