OORJA
ACCESS - INCLUSION - IMPACT

4th Wheel Social Impact

OORJA IMPACT REPORT 2024

Turning Energy Into Equity

JULY 2025

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Photo Courtesy: Sharon Avraham

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1. EXECUTIVE SUMMARY

Oorja's 2024 Impact Report presents evidence of meaningful improvements in agricultural productivity, cost efficiency, and household well-being for smallholder farmers in Uttar Pradesh, India. Through its solar-powered irrigation service and Climate-Smart Farmer Advisory, Oorja continues to support farmers in addressing key challenges such as water access, rising input costs, and climate variability.

Study Overview

The impact assessment, conducted by 4th Wheel Social Impact using a quasi-experimental design, covered 333 farmers (222 Oorja customers and 111 non-customers) across 49 villages in the districts of Bahraich, Barabanki, and Hardoi. Data was collected across three agricultural seasons—Rabi, Zaid, and Kharif—and included household surveys, focus groups, and SROI analysis.

Key Findings

1. Social Return on Investment (SROI)

Over a four-year period, Oorja generated an SROI of 1:4.35, meaning every rupee invested returned INR 4.35 in social, economic, and environmental value. The outcomes include increased incomes, reduced farming costs, enhanced food security, and improved gender equity.

2. Higher Crop Yields and Diversification

Oorja customers achieved higher yields across key crops:

- Rice yields were 11.4% higher in Kharif
- Wheat yields rose by 19% in Rabi
- Peppermint yields improved by 62% in Zaid

Farmers also diversified into high-value and climate-resilient crops such as chickpeas, pulses, and vegetables.

3. Positive Income Trends

Despite retaining more produce for home consumption, 89% of customers reported an increase in income. This was attributed to reduced cultivation costs, better yields, and market sales of cash crops.

4. Increased Food Security and Balanced Crop Use

Oorja's services encouraged a more sustainable cropping model. While commercial crops like peppermint and potatoes were mostly sold, customers retained more rice, wheat, and pulses for household consumption, boosting year-round food security.

5. Cost and Input Reductions
Customers reported up to 50% lower costs on irrigation, fertilizers, and pesticides compared to non-users. On average, seasonal irrigation costs were INR 1,700–2,000 lower for Oorja users. Usage of chemical inputs was also significantly lower, with farmers shifting toward natural alternatives.

6. Women's Empowerment and Reduced Drudgery
Solar irrigation enabled 73% of women to manage irrigation independently, enhancing their autonomy. Time saved was redirected to household care and other income-generating activities, improving overall quality of life.

7. Shift to Solar-powered Irrigation
Solar pump usage among Oorja customers rose from 29% to 87%. The Pay-Per-Use model played a central role in making clean energy accessible by eliminating upfront capital costs and maintenance burdens.

Regional Variations and Program Duration

District-level analysis revealed that the depth of impact correlates with the length of Oorja's engagement. In Bahraich (4–5 years), farmers experienced stronger outcomes in income growth and food security. In contrast, Barabanki and Hardoi (2–3 years) reflected early-stage gains, such as cost savings and operational convenience.

Conclusion

The findings affirm Oorja's integrated model as both impactful and scalable. With tailored district-level strategies, continued engagement, and improvements in service delivery, Oorja is well-positioned to sustain and expand its contributions to climate-smart agriculture and rural development.

2. INTRODUCTION

Oorja is a leading innovator in Farming-as-a-Service (FaaS), committed to transforming the agricultural sector through sustainable practices and clean energy solutions. With a mission to empower one million farmers globally by 2030, Oorja aims to address the persistent challenges faced by smallholder farmers, including low productivity, high operational costs, and vulnerability to climate change. By integrating renewable energy-powered technologies, Oorja provides farmers with the tools and resources necessary to enhance their productivity, increase income, and improve resilience to environmental stresses.

Oonnati: Irrigation-as-a-Service

The Oonnati solar-powered irrigation system provides a sustainable and cost-effective solution for smallholder farmers, with a tariff of INR 2-4 per m^3 of water pumped. The system utilises a 5 HP submersible pump powered by a 5 kWp or 3kWp photovoltaic (PV) array. It is equipped with a mechanical analogue flow meter and remote monitoring of PV generation to ensure optimal performance. A community-based model is employed, where each pump serves 15-20 farmers, covering approximately 20-25 acres, ensuring equitable distribution of water. With water usage metered and charges based on the volume of water consumed, this approach encourages efficient water use and supports fair pricing within the farming community.

Oorvar: Climate-Smart Farmer Advisory

Oorvar, the Climate-Smart Farmer Advisory service, focuses on enhancing productivity and equipping farmers with the knowledge to adapt to climate-related challenges. Key offerings include training on growing high-value, climate-resilient crop varieties tailored for different seasons, and optimising inputs with climate-resilient seeds and natural farming practices. Farmers also receive agronomic training in systems like System of Rice Intensification (SRI) and System of Wheat Intensification (SWI), which increases water efficiency and is expected to boost yields. Oorvar provides support in pest management, sowing timing, and access to digital tools, helping farmers make informed decisions to cope with climate impacts and improve farm resilience.

3. STUDY DETAILS

To assess the impact of Oorja's interventions, the study used a quasi-experimental design. The research employed three key methods:

- **Pre-Post Analysis,** which compared baseline data with post-intervention data across three agricultural seasons (Rabi 2023-24, Zaid 2024, and Kharif 2024) to track changes in indicators such as crop productivity, income, and farming practices.
- **Comparison Group Analysis,** where farmers using Oorja's services were compared with a control group of non-customers identified during the baseline period.
- **SROI Analysis,** which quantified the social, economic, and environmental impacts of Oorja's services in monetary terms to evaluate the return on investment.

The study sample consisted of 333 farmers, with 222 customer farmers who use Oorja's solar-powered irrigation and advisory services, and 111 comparison farmers from the same regions who do not use Oorja's services. The research employed surveys and focus group discussions as the primary engagement methods for both customer and comparison groups.

The study was conducted in 49 villages in Uttar Pradesh, across Bahraich (27 villages), Barabanki (10 villages), and Hardoi (12 villages) districts. The sample for the study was distributed across three districts, with the highest representation from Bahraich, accounting for 67% of the total respondents. Hardoi followed with 22%, while Barabanki constituted 11% of the sample. 9 members of Oorja's internal team participated in virtual focus group discussions to provide insights from the service provider's perspective.

While the study provides valuable insights, limitations include respondent availability (with some baseline participants unavailable for the midline), potential respondent fatigue leading to a smaller sample size, and the fact that findings may not be fully generalizable to other regions or populations with different conditions.

4. WHAT OUR CUSTOMERS SAY

For Oonnati, 64% of customers expressed satisfaction with the irrigation service, with Barabanki having the lowest satisfaction at 55%. 81% of customers reported receiving water on time, though 19% experienced delays due to inconvenient pump locations and overcrowding. Technical downtime was minimal for 83% of customers. Key benefits identified by customers included reduced effort in carrying pumps (66%) and lower irrigation costs (41%). However, 22% of customers faced challenges, particularly with uncooperative pump operators (65%) and low water output (15%). Regarding tariff fairness, 25% felt the price was fair, while 40% disagreed, indicating a need for a review of the tariff structure.

For Oorvar, feedback revealed that 11% of farmers received soil testing, and all reported increased crop yield and reduced input costs. Paddy seed distribution reached 69% of farmers in Bahraich, with 82% of farmers growing these varieties for the first time. The main reason for selecting the seeds was the belief in better yields (88%). WhatsApp groups were utilised by 36% of farmers, with 78% finding them useful. Training programs received positive feedback, with 91% of farmers finding them beneficial. However, 74% of farmers did not attend due to lack of awareness or time constraints. The most valued training aspects were seed treatment (75%) and water utilisation practices (70%). The feedback also identified key areas for improvement, including enhanced engagement in WhatsApp groups, increased in-person visits by farmer advisors, and more structured training sessions.

Customer Satisfaction Score (CSAT) & Customer Effort Score (CES)

I. CES[1]: Farmers report **high satisfaction** with Oonnati's solar irrigation services, with 73% finding the system 'convenient' or 'very convenient'— a testament to its user-friendly design. Many emphasise how the simple "switch-on-and-irrigate" functionality has brought reliability to their farming cycles, ensuring they can "plant on time, every season" without dependence on other water sources.

II. CSAT[2]: The **64% 'good' or 'very good' service rating** reflects an appreciation for the tangible benefits, like the time savings redirected to childcare or livestock *"More time to help my children study"* and yield improvements linked to consistent irrigation *"My wheat yield increased by 30% with timely irrigation"*.

5. POVERTY PROBABILITY INDEX

The Poverty Probability Index (PPI) was administered to all 222 Oorja customer households across Bahraich, Barabanki, and Hardoi to estimate the likelihood of living below the $3.20/day poverty line (approx. INR 274/day). On average, 64% of households were found likely to fall below this threshold. While not a definitive poverty measure, this provides a baseline for tracking changes in poverty likelihood over time among Oorja's customer base.

[1] CES, is a metric that measures a product or service's ease of use to customers, and it reflects the amount of effort a customer had to exert to use a product or service, find the information they needed, or get an issue resolved.

[2] CSAT measures a customer's immediate satisfaction with a product, service, or interaction. CSAT aims to capture customer feedback right after they engage with a company's product/service, allowing the company to gauge and respond to feedback quickly.

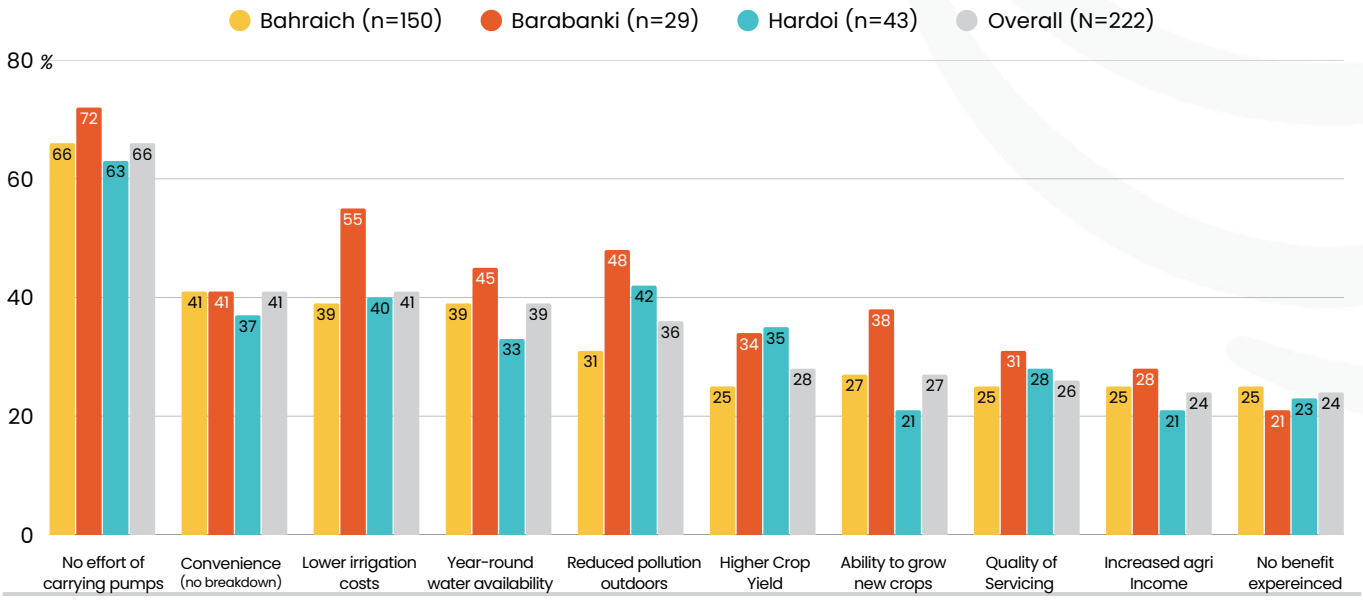
6. SOCIAL RETURN ON INVESTMENT

The Social Return on Investment (SROI) mapped key outcomes experienced by farmers, including improved crop yields, reduced irrigation and input costs, increased income, enhanced food security through self-consumption, reduced drudgery—especially for women—and environmental benefits from lower diesel and chemical usage. These outcomes were then monetised using financial proxies derived from farmer-reported data, government rates, and market benchmarks. To ensure accuracy and avoid overestimation, standard discounting factors such as deadweight, attribution, displacement, and drop-off were applied. Based on these calculations, the SROI ratio was derived to quantify the social, economic, and environmental value created for every rupee invested in Oorja's services.

6.1 Key Outcomes

The outcomes experienced by farmers using Oorja's solar irrigation services reflect significant improvements across agricultural, economic, and social dimensions. The most commonly cited benefit was the reduction in physical effort from not carrying pumps (66%), followed by fewer breakdowns (41%) and lower irrigation costs (41%). Year-round water availability was noted by 39% of customers. Higher crop yield and the ability to grow new crops were reported by 28% and 27% of customers, respectively. Other recognised benefits included quality of servicing (26%) and increased agri income (24%). Only 24% of customers stated they experienced no benefits, suggesting a broad positive perception of the services.

Figure 1: Benefits of using Oorja Solar Irrigation Services



6.1.1 Increased Crop Diversification

The data highlights interesting trends in crop diversification among farmers using Oorja's solar pumps (customers) compared to the comparison group. Customers demonstrate a broader range of crop choices, particularly in the Rabi and Zaid seasons, indicating a shift toward a more diversified agricultural system. This includes the adoption of high-value crops like peppermint, vegetables, and groundnut, alongside traditional staples such as rice and wheat. In contrast, comparison groups remain more focused on staple crops, with limited engagement in pulses or other high-value crops.

6.1.2 Higher Cropping Intensity

The comparison group cultivates more land on average (19 bighas vs. 15 bighas) and owns/leases slightly more land (9.5 bighas vs. 8.5 bighas). However, customers achieved an average cropping intensity of 198%, while the comparison group recorded an average cropping intensity of 186% which reinforces the positive impact of Oorja's interventions on agricultural productivity and land use efficiency.

1 acre = 5 bighas in our operational areas

6.1.3 Improved Yields for Crops across Seasons

In the Kharif season, customers using Oorja's solar pumps demonstrated more stable and higher yields for staple crops like rice compared to the comparison group – 1832 kg/acre vs. 1644 kg/acre, reflecting an 11.4% increase in yield. This stability is likely due to the consistent water supply provided by solar irrigation, which mitigates the risks of water scarcity during the monsoon-dependent Kharif season. Additionally, customers showed a greater willingness to cultivate crops like maize, even on less optimal land. This suggests that the reliability of solar-powered irrigation encourages farmers to diversify their cropping patterns, despite minor yield variations.

During the Rabi season, customers achieved higher yields for wheat – 1422 kg/acre compared to 1195 kg/acre in the comparison group – a 19% increase, highlighting the importance of reliable irrigation for Rabi crops, which often face water shortages due to declining groundwater levels. For crops like mustard, while yields were slightly lower among customers, the broader adoption rate indicates that solar irrigation supports diversification, even on marginal lands. In contrast, higher potato yields among the comparison group may reflect differences in farming practices, or access to high-quality seeds, rather than irrigation alone.

In the Zaid season, customers achieved notably higher yields for high-value cash crops like peppermint – 78 kg/acre compared to 48 kg/acre in the comparison group – a 62% increase. This demonstrates the effectiveness of solar irrigation in supporting crops that require a consistent water supply, particularly during the dry Zaid season. Customers also diversified into nutrient-rich crops like chickpeas and peas with 467 kg/acre and 1105 kg/acre, respectively. The absence of these crops among the comparison group may indicate barriers such as water scarcity or lack of awareness regarding their cultivation.

6.1.4 Market Sale of Crops and Self-Consumption

Oorja's customers demonstrate a measured approach to crop utilisation. Between baseline and midline, these farmers have increased retention of staple crops while maintaining market sales of high-value produce.

- **Improved Food Security through Self-Consumption:** Oorja customers have increased retention of staple and nutrient-rich crops for household consumption. Rice kept for self-use rose from 29% to 36% of harvests, while the comparison group saw a slight decline (32% to 30%). Wheat kept for self-consumption increased, rising from 28% to 44% of total produce. The approach to pulses is noteworthy - customers now retain 100% of Kharif pulses (versus 25% in the comparison group) and 69% of Zaid pulses. Seasonal patterns demonstrate that 40% of Rabi pulses and 45% of Zaid maize are retained for household use (compared to 20% and 34% respectively in the comparison group). This is complemented by the consumption of peas (58%) and newly adopted chickpeas in the midline (32%), creating a more diverse, nutrient-secure household food supply.

- **High-Value Cash Crops for Income Generation:** While prioritising household nutrition, Oorja customers maintain focus on income generation through near-total sales of high-value commercial crops. Peppermint (96%), potatoes (86%), and vegetables (100%) continue to be almost entirely sold, demonstrating the economic viability of these crops.

This balanced approach - maximising returns from cash crops while retaining staples - contrasts with comparison farmers who typically sell over 80% of both commercial and nutritionally valuable crops. This evolving pattern reflects a dual benefit of Oorja's interventions: sustained income from market crops alongside improved year-round nutrition from retained staple crops.

6.1.5 Switch to Environmentally Sustainable Irrigation Systems

The irrigation methods in the customer group showed a shift towards solar pumps, with adoption increasing from 29% at baseline to 87% at midline, reflecting high uptake facilitated by Oorja's Pay-Per-Use service. In contrast, the comparison group largely relied on diesel pumps (77%) and tubewells or submersible pumps, with minimal access to or adoption of solar pumps, likely due to the absence of supportive service models. Data from the three districts shows a strong preference for solar pumps among customers– driven not just by the technology itself, but by Oorja's Pay-Per-Use model, which removes barriers such as upfront capital investment and maintenance responsibilities. This model has enabled smallholder farmers to access solar-powered irrigation affordably and reliably, leading to long-term economic and environmental benefits, including lower operational costs and reduced carbon emissions.

6.1.6 Reduced Irrigation Costs

While a significant portion of both customers and the comparison group perceive irrigation costs as relatively high (with data indicating that 43% of customers and 62% of the comparison group consider costs as "very high" or "high"), a notable difference emerges when focusing on the perception of affordability.

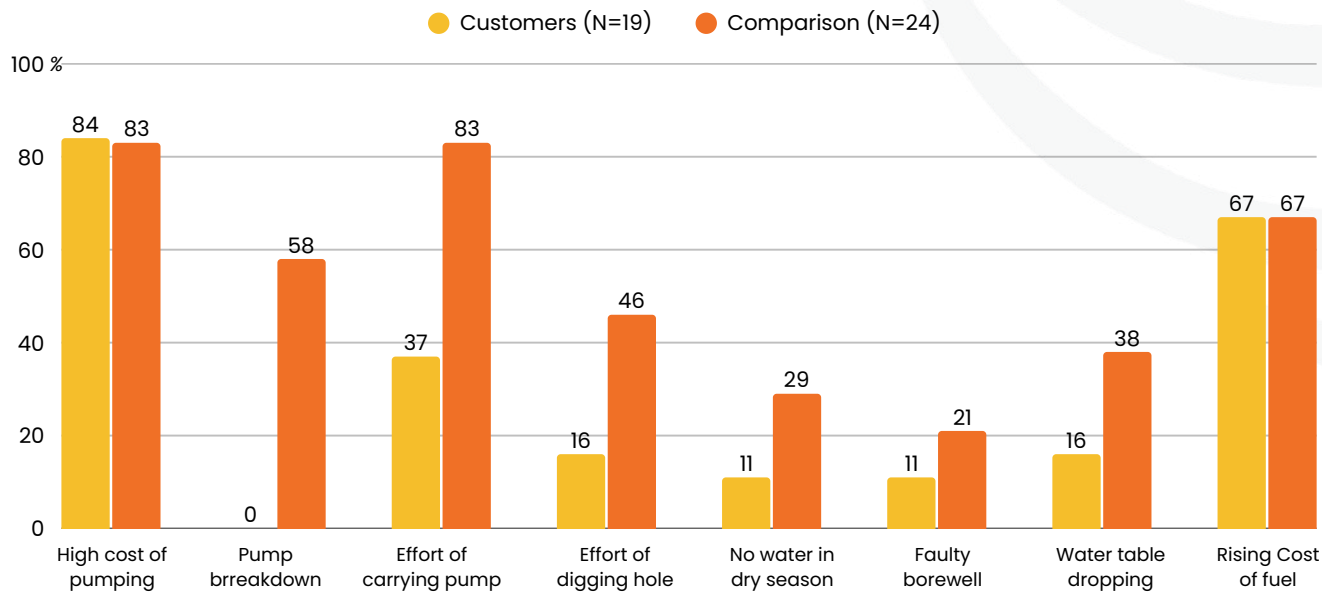
- **Electric Pump Usage and Costs:** Customers pay significantly less for electric pumps across seasons. In Bahraich, customers pay an average of INR 3,870 in Kharif, while the comparison group pays INR 5,532.

- **Diesel Pump Usage and Costs:** Comparison groups have a higher percentage of rented diesel pumps (64%) compared to customers (28%), reflecting customers' lower dependency on diesel pumps due to their reliance on cost-effective solar irrigation solutions. The average cost per hour for rented diesel pumps is INR 45 for customers and INR 49 for comparison groups, with customers also consuming less diesel (224 litres) compared to the comparison group (341 litres).

6.1.7 Ease of Irrigation

Customers, who use solar irrigation generally report higher levels of satisfaction and convenience with their irrigation system. The comparison group faces more challenges related to the cost, effort, and maintenance of traditional irrigation systems, pump breakdowns and the effort involved in carrying and digging. Customers also perceive more timely availability of irrigation compared to the comparison group, further reinforcing the advantages of solar irrigation in terms of efficiency and reliability.

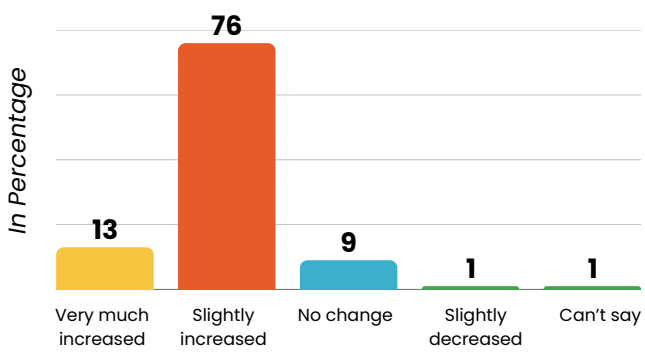
Figure 2: Reasons for dissatisfaction associated with traditional irrigation methods



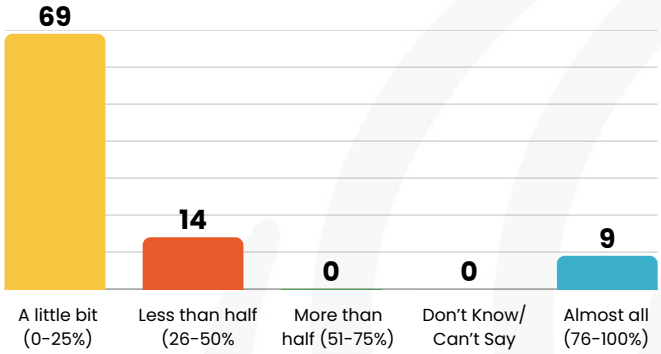
6.1.8 Improvements in Incomes

The data suggests that Oorja's services have impacted the income of farmers, with 89% of the customers group reporting that their income has either "slightly increased" (76%) or "very much increased" (13%) due to Oorja. 69% estimate gains of 0-25%, while 14% report 26-50% increase in income. This reflects a trend where Oorja's services are helping farmers improve their earnings, but the increase is relatively modest for the majority.

Figure 3: Self-Reported Income Changes Attributable to Oorja's Services



Has the money you earn (your income) changed because of Oorja?



Rough Estimate on how much money earned has increased because of Oorja?

The data reveals distinct trends in farming incomes between customers using Oorja's solar pumps and comparison group, reflecting the trade-off between food security and income generation. Customers' lower incomes from sold crops reflect their focus on retaining a portion of their harvest for household consumption, ensuring food security. For example, customers earn INR 11,333 from selling pulses in Bahraich district, while the comparison group earn INR 29,000, reflecting customers' focus on household consumption.

- In comparison farmers generate higher gross market incomes (INR 70,093 in Bahraich and INR 67,811 in Barabanki versus INR 43,237 and INR 45,374 for Oorja customers) by selling nearly their entire Rice harvests, this approach comes at the cost of household food security.

- Oorja customers demonstrate a more sustainable model, selling high-value cash crops like peppermint (96% sold) and sugarcane (100% sold) while retaining significant portions of staples (36% rice, 44% wheat, and 100% pulses) for household consumption.

The income picture becomes clearer when considering both cash earnings and the value of retained crops - while comparison farmers may show higher gross sales, Oorja customers achieve greater net economic benefits through reduced food expenses and more stable year-round incomes. This explains why 89% of Oorja farmers report improved household incomes despite lower market sales figures.

Photo Courtesy: Soumya Khandelwal, Acumen

6.1.9 Reduced Drudgery in Irrigation and Impact on Women

73% of female respondents reported that solar-powered irrigation services made it more convenient for women to manage irrigation independently in the absence of male farmers. This shift is particularly impactful given the traditional gender dynamics in rural farming, where women often face barriers in managing irrigation due to the physical demands of traditional irrigation methods.

Moreover, the time savings associated with solar irrigation were especially important for women, 81% of whom also managed household chores and childcare. The flexibility to irrigate without depending on male family members allowed them to choose convenient timings, resulting in a better balance between farm and household responsibilities, and enabling them to use their time more productively.

The empowerment gained through this increased independence is notable. The ability to manage irrigation independently boosts women's self-esteem and confidence, contributing to their overall empowerment. As they gain more control over agricultural activities, women also have the opportunity to connect with other farmers and agricultural experts, further enhancing their skills and knowledge (33% reported better connections through Oorja's services).

6.1.10 Quality of Life

The quality of life for households in the customer group has likely improved. While both groups rely almost entirely on agriculture, the customers' group appears to have a slightly higher diversification of income sources, with a larger proportion engaged in shop ownership and wage labour. This suggests that access to solar-based irrigation might be enabling additional income-generating activities beyond farming, reducing reliance on precarious non-farm labour. In contrast, the comparison group shows a greater dependence on wage labour and private employment, particularly in Bahraich and Hardoi. This could indicate less stability in agricultural income, pushing households to seek alternative employment. The significantly higher engagement in livestock rearing in the comparison group, especially in Barabanki, suggests that households without access to solar irrigation may be using livestock as a risk-mitigation strategy against uncertain agricultural yields.

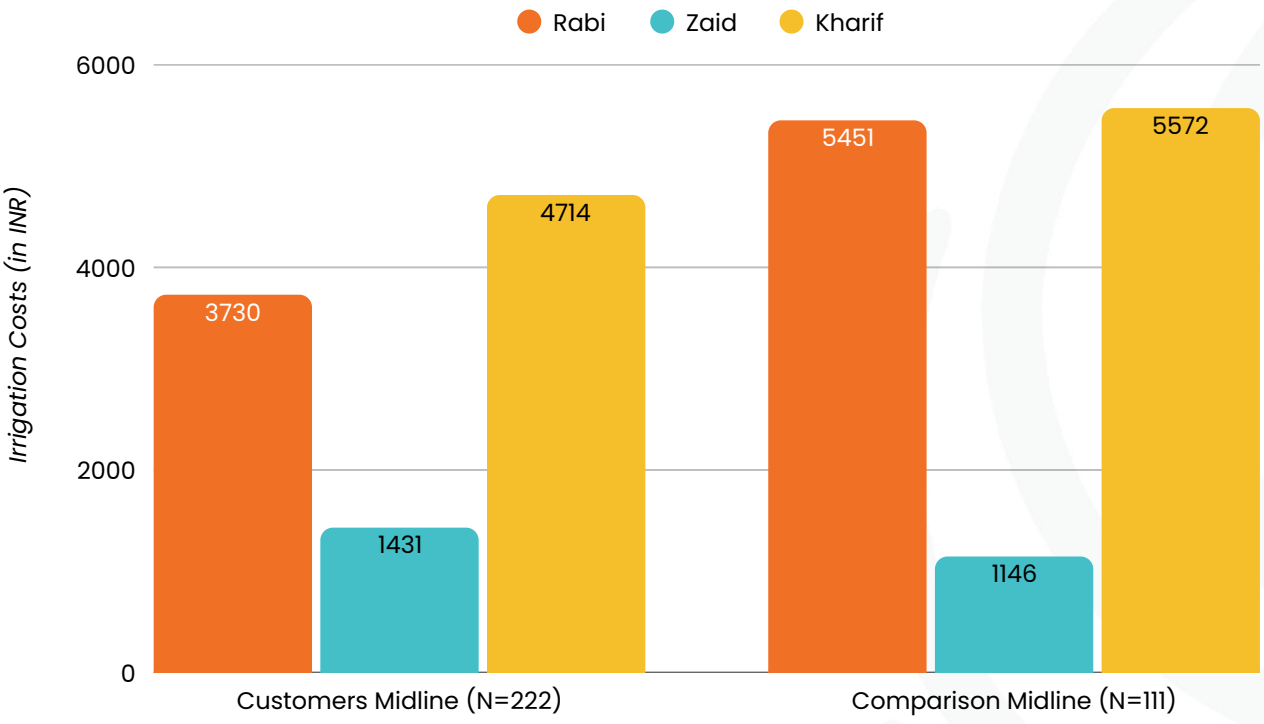
A notably higher percentage of customers (23%) reported purchasing household items in the last 365 days, compared to only 7% of the comparison group. This indicates that customers, likely benefiting from the economic advantages of Oorja's services, are in a better financial position to make purchases. The increased purchasing power among customers suggests improved financial stability, better access to resources, and more disposable income, enabling them to invest in items that enhance their quality of life. Customers more frequently bought mobile phones, smartphones, and household items (fans, coolers, motorcycles), indicating higher disposable incomes and improved communication access.

Photo Courtesy: Sharon Avraham

6.1.11 Reduced Costs of Cultivation

This outcome reflects the combined effect of Oorja's solar irrigation and advisory services. On average, customers report irrigation costs ranging from INR 3,730 to INR 4,714 per season, compared to INR 5,451–5,572 for the comparison group — highlighting cost reductions primarily due to solar pump adoption.

Figure 4: Average Irrigation Cost 2023-24 (INR.)



- **Chemical Fertiliser Costs:** In the Rabi season, customers spent an average of INR 4,421 on fertilisers, compared to INR 8,369 for the comparison group – a reduction of nearly 50%. In Kharif, customers spent INR 3,528 versus INR 5,829 for the comparison group, indicating a 40% saving. In Zaid, where input usage is lower overall, customers spent INR 678 compared to INR 398 by the comparison group, likely due to different crop selections.

- **Chemical Pesticide Costs:** Customers spent 35% less on pesticides in both Rabi (INR 848 vs. INR 1,313) and Kharif (INR 662 vs. INR 1,024) seasons compared to the comparison group.

These trends indicate that customers consistently spent 35–50% less on chemical inputs across seasons, highlighting the cost-saving potential of sustainable farming practices supported by Oorja.

6.1.12 Reduced Use of Chemicals and GHG emissions

Customers use lower quantities of chemical fertilisers and pesticides compared to the comparison group. In Rabi, customers used 209 kg of fertilisers and 72 kg of pesticides, while the comparison group used 463 kg of fertilisers and 125 kg of pesticides, representing **54.9% lower fertiliser use and 42.4% lower pesticide use among customers.** In Kharif, customers used 212 kg of fertilisers and 80 kg of pesticides, compared to 394 kg of fertilisers and 134 kg of pesticides for the comparison group, indicating **46.2% and 40.3% lower usage,** respectively.

The use of Oorja-specific inputs like Kanda tonic (2% in Rabi & Kharif, 8% in Zaid), Neemastra (2% in Rabi) and Agniastra (8% in Zaid) is unique to the customer group and absent in the comparison group

6.1.13 Negative Outcomes

While the benefits are significant, potential negative outcomes were also acknowledged. One concern is the possible shift toward water-intensive crops, which may compromise nutritional balance and long-term sustainability. Additionally, environmental risks related to the manufacturing and end-of-life disposal of solar panels must be considered, particularly in the context of scaling clean energy solutions.

6.2 Well-Defined Outcomes

To strengthen the credibility and accuracy of the SROI analysis, all identified outcomes were systematically refined into a set of well-defined, distinct, and measurable results. This process ensured that each outcome reflected a meaningful and material change experienced by stakeholders, while preventing any double-counting of similar benefits[3]. Grounded in qualitative data analysis, the refinement followed principles of Grounded Theory to construct logical outcome chains that trace the pathway of change from activities to long-term impact.

Table 1: Well-Defined Outcomes for Stakeholder Groups

S.NO.	WELL-DEFINED OUTCOMES	BAHRAICH	BARABANKI	HARDOI
1	Increased household income due to increase in crop diversification	60%	33%	8%
2	Improved household food security & nutrition due to increased self-consumption of crops	66%	16%	18%
3	Increased convenience and reliability in irrigation due to reduction in diesel pump breakdowns and repairs	66%	14%	20%
4	Increased time savings & reduced drudgery for farmers due to ease of irrigation	77%	79%	56%
5	Reduced irrigation-related cultivation costs due to adoption of solar pumps	45%	59%	56%
6	Reduced chemical fertiliser & pesticide-related cultivation costs due to adoption of natural farming alternatives	29%	38%	30%

[3] Outcomes were grouped based on similarity, sequenced to reflect logical progressions (e.g., from training to behaviour change to improved income), and aggregated where appropriate to represent common experiences. For instance, various forms of cost savings—on irrigation, fertilisers, and pesticides—were consolidated under broader outcome categories related to reduced cultivation costs. Additionally, outcomes were only considered final when they signified significant transformation, such as moving from ease of irrigation to increased time savings and reduced drudgery. This structured approach allowed for stronger stakeholder-driven insights and more rigorous monetisation during the SROI calculation.

6.3 Monetising Outcomes

To estimate the total value of benefits generated through Oorja's interventions, six key outcomes were selected for monetisation based on their relevance, materiality, and availability of reliable data. Each outcome is linked to a financial proxy that represents the economic value of the change experienced by customers. These proxies are grounded in primary data from the midline survey and, where needed, supported by credible secondary sources. The table below outlines each outcome, its associated financial proxy, calculation logic, and source of data. Together, these formed the basis for calculating the overall SROI ratio.

Table 2: Well-Defined Outcomes and Financial Proxies

S.NO.	OUTCOME	FINANCIAL PROXY DETAIL	FINANCIAL PROXY (MEAN)	SOURCE
1	Increased household income due to crop diversification	Additional annual income from newly adopted crops. Calculated as: (Avg quantity sold) × (Market sale price/kg)[4]	Bahraich: INR 1,18,720 Barabanki: INR 15,000 Hardoi: N/A	4th Wheel primary data
2	Improved household food security & nutrition	Value of quantity of crops retained for self-consumption, valued at local market price. Includes rice, wheat, pulses, chickpeas, peas.[5]	INR 11,527 per household/yr	4th Wheel survey + MSP
3	Increased convenience and reliability in irrigation	Average annual cost saved per customer on diesel pump maintenance and repairs.	INR 3,255 per customer/yr	Farmer-reported savings
4	Increased time savings & reduced drudgery in irrigation	Average cost saved per customer per year due to reduced drudgeryAverage hours saved per year per customerAverage cost saved on hiring a labour per year	INR 2,922 per customer/yr	MGNREGA wage + survey
5	Reduced irrigation-related cultivation costs	Reduction in total seasonal irrigation cost (solar vs. diesel). Based on average reported spend by customers and comparison group.[6]	INR 36,400 per customer/yr	4th Wheel survey data
6	Reduced chemical fertiliser &pesticide-related costs	The difference between the average cost of crop treatment using chemical fertilisers, pesticides & insecticides and the average cost of crop treatment using natural inputs (Agniastra, Kanda tonic, Neemastra, vermicompost)	INR 2,046 per customer/yr	4th Wheel survey data

[4] Bahraich: Chickpea (200 kg × INR 80), Rabi pulses (70 kg × INR 72), Zaid pulses (33 kg × INR 70), vegetables (60 kg × INR 50), mustard (16 kg × INR 60), mango (2770 kg × INR 33). Barabanki: Vegetables (50 kg × INR 80), mustard (200 kg × INR 55). Hardoi: No new crops adopted during midline.

[5] Quantity retained multiplied by MSP or local market price per kg (e.g.rice: INR 20, wheat: INR 22, chickpeas: INR 80, pulses: INR 70).

[6] Average annual cost of irrigation using solar pumps INR 7,652. Average annual cost of irrigation using diesel pumps INR 44,052.

6.4 Discounting Outcomes

To ensure the SROI calculation reflects a realistic and credible estimate of Oorja's social impact, four key discounting factors were applied to each monetised outcome: Deadweight (what would have happened anyway), Attribution (the role of other actors), Drop-off (decline in benefits over time), and Displacement (negative effects on others). These were estimated based on midline data, qualitative insights, contextual knowledge, and sector-specific benchmarks. Deadweight and attribution consider overlapping influences such as existing government schemes or NGO support. Drop-off was applied after a three-year benefit period to account for reduced effectiveness over time due to service limitations, maintenance, or external risks. Displacement reflects unintended negative consequences, such as reduced income for diesel pump service providers or agro-input retailers.

Table 3: Discount Rates by Outcomes

OUTCOME	DEADWEIGHT	ATTRIBUTION	DROP-OFF	DISPLACEMENT
Increased household income due to crop diversification	15%	10%	15%	5%
Improved household food security & nutrition	15%	10%	20%	0%
Increased convenience & reliability in irrigation	15%	5%	10%	25%
Increased time savings & reduced drudgery in irrigation	7%	5%	10%	10%
Reduced irrigation-related cultivation costs	5%	10%	10%	5%
Reduced chemical fertiliser & pesticide-related cultivation costs	5%	20%	15%	15%

6.5 Social Return on Investment

The SROI analysis highlights the significant impact of Oorja's services on its customers (farmers from the 3 districts - Bahraich, Barabanki, Hardoi). With a total investment of INR 16,54,79,630 over four years, the cumulative value of the outcomes generated during this period amounts to INR 72,01,55,191.23, resulting in an **SROI ratio of 1:4.35** (Refer to the attached ***Value Map***).

Insight: Program Duration Shapes the Type and Depth of Impact

Analysis across Bahraich, Barabanki, and Hardoi reveals a strong link between how long Oorja's services have been implemented and the kinds of outcomes they generate.

In newer districts like Barabanki and Hardoi (2-3 years of intervention), outcomes are utility-driven and short-term: reduced irrigation costs, easier pump operation, and time savings. These are driven by the switch from diesel to solar irrigation and are among the earliest benefits to the surface. The SROI value maps from these districts show a high concentration of value in these short-term outcomes.

In contrast, longer-engaged districts like Bahraich (4-5 years of presence) show a shift toward structural livelihood improvements, an increase in household income from diversified crops, improved food security through higher self-consumption, and indicators of financial mobility like land leasing. These benefits depend on gradual behavioural shifts (e.g., willingness to try new crops), strengthened trust in the reliability of the system, and the combined effect of irrigation and advisory services over time. Farmers begin to leverage existing cost savings to generate more value—not just through income increases but also through reinvestment.

This pattern reinforces a key programmatic insight: Oorja's integrated model delivers a more resilient impact when implemented over multiple years.

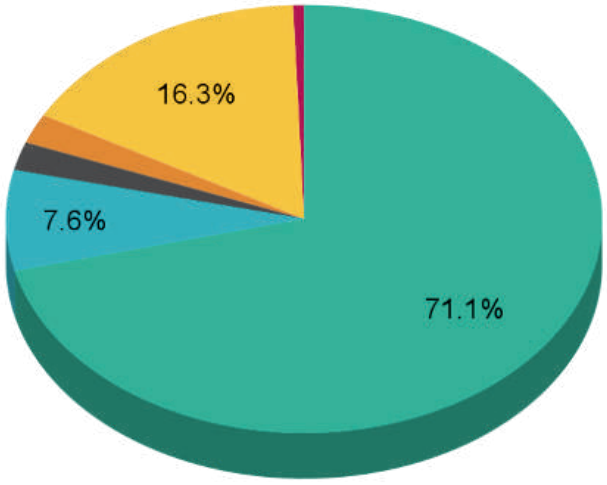
This insight has three major implications:

- **Sustained presence leads to compounding social value.** Beyond geographic expansion, there is a case for deepening engagement in existing districts to witness long-term outcomes.

- **Barabanki and Hardoi could show similar shifts toward income and resilience outcomes if re-evaluated after 2–3 more years.** This supports a longitudinal approach to future SROI and impact assessment.

- **The data strengthens Oorja's case for program continuity.** Short-term value is visible quickly, but structural livelihood improvements require consistent support over time—Oorja's model is structured to deliver that.

Bahraich



Increased household income due to an increase in crop diversification

Improved household food security & nutrition due to increased self-consumption of crops

Increased convenience (ease) and reliability in irrigation due to a reduction in diesel pump breakdowns and repairs

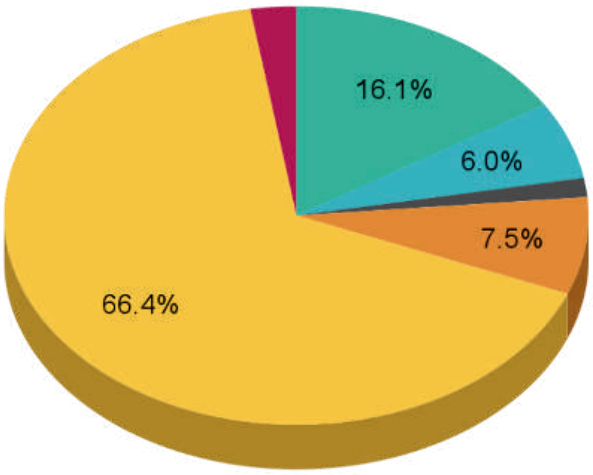
Increased time savings & reduced drudgery for farmers due to ease of irrigation

Reduced irrigation-related cultivation costs due to the adoption of solar pumps

Reduced chemical fertiliser & pesticide-related cultivation costs due to adoption of natural farming alternatives

Figure 5: Value Experienced by Bahraich Farmers

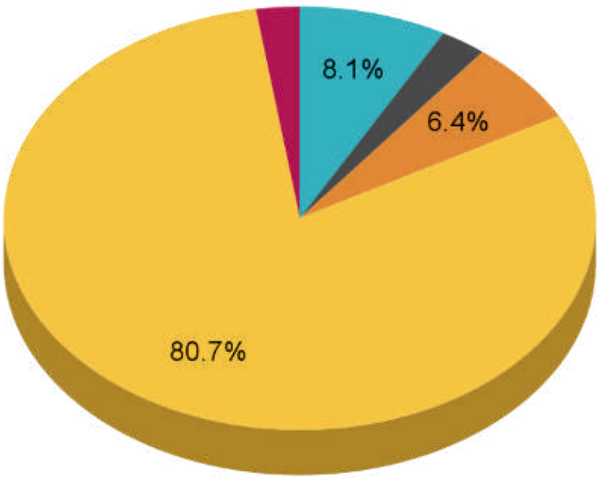
Barabanki



- Increased household income due to an increase in crop diversification
- Improved household food security & nutrition due to increased self-consumption of crops
- Increased convenience (ease) and reliability in irrigation due to a reduction in diesel pump breakdowns and repairs
- Increased time savings & reduced drudgery for farmers due to ease of irrigation
- Reduced irrigation-related cultivation costs due to the adoption of solar pumps
- Reduced chemical fertiliser & pesticide-related cultivation costs due to adoption of natural farming alternatives

Figure 6: Value Experienced by Barabanki Farmers

Hardoi



- Improved household food security & nutrition due to increased self-consumption of crops
- Increased convenience (ease) and reliability in irrigation due to a reduction in diesel pump breakdowns and repairs
- Increased time savings & reduced drudgery for farmers due to ease of irrigation
- Reduced irrigation-related cultivation costs due to the adoption of solar pumps
- Reduced chemical fertiliser & pesticide-related cultivation costs due to adoption of natural farming alternatives

Figure 7: Value Experienced by Hardoi Farmers

7. RECOMMENDATIONS

Each district exhibits a distinct pattern of outcome values that offer a roadmap for where focused training, resources, and strategic attention can drive stronger adoption. By tailoring these action areas to the specific evidence and success factors observed in each district, Oorja can optimise its solar irrigation and advisory approach, sustain its current SROI momentum, and observe a deeper impact across future expansions.

Table 4: District-Level and Program-Wide Recommendations

RATIONALE	DISTRICT-LEVEL RECOMMENDATIONS
Farmers in Bahraich derive the majority of value (71.1%) from increased household income due to crop diversification, indicating that they have leveraged Oorja's services to diversify and market new, higher-value crops.	Bahraich: **Strengthen Crop Diversification for Higher Returns**
	• Continue promoting crops that align with both Oorja's business incentives and farmer profitability. This includes **water-intensive**, **high-value crops** like peppermint and select horticulture or pulse varieties that require regular irrigation. These crops offer a **win-win pathway**, increasing irrigation usage while delivering better margins for farmers. • Pair irrigation support with advanced advisory on post-harvest handling and market linkages - for example, connect farmers with FPOs or local buyers for newly adopted crops.
66.4% of the value for Barabanki farmers is tied to reduced irrigation-related cultivation costs, reflecting a strong cost-saving orientation. Meanwhile, diversification and food security represent a smaller portion, indicating untapped potential.	Barabanki: **Build on Cost Savings and Start Crop Diversification**
	• Pilot a **"customer success blueprint"** establishing clear operator accountability to ensure reliability of irrigation systems by introducing tools (e.g., operator scorecards, uptime dashboards). • Organise short, seasonal demonstrations showing how saved costs can be redirected toward high-value or climate-resilient crops.

RATIONALE	DISTRICT-LEVEL RECOMMENDATIONS
Hardoi farmers experience 80.7% of their value from irrigation cost savings, with no recorded crop diversification at midline. This signals heavy reliance on cost reduction rather than dual strategies (cost reduction + higher-value crops), which limits the region's capacity to realise returns from diversification seen in the other two districts.	Hardoi: **Leverage Crop Diversification Potential** • Identify a cluster of farmers willing to trial **water-reliant, higher-value crops** that create regular irrigation demand. • Prioritise crops that are viable in local agro-climatic conditions and offer economic returns, such as vegetables or select pulses. • Provide close technical support (timely irrigation schedules, seed access) for at least one season. • Introduce demo plots and peer learning to build trust and show tangible returns from new crops (e.g., vegetables, pulses). • Train pump operators to align irrigation support with the needs of these new cropping cycles.

ISSUE	ACTION AREA
Clarify the Type of Diversification That Supports Oorja's Model	• Not all diversification contributes equally to Oorja's business model or to farmer income. Recommendations should prioritise **crops that are both irrigation-dependent and high-value,** ensuring regular usage of Oorja's Pay-Per-Use services and delivering better returns to farmers. • Future advisory content and demonstration plots should be aligned to this dual-impact logic to deepen engagement and maximise shared value.

ISSUE	ACTION AREA
Engage Farmers to Improve Tariff Fairness: 40% of customers find the tariff unfair or lack clarity on cost components.	• Conduct focused group discussions or **launch a Tariff Feedback Initiative** to explore the root causes. Use these insights to refine the pricing model and identify whether confusion, communication gaps, or genuine affordability issues drive dissatisfaction. • Roll out easy-to-understand **posters, short videos**— and offer targeted **Q&A sessions** for cost breakdowns. • **Tie tariff rates to realistic usage patterns,** helping farmers understand exactly how charges relate to water volume or time of use.
Operator Accountability and Service Reliability: Complaints about uncooperative operators, inconsistent water availability, and low shares of improved irrigation reliability in Barabanki and Hardo**i.**	• Introduce a **Performance-Linked Incentive** for **operators,** rewarding timely service and minimal downtime. • **Adopt a tech platform (WhatsApp or IVR) for farmers to report issues,** track response times, maintain a transparent scheduling system (e.g., simple mobile apps or WhatsApp-based alerts), and escalate concerns to Oorja's field management.
Financial Literacy: Farmers experience cost reductions through Oorja's solar irrigation services, but these savings are not always reinvested in ways that drive long-term improvements in productivity or resilience.	• Encourage farmers to **channel saved funds into better-quality seeds and on-farm improvements.** • Support this by integrating light-touch guidance into existing touchpoints — such as **field visits or advisory sessions** — to help farmers plan debt repayments and make informed reinvestment decisions.

ISSUE	ACTION AREA
Mobile-based agri-weather advisory	• Explore partnerships with agri-weather platforms (e.g., IMD, Skymet) to deliver timely, localised irrigation and crop advisories via SMS or app notifications. • This can enhance farmers' responsiveness to weather events
Perspectives of Broader Stakeholders: Missing feedback from local government agencies (e.g., KVKs, agri departments) and community leaders.	• Current data primarily reflects Oorja's internal perspective and direct beneficiary experiences. Seek alignment with public agricultural schemes and other NGO/NPO initiatives, for feedback loops and a full ecosystem view. • This could also enable broader synergy and potential partnerships for Oorja.
Improvement in Internal Impact Monitoring: Baseline data inconsistencies prevented application of more rigorous methods (e.g., difference-in-differences).	• **Standardise data collection tools and surveys** across baseline and midline. • **Align future studies with the revised midline instrument** (December 2024), capturing consistent indicators and reference periods to allow quasi-experimental approaches. Ensuring consistency will enable better causal attribution of outcomes.
Maintain and Scale SROI Gains: An overall SROI ratio of 1:4.35 indicates strong social value creation.	• Continue **refining core offerings** (solar irrigation plus advisory). • Scale **region-specific innovations**—e.g., targeted crop diversification in Bahraich, and cost-saving measures in Hardoi. • **Leverage these successes to scale Oorja's model in new geographies.**

ISSUE	ACTION AREA
Outline Impact outcomes which differ based on the duration of Oorja's presence in each district/geography: Short-term outcomes like irrigation cost savings and ease of use are visible within the first 1–2 years, while long-term outcomes such as income growth, crop diversification, and food security require sustained engagement over 3–5 years as witnessed in Bahraich.	**Redesign the impact measurement cycle to reflect outcome maturity timelines.** • Full-scale SROI or impact assessments should be scheduled at multi-year intervals (every 2–3 years per geography), once longer-term outcomes are more likely to materialise. **Introduce a dashboard-driven approach for interim years:** • Track service delivery, satisfaction, and early indicators through light-touch digital monitoring tools (e.g., CSAT surveys, basic field checklists). • Integrate periodic qualitative check-ins to capture early shifts in cropping patterns, land use, or irrigation behaviour.

ABOUT OORJA

Oorja Development Solutions India Private Limited is a Farming-as-a-Service company working at the intersection of sustainable agriculture and clean energy. Founded in 2016, Oorja aims to address the climate crisis by promoting clean solar energy in India through inclusive and affordable solar-powered irrigation solutions. Oorja leverages decentralised solar PV infrastructure to provide clean energy solutions that meet the needs of farmers and farming based institutions. Our farmer-centric business models enable transition from fossil fuels to clean energy thereby reducing carbon footprint, boosting productivity, increasing income, long term saving and enhancing climate resilience of communities, contributing to the SDGs.

ABOUT 4TH WHEEL

4th Wheel Social Impact, established in 2010, is a research and advisory firm specialising in the monitoring and evaluation of social development programs. The organisation focuses on generating actionable insights to support data-driven decision-making in the social sector. It offers strategic advisory services to help design and strengthen Monitoring, Evaluation, and Learning (MEAL) systems for effective program management. 4th Wheel's approach emphasises practical and culturally relevant impact assessment strategies, engaging diverse stakeholders throughout the evaluation process.

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