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INSIGHTS FROM THE FIELD

Every Drop Counts: Gendered Impacts of Solar Pumps, Within and Outside Rural Households in Chhattisgarh

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1. INTRODUCTION

In February 2025, I visited several remote tribal villages in Korba district, Chhattisgarh, to conduct a survey and explore aspects of solar photovoltaic (SPV) pump adoption. These villages were located in densely forested, hilly terrain. Residents often experienced power outages lasting several days and unstable mobile networks. They predominantly lived in *kutcha* houses (made of mud and bamboo thatch or a tile roof). As in most parts of rural India, their lives and livelihoods revolved around the monsoons (rain-fed agriculture) and seasonal manual labour. On my way to Pahargaon in Pali block, I came across a public handpump—one of several sources of potable water, including *nalas* (streams), *kuis* (small wells), and *dhodhi kuas* (natural pits). Women and young girls were waiting in a serpentine queue, holding utensils of various shapes and sizes. A brief conversation with them revealed that they had walked distances of between half a kilometre and one and a half kilometres to collect water. This kind of time and labour-intensive, gendered drudgery is quite common, not just in India but across the entire Global South.

In the *basti* (hamlet) in Pahargaon, I met many women from households that had adopted SPV pumps. Unlike the handpump group that I had encountered earlier, these women had access to a stable source of water close to their homes. They reported that they could complete household chores more comfortably because of the time and energy they saved by not having to travel long distances to collect water. Their homes were usually

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adjacent to the field where the SPV pumps were installed for irrigation. However, the water from these pumps was also used for drinking, bathing, cooking, and washing clothes, among other purposes.

Signs of irrigation using SPV pumps are clearly visible to any visitor to Pahargaon. Wheat, *urad* (black gram), and *matar* (peas) are sown during the rabi season and are part of double-cropping cycles. Additionally, most households are also engaged in vegetable cultivation—a welcome shift in cropping patterns compared to the pre-SPV pump period, when farmers primarily relied on mono-cropping of paddy (particularly during the kharif season) due to limited or no access to irrigation. These crops and vegetables are primarily used for self-consumption. They reduce the household expenditure on food, and the surplus produce is sold in the market to generate additional income. The SPV pumps have significantly transformed and eased the daily lives of all the households that have adopted them, reducing the drudgery of agricultural and domestic work. Although both men and women are involved in agricultural work, it is mostly women who are responsible for domestic chores. Such a gendered division of labour is the widely prevalent norm in rural India.

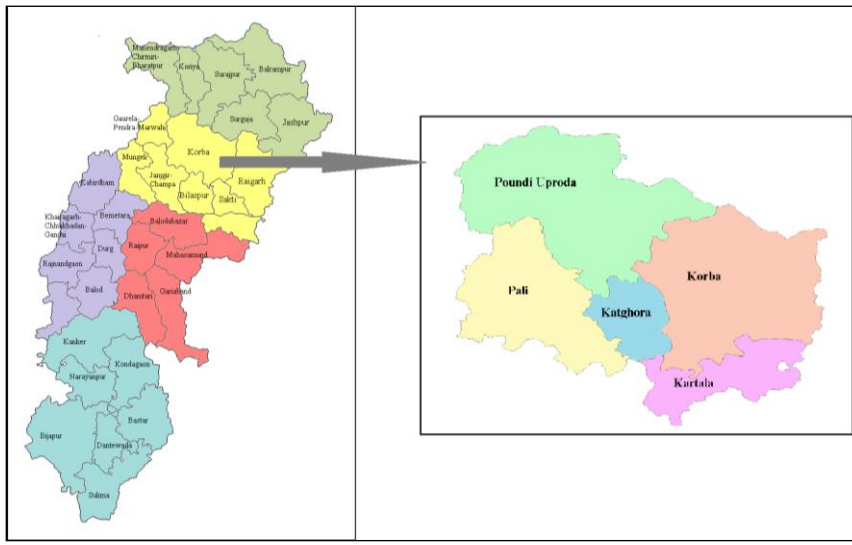
Several studies have documented improvements in livelihoods and income resulting from the adoption of SPV pumps (Burney *et al.* 2010; Suman 2018; ICA–IIEC 2022; Rahman and Jain 2022; Buisson *et al.* 2024; Sunny *et al.* 2023; Bassi 2017; Shah 2009). However, the contribution of solar pumps in reducing the drudgery of those engaged in household work has received limited attention. Similarly, the gendered impact of piped water connections is well-known. While piped water connections are centralized, requiring a minimum scale of operations and involving substantial expenditure for their construction and maintenance, SPV pumps do not require the first two of these requirements. Furthermore, in Chhattisgarh, the prohibitively high upfront cost of SPV pumps (typically ranging between INR 3.5 lakh and INR 5 lakh, depending on capacity and specifications) is addressed through the 90%–95% subsidy provided under the state government's Saur Sujala Yojana (Chhattisgarh State Renewable Energy Development Agency 2025). The scheme is implemented through the state's renewable energy development agency, making SPVs both affordable and sustainable[1] for small and marginal farmers. The out-of-pocket expenditure for beneficiaries

[1] In the surveyed districts, piped water coverage remains low. Although, taps were installed under the *Jal Jeevan Mission* (JJM) over a year ago, water supply has not yet commenced. Such gaps between infrastructure provision and service delivery highlights the continued reliance on traditional water sources, thereby underscoring the importance of SPV pumps for both domestic and agricultural needs.

ranges from INR 7,000 to INR 20,000, depending on the pump capacity and the social category of the applicant, in addition to a processing fee of INR 3,000 and INR 4,800 (for 3 HP and 5 HP pumps, respectively).

2. THE STUDY AREA

Figure 1: Location Map of the Study Area



Source*:* Author's compilation
Note*:* The left panel shows a district-level map of Chhattisgarh state, and the right panel shows the five blocks that were studied within the Korba district.

Chhattisgarh's demographic is predominantly rural, with agriculture being the primary occupation for approximately 70% of its population. SPV pumps are promoted in the region through the state's Saur Sujala Yojana, launched in 2016 by the Chhattisgarh Renewable Energy Development Agency (CREDA).[2] In 2025, Chhattisgarh reported the highest number of SPV pump adoptions (119,282 pumps) across all states (MoSPI 2025).

[2] CREDA is the state's nodal agency for promoting non-conventional and renewable energy sources. It was formed in 2001 by the Department of Energy, Government of Chhattisgarh. The parent (amended) policy can be accessed at https://creda.co.in/Image/Saur%20Sujala%20Yojana_11ece56ffb70baef9225b42e99c9ac7b.pdf. Farmers owning more than one acre of land are eligible for the scheme and can receive a subsidy of up to 95%.

I conducted the survey between January and March 2025. My primary objective was to identify the drivers for and barriers to the adoption of SPV pumps in two selected districts of the state—one of which was Korba. Data was collected through semi-structured interviews, covering over 100 beneficiaries of subsidies for SPV pumps from all five blocks of the district (Figure 1).

The interview schedules were prepared to capture a variety of information. The direct questions concerned the direct impact of irrigation on shifts in agricultural practices, livelihood opportunities, and changes in income, if any. The indirect questions captured the qualitative and mostly invisible intra-household impacts, such as changes in dietary diversity or time use (Kabeer 1999; Meinzen-Dick *et al.* 2014). As a woman myself, I was able to gain access to the inside of households and witness some of these changes firsthand. This also facilitated more intense interactions with women in the (women-only) safe spaces within households. This is particularly significant in the context of discussing gender segregated work in rural India. I used open-ended questions and the case study method to document the experiences of women from households with SPV pumps. Responses were also collected from women belonging to households without SPV pumps. The responses from these two different types of respondents helped me identify the impact of SPV pumps on women's daily lives.

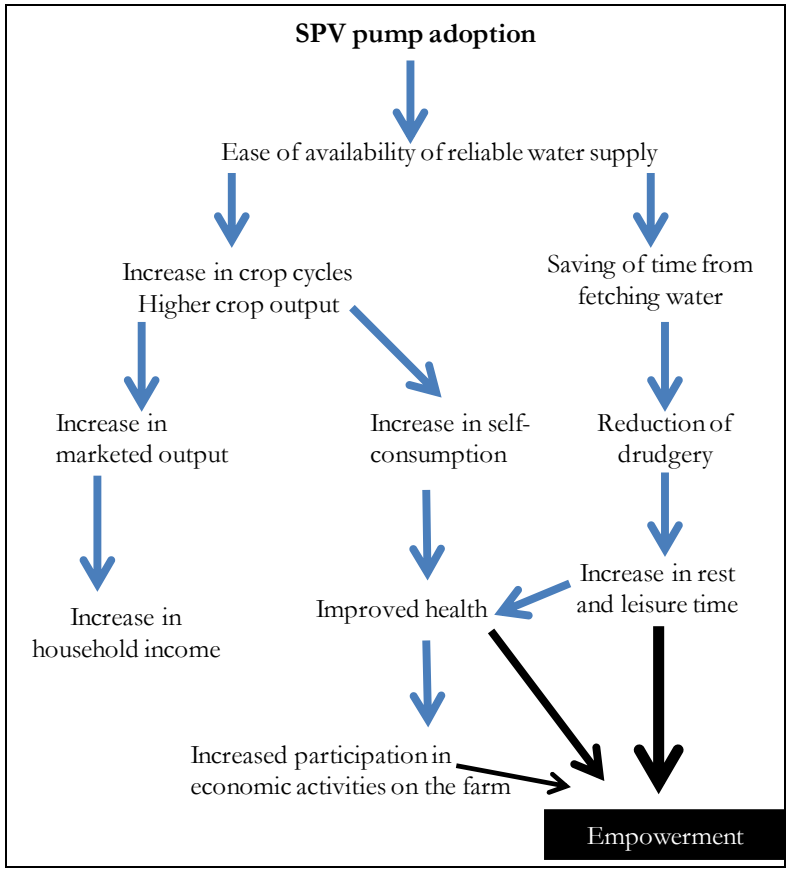
3. TRACKING THE GENDERED CO-BENEFITS OF SPV PUMPS

Figure 2 illustrates the framework that connects the causal variables and their respective impacts. This is based on my experience conducting a field survey in Korba district. The figure shows SPV pump adoption as the exposure (treatment) variable and women's empowerment as the outcome variable. The term "empowerment" is used here as a broad construct, with economic (thinnest arrow) and non-economic (thicker arrows) dimensions. The outcome results from three intermediate paths or outputs—reduced drudgery, improved health, and greater engagement in economic activities—that originate from improved access to water.

An outcome always appears after the output; yet, the lag between the two can be considerable (White 2009). In Figure 2, the thicker the arrow, the greater the lag. With SPV pump adoption, an immediate increase in rest and leisure time among women is observed. However, improvements in health (higher food consumption is a confounder here) occur with some lag. Not having to travel far to fetch water led to less pain and fatigue, as reported by many respondents. This is curative in nature, somewhat restoring the

deterioration in health. Health improvements can occur only subsequently, similar to the growth of an economic system, which develops only after it becomes stable.

Figure 2. Causal Diagram: The Gendered Impacts of SPV Pump Adoption



Source: Author's illustration

Meanwhile, participation in farm activities is dependent on many other factors, including social norms that govern women's engagement outside their homes. Some women respondents began using the time saved from not fetching water to cultivate vegetables for their own consumption and then sell the surplus produce locally. For instance, Asha Devi[3] from Jemra, Pali block shared: "When we did not have a pump, I used to constantly worry about fetching water before doing anything else. It was the first task

[3] All respondent names have been changed in the paper to maintain anonymity.

of the day. Now, I have sufficient time to grow vegetables and rest" (translated from Chhattisgarhi into English by author). Likewise, Manoj Kurre from Laad, Poundi Uproda block, compared his pre- and post-SPV pump days: "Earlier, I used to travel three kilometres with my mother to Hasdeo River to wash clothes. We have a small wooden well in our home for drinking and other domestic uses. Our family is grateful for this scheme—it has truly improved our lives" (translated from Chhattisgarhi into English by author). Similarly, Rajesh Markam's wife from Pahargaon, Pali block, recounted: "Fetching water was our primary chore every morning and evening, whether from the river or the handpump. I used to have back pain and swollen legs. Now, I feel more relaxed. I can help in the fields, and my husband has time to engage in MNREGA or other wage labour work" (translated from Chhattisgarhi into English by author).

Figure 3. Women Travelling Long Distances to Draw Water in Laad village, Poundi Uproda Block (18 February 2025)

Figure 4. A Farmer Using an SPV Pump in Their Field in Jemra village, Pali Block (21 February 2025)

Source: Photographs captured by author

4. CONCLUSION

All these responses, albeit anecdotal, categorically point to greater availability of time. These case studies also reveal the multifaceted impacts of SPV pumps in Chhattisgarh's remote and tribal regions—transforming livelihoods, empowering women, reducing their drudgery, and generating an oft-neglected co-benefit: reshaping men and women's time-use patterns. The transformative potential of this intervention is tremendous. Most importantly, it is virtually costless (from the perspective of the beneficiary),

not just compared to other electricity- or diesel-fuelled irrigation options, but also in absolute terms due to the substantial government subsidy.

While several infrastructure and groundwater-related issues, such as low borewell water levels, borewell collapse, inadequate casing, theft of pipes, cables, and panels, and panel damage have been reported by respondents, given the variety of benefits, the advanced social position of its beneficiaries, and its cost-saving potential and environmental sustainability, this intervention can be a key instrument in facilitating a truly just energy transition.

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Ethics Statement: I hereby confirm that this study complies with requirements of ethical approvals from the institutional ethics committee for the conduct of this research.

Data Availability statement: The data used to support this research cannot be shared openly to protect the privacy of study participants and is stated in the paper.

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