Irrigation, Water Markets, and Agriculture in Bihar: Field Insights

Ashish Adhikari

Introduction

From June 9 to 20, 2025, I conducted a field scoping visit in Bihar along with Satish Bajracharya, as part of work with Yale's Inclusion Economics India Center. We visited four districts: Bhojpur and Gaya in the south, and Darbhanga and Araria in the north. Our primary mandate, under Inclusion Economics, was to assess the status of Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) and its convergence with Jeevika and other government bodies. At the same time, I also focused on three other key aspects: the overall irrigation scenario in the area, the functioning of informal water markets, and the availability and use of weather forecasting services, if any. In each district, we interviewed district officers of MGNREGA and Jeevika, block-level officials, and a cross-section of village residents including Self-Help Group members, large and small farmers, and landless households. Below, I present a detailed narrative account of our findings—beginning with irrigation scenario, followed by water rental markets and weather forecasting, and concluding with additional agricultural observations and related recommendations.

1 Traditional irrigation canals

Historically, Bihar's irrigation hinged on an extensive network of traditional canals—locally known as *ahar-pyne* in the south and seasonal feeder channels in the north—built decades ago under various state and central schemes. Ahar-pyne is a traditional water management system in Bihar that uses ahars (storage ponds) and pynes (channels) to harvest and distribute rainwater, differing from modern irrigation canals in that it relies on localized, gravity-based water flow and community maintenance rather than large-scale engineered supply from rivers or reservoirs. In Bhojpur and Gaya, nearly all primary canals lie defunct outside the monsoon months. Many sections have become unusable due to silt buildup, houses built along the sides, and lack of regular maintenance. Farmers in Ghoga village (Bhojpur) reported that government repair orders are issued only after repeated Gram Sabha resolutions, yet actual desilting and bank strengthening rarely occur. Even

where small check dams were built under MGNREGA or the Jeevika program, their utility is confined to the monsoon and early post-monsoon period; the earthen channels feeding those dams dry up by November, stalling irrigation until the next rains.

(a) Ahar-Pyne system in Gaya infested with weeds and lacks maintenance

(b) Ahar-Pyne system in Araria. A house is built over it rendering the canal useless.

(c) Dried irrigation canal in Darbhanga. Most of traditional irrigation canals are only functional during monsoon in Bihar

Figure 1: Traditional Ahar-Pyne irrigation systems observed in three different districts of Bihar

We observed that most of the traditional irrigation canals are seasonal—operational only during the monsoon and dry for the rest of the year. Examples of these canals are shown in Figure 1. Maintenance is minimal, and many canals are overgrown with weeds.

2 Groundwater irrigation pumps and Informal water market

Bhojpur

Irrigation in Bhojpur is mainly done using electric submersible pumps. Diesel pumps have become rare due to rising costs and removal of subsidies, while solar pumps are absent. Most farmers own electric pumps, so there is little to no wait time for rentals. Water is typically rented at INR 25 per hour or INR 600 per bigha. However, smallholders and sharecroppers still face challenges, especially with low and fluctuating voltage. Transformer upgrades haven't kept up with pump usage, making electricity unreliable in some areas. Some farmers must pay in cash and in advance to rent pumps, which can cause delays if they don't have the money on hand. High irrigation costs, particularly for those who rent, often reduce profit margins and make agriculture less viable.

Gaya

In Gaya, irrigation is difficult due to the rocky terrain and very deep groundwater levels, which can reach up to 600 feet. Installing a borewell here is costly—up to INR 200,000—making it unaffordable for many farmers. Traditional rain-fed systems like ahar-pyne and check dams are used but hold water only temporarily and depend entirely on rainfall. Some areas benefit from rainwater seeping in from nearby hills, but this is limited. Overall, irrigation is uncertain, and many farmers rely heavily on the monsoon, making agriculture in the region risky and water-scarce. For most smallholders, the high cost of borewell irrigation is not economically sustainable.

Figure 2: Rocky terrain and deep water tables make drilling difficult in Gaya.

Darbhanga

Darbhanga has a relatively better irrigation setup with shallower groundwater and access to borewells, ponds, and makhana ponds. Electric pumps are common, and diesel pumps are slowly disappearing. In areas where electricity supply is irregular or unavailable, farmers are adopting 7 HP solar pumps. Government schemes like MGNREGA and Jal Jeevan Hariyali have worked on reviving traditional water sources, but some assets are poorly located or underused. Solar pumps are being promoted by Bihar Renewable Energy Development Agency (BREDA) in areas without electricity, but awareness and access to credit remain challenges. Under The Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), or Prime Minister's Irrigation Scheme, around 500 acres have been brought under drip and sprinkler irrigation for vegetables and fruit crops, showing a gradual shift toward water-efficient farming. However, input and irrigation costs remain a concern, and for tenant farmers or those without irrigation infrastructure, profitability remains limited.

Araria

Irrigation in Araria mostly relies on shallow tubewells, built under the "Million Shallow Tube Well" scheme, which tap water from 20–40 meters deep. While groundwater is abundant, only about 25% of farmers own pumps. The rest depend on rentals, paying INR 150 per hour or INR 1,000 per bigha (0.25 hectares). The rental system is informal and sometimes unfair. The high cost of pump rental eats into farming profits and makes irrigation unaffordable for many small and marginal farmers.

Most pump owners still use diesel pumps, but about one-third now use electric pumps. However, the trend is rapidly shifting, with more farmers transitioning from diesel to electric pumps. There is a solar pump scheme in the area that provides three levels of subsidy—35%, 65%, and 75%—depending on the size of the pump.

3 Weather Forecasting Services

Weather Forecasting Access Across Districts

Bhojpur

There is no formal access to weather forecasting among most farmers. SHG members in Ghoga village noted that they had demanded forecasting services through Jeevika, but no support had arrived. Farmers expressed strong interest in adopting forecasting tools if made available. At present, they rely on observation or word-of-mouth for weather forecasting.

Gaya

No formal or localized weather forecasting system is in place. Residents depend on natural signs, and even MGNREGA and Jeevika officials did not mention any forecasting integration in planning. This gap is particularly problematic in a semi-arid zone where rainfall timing is critical.

Darbhanga

Darbhanga stands out for having a relatively better weather advisory system. The Krishi Vigyan Kendra (KVK) issues a 3-day agro-advisory bulletin, considered accurate within a 5 km radius. These bulletins include rainfall, temperature, humidity, and cropping suggestions and are sent out twice a week (Tuesdays and Fridays). Forecasts are also disseminated via TV (Krishi Darshan), newspapers, Kisan Call Centers, and mobile updates. The Bihar Renewable Energy Development Agency (BREDA) has installed 10 weather stations that monitor real-time conditions. Private forecasting tools like SkyMet and IFFCO Weather are used by large farmers who can afford premium services.

Araria

Weather forecasting infrastructure is limited. A notable initiative is the "Paani App," developed by Krishi Vigyan Kendra and Bihar Agricultural University. It provides 5-day forecasts, but adoption remains low. Most farmers are not aware of or do not use these services. Some data is circulated via BAU/IMD websites, but offline outreach is poor.

4 Other findings

4.1 Crop Insurance

In Bihar, crop insurance exists on paper but is not meaningfully accessible for most small and marginal farmers. From our conversations in Darbhanga and Araria, it was clear that insurance schemes are not linked to individual farm-level losses. Instead, compensation is provided only when a block or district is officially declared as drought- or flood-affected by the India Meteorological Department (IMD). This means that even if a farmer suffers complete crop failure due to excess rain or a dry spell, they are not eligible for any payout unless the entire area is officially recognized as affected. This creates a significant gap between actual losses on the ground and the coverage provided by the scheme. Several farmers we spoke to expressed frustration that the process is not transparent and often excludes them, despite visible damage to their fields.

Moreover, the process for claiming insurance is burdensome. It requires documentation, official notifications, and verification at multiple administrative levels. Many farmers, especially those with low literacy or limited support from local institutions, find it difficult to navigate the system. In Araria, there was little awareness about the crop insurance process or how to register for it, and in Bhojpur and Gaya, most farmers told us they had never received any compensation even after losing crops to erratic weather. This disconnect suggests that while crop insurance is positioned as a safety net, it currently fails to provide reliable or timely relief to those who need it most. Some government officers acknowledged this gap, noting the need for better targeting and simplification of procedures, but practical solutions or reforms were not clearly outlined.

4.2 Agricultural Infrastructure and Market Linkages

Across all districts, the lack of functional irrigation infrastructure directly affects crop choice, timing, and productivity. Farmers often limit themselves to water-efficient or monsoon-aligned crops due to uncertainty in irrigation. In Bhojpur and Koilwar, share-cropping dominates, and many farmers avoid high-risk crops like vegetables. In Araria, farmers reported overproduction of maize and expressed the need for local processing industries to avoid distress sales. Current maize prices (INR 1600–1700/quintal) are far below urban rates (INR 2300–2400), with no facility for value addition. Organic farming and drip irrigation systems are being promoted in Darbhanga, but only among agriculture-department-covered plots. Private adoption is still rare. Similarly, crop insurance schemes are present in theory, but non-functional at the household level unless entire zones are declared disaster-affected.

5 Conclusions and Recommendations

This field visit across four districts of Bihar highlighted several key challenges in irrigation, water access, crop insurance, and agricultural planning. While electric pumps are becoming more common, many small farmers still struggle with high irrigation costs, unreliable electricity, and limited access to pump rentals or ownership. Groundwater levels vary widely—shallow in Araria and Darbhanga, but extremely deep in Gaya, making borewell irrigation unaffordable for many. Solar pump schemes are being introduced, but uptake remains low due to poor awareness and financing hurdles.

Informal water markets operate widely, but access remains unequal for tenants, smallholders, and farmers with limited cash. In some cases, pump rentals are only given with upfront payment, excluding the poorest. At the same time, most farmers do not have access to timely and localized weather forecasts, which affects crop planning and increases vulnerability to rainfall shocks. Crop insurance schemes exist but rarely benefit individual farmers due to area-based thresholds and a complex claims process.

Based on what we observed during the field visits, it seems that irrigation access, weather information, and crop insurance could be improved in several ways. For example, it might be helpful if solar pump schemes were made more accessible by simplifying the application process and spreading more awareness through local networks like SHGs or Jeevika. In areas where electric pumps are growing in use, improvements to electricity supply and transformer upgrades could make a big difference. Water rentals are often informal and not always fair—especially for landless or tenant farmers—so maybe local groups or panchayats could play a role in making access more equitable. On the weather side, simple and regular bulletins, possibly shared through SMS or local radio in local languages, could help farmers make better decisions. And finally, crop insurance is available in principle but rarely reaches individual farmers; making the process easier to understand and linking payouts more closely to individual losses, rather than waiting for block-level disaster declarations, could potentially increase trust and uptake. These are just reflections based on limited observations, and further research would be needed to understand what approaches work best in different local contexts.

6 Some pictures during Bihar Scoping

Figure 3: Taking interview with a local farmer in Bhojpur, Bihar

Figure 4: Field visit in MGNREGA plantation site in Gaya, Bihar

Figure 5: Weed infested government pond which is also used for irrigation for nearby fields

Figure 6: A farmer grazing buffaloes on the fields of Darbhanga