

DIGITAL TOOLS AND SMART STRATEGIES FOR WATER
MANAGEMENT IN SEMI-ARID AGRICULTURE
SDG 6

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The semi-arid region in Northeastern Brazil experiences limited rainfall, extreme evaporation, little water infrastructure, and social and economic difficulties that reduce farm productivity and sustainable use of water. This research sought to understand what international research has been conducted on digital technologies in water management and agriculture, including artificial intelligence (AI), Internet of Things (IoT), and remote sensing, and to understand the these technologies potential use for family farmers in the semi-arid Brazilian zone. A review was done utilizing international articles from 2020 to 2025 that appeared in indexed journals. Articles were selected based on three main themes: water resource management, sustainable agriculture in semi-arid areas, and application of AI in agriculture. Results indicated that advanced weather modeling, irrigation monitoring technologies and efficient irrigation systems can improve water use, forecast severe weather and contribute to more resiliency in farming systems. For instance, AI models such as Random Forests and neural networks involving crop growth simulations were very effective at objectively and accurately estimating crop water requirements, even in low density weather station areas, highlighting their potential for use in the Northeastern semi-arid region. These models provide real-time decision support and can be combined with IoT-based irrigation systems to improve crop watering efficiency and manage soil moisture. Despite multiple benefits, the review presented obstacles, including weak infrastructure, poor internet connectivity, high costs, and the need for farmers to learn how to use new digital technologies. Likewise, digital technologies must complement existing traditional techniques of water conservation, such as cistern systems and rainwater harvesting, in order to be viable alternatives. Public policies, subsidies, and technical training are also essential to help farmers use these solutions widely. In conclusion, these experiences provide valuable information on how to improve water efficiency and strengthen farming systems in semi-arid regions. However, adapting them to the Brazilian semi-arid needs a mix of technology, local knowledge, and government support. Subsequent research should focus on applied studies, and create AI applications or models according to the local environmental and socioeconomic context, so that digital solutions contribute to sustainable water management and improved food security.

Keywords: Water efficiency; Digital technologies; Artificial intelligence (AI); Irrigation.