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A Review of Irrigation in the Lower Mekong Basin: Opportunities and Challenges from a Water-Food-Energy Nexus Perspective

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Agriculture is essential for economic growth in the Lower Mekong River basin (LMB), which plays a key role in ensuing water and food security of the riparian regions and provides livelihoods for tens of millions of people. Agricultural irrigation, hydropower development, increasing water demand from other sectors, and ecosystem protection necessitate taking a holistic approach when analyzing irrigation in the LMB. This paper examines the existing problems and opportunities of irrigation in the LMB from the angle of water-food-energy (WFE) nexus. We selected journal articles from the Web of Science database and imported them into CiteSpace, a bibliometric analysis software for visual exploration of scientific literature. The visualized results summarize the significance of authors and their affiliations in the selected body of literature, and the country-wise distribution. Four key research themes of LMB irrigation were identified based on the bibliometric analysis, for conducting an in-depth review. First, we investigated the factors that influence agricultural water management which directly affects irrigation water demand and supply as well as crop productivity. This part of the literature focused on water and land management and applications of various models to assess impacts on crop yields of irrigation management. Second, from the literature we analyzed the identified impacts of human flow alternations on downstream water uses, ecosystem health, and land subsidence due to groundwater overdraft. Nevertheless, upstream water management can mitigate downstream flood damages and augment dry-season water supply. Third, the spatiotemporal mismatch between water demand and supply pose a serious challenge for transboundary river basin management. Moreover, inappropriate water utilization, mismanagement and poor governance appear to be the more fundamental causes of the LMB water problems, thus calling for sound agricultural water policies within a riparian country and effective water management cooperation strategies across the riparian countries. Fourth, despite of the relatively few publications on the Mekong's WFE nexus so far, this particular topic is gaining growing attention in the Mekong basin research community. Moreover, it offers a valuable holistic perspective for analyzing irrigation in the LMB, by considering its connections with the food and energy sectors in one way or another, compared against many existing studies that view irrigation as solely an agricultural water management problem.