



# PM-KUSUM Yojana (Solar Agriculture Pumps): An Exploratory Study in Deoria district of Uttar Pradesh

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**Abstract**— The Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan (PM-KUSUM) Yojana was launched by the Government of India in 2019 to promote the use of solar energy in agriculture, reduce dependence on conventional energy sources, and ensure sustainable irrigation. The present study was conducted in Deoria district of Uttar Pradesh, which had one of the highest numbers of installed solar irrigation pumps under the scheme. A total of 100 beneficiary farmers were selected randomly, and data were collected through a structured interview schedule. The study assessed the knowledge and adoption levels of beneficiary farmers regarding solar agricultural pumps under PM-KUSUM. The findings revealed that respondents possessed a satisfactory level of knowledge about the scheme, with the highest awareness observed regarding the environmental friendliness of solar pumps (MPS 86.20), reduction in irrigation costs (MPS 85.60), and future sustainability (MPS 84.70). The adoption level was also encouraging, as most respondents perceived the scheme as beneficial for farmers (MPS 85.40), ensuring sustainable irrigation (MPS 83.60), and providing a better alternative to diesel and electric pumps (MPS 82.40). However, challenges such as high initial investment costs, delays in registration and subsidy disbursement, limited technical guidance, and reduced efficiency during cloudy weather were reported by farmers. The study concludes that PM-KUSUM has significantly contributed to promoting renewable energy use and improving irrigation facilities among beneficiary farmers. Strengthening extension services, ensuring timely financial support, and providing regular technical assistance can further enhance the effectiveness and adoption of the scheme.

**Keywords**— PM-KUSUM Yojana, Solar Agriculture Pump, Beneficiary Farmers, Sustainable Agriculture, Farm Income.

## I. INTRODUCTION

Agriculture is one of the most critical sectors of the Indian economy and relies heavily on irrigation and energy resources. In India, groundwater serves as the primary source of irrigation, and the majority of irrigation pumps are powered by electricity or diesel. However, rising diesel prices, erratic power supply, and environmental pollution have created numerous challenges for farmers — particularly for small and marginal farmers.

To address these issues, the Government of India launched the 'Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan' (PM-KUSUM) scheme in 2019 to promote the use of solar energy in agriculture. This scheme encourages the adoption of solar-powered irrigation pumps to reduce dependence on traditional energy sources and foster sustainable farming practices. Under 'Component-B' of this scheme, farmers are provided with financial assistance to install standalone solar pumps. Farmers receive a subsidy of up to 60 percent, comprising 30 percent from the Central Government and 30 percent from the State Government. Farmers are required to contribute only 10 percent of the total cost, while the remaining amount can be secured through bank loans.

The Solar Agriculture Pump (PM-KUSUM Yojana) scheme has rapidly expanded across the country, including Uttar Pradesh. According to official government figures, by December 2024 [or projected by December 2025 — please verify], the program had assisted around 21.77 lakh farmers. Under various PM-KUSUM components, a total solar capacity of 10,203 MW has

been deployed. Approximately 9,75,227 solar pumps totaling 4,398.57 MW have been deployed under Component B, which enables independent solar agricultural pumps. About 12,01,552 grid-connected agricultural pumps, totaling 5,829.98 MW of capacity, have been solarized under Component C. These solar pumps lower fuel and power costs, provide farmers with dependable daytime watering, and support sustainable agriculture.

The scheme aims to achieve a total target of 34,800 MW of solar power by March 2026. In India, the PM-KUSUM program is crucial for raising farmers' incomes, promoting the use of renewable energy, and bolstering ecologically friendly farming methods.

In Deoria district of Uttar Pradesh, approximately 901 standalone solar pumps — with a combined capacity of 1.91 MW — have been installed under this scheme. Studies conducted across the district indicate that the level of knowledge and adoption of the Solar Agriculture Pump (PM-KUSUM Yojana) among farmers varies depending on the information they receive, their economic capacity, and their understanding of solar irrigation technology. Farmers who have adopted solar pumps have reported several benefits, such as reduced irrigation costs, improved energy availability for agricultural operations, and better management of farming-related activities. Despite these advantages, many farmers face problems such as lack of information, high installation costs, procedural difficulties, and delays in receiving subsidies. Therefore, the present study was undertaken to assess the knowledge and adoption level of the Solar Agriculture Pump (PM-KUSUM Yojana) among farmers.

## II. RESEARCH METHODOLOGY

The ex-post facto research design and survey method were used for this study. The study was conducted in purposively selected Deoria district in the eastern region of Uttar Pradesh, which has one of the highest numbers of installed solar pumps (901) under the scheme. Therefore, Deoria district was considered suitable for conducting the study as it provided adequate respondents and a better scope for assessing the awareness and adoption of the Solar Agriculture Pump (PM-KUSUM Yojana) among farmers.

A total of 100 beneficiary farmers were randomly selected as respondents for the study. Data were collected using a structured interview schedule. Statistical tools such as Mean Percent Score (MPS), ranking method, frequency, and percentage were employed for data analysis.



FIGURE 1: Map of research area showing Deoria district in Uttar Pradesh

### III. RESULTS AND DISCUSSION

#### 3.1 Demographic Profile of Respondents

A table presenting the demographic characteristics of the 100 respondents (age, education, landholding size, farming experience, previous pump type).

**TABLE 1**  
**DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS (N=100)**

Characteristic	Category	Frequency (n)	Percentage (%)
Age	Below 30 years	3	3
	30–45 years	18	18
	46–60 years	40	40
	Above 60 years	39	39
Education	Illiterate	14	14
	Primary (up to Class 5)	6	6
	Middle (Class 6–8)	10	10
	High school (Class 9–10)	15	15
	Intermediate (Class 11–12)	30	30
	Graduate and above	25	25
Landholding	Marginal (< 1 ha)	48	48
	Small (1-2 ha)	32	32
	Semi-medium (2-4 ha)	11	11
	Medium (4–10 ha)	7	7
	Large (>10 ha)	2	2
Farming experience	Less than 5 years	5	5
	5–15 years	20	20
	16–25 years	35	35
	Above 25 years	40	40
Previous pump type	Diesel pump	53	53
	Electric pump	35	35
	No pump previously	12	12

#### Summary Demographic Profile of Respondents:

The majority of the respondents were middle-aged and elderly farmers, as 40 percent of the respondents were in the age group of 46-60 years, while the least proportion (3 percent) of the respondents was below 30 years.

The highest proportion of respondents who had completed education up to intermediate level was 30 percent, while the lowest proportion of those who had primary education was 6 percent. Hence, most of the respondents had a medium-level education.

The maximum number of respondents was amongst the marginal category of farmers (48 percent), whereas the least was among those of the large category of farmers (2 percent), indicating that the majority of the beneficiary farmers were marginal farmers.

In a bid to consolidate general farmers' perspectives on their experiences of value addition on poultry shells, and their perception and understanding of the value addition processes, a survey was conducted across various poultry farmers.

The result showed that about 40 percent of the farmers had more than 25 years of farming experience, while at the other extreme, the least percentage of farmers had less than 5 years of experience.

### 3.2 Knowledge Level of Respondents about the Solar Agriculture Pump (PM-KUSUM Yojana)

Table 1 (renumbered as Table 2 in final manuscript) shows the level of knowledge of farmers about the Solar Agricultural Pumps (PM-KUSUM Yojana). The data reveal that most respondents were well informed about different aspects of the scheme and its usefulness in agriculture.

**TABLE 2**

**KNOWLEDGE LEVEL OF RESPONDENTS ABOUT THE SOLAR AGRICULTURE PUMP (PM-KUSUM YOJANA) (N=100)**

S. No.	Statement	MPS (%)	Rank (within category)	Overall Rank
<b>A.</b>	<b>Technical Knowledge</b>			
1	Fully aware of solar pump operation	82.5	I	V
2	Operate without help	78.4	III	IX
3	Regular use	80.2	II	VII
4	Follow guidelines	76.8	IV	XI
5	Maintenance is easy	72.3	V	XV
<b>B.</b>	<b>Economical Knowledge</b>			
1	Reduced irrigation cost	85.6	I	II
2	Initial investment is not affordable	65.2	IV	XVIII
3	Increased farm income	83.1	II	IV
4	Cost-effective technology	81.7	III	VI
<b>C.</b>	<b>Social &amp; Psychological Knowledge</b>			
1	Confidence in use	79.6	I	VIII
2	Prefer over diesel/electric	77.2	II	X
3	Social status and recommendation	70.5	III	XVII
<b>D.</b>	<b>Institutional Knowledge</b>			
1	Training received	74.3	II	XIII
2	Extension support	73.8	III	XIV
3	Subsidy motivation	75.1	I	XII
4	After-sales service	71.4	IV	XVI
<b>E.</b>	<b>Sustainability Knowledge</b>			
1	Environmentally friendly	86.2	I	I
2	Continuity in the future	84.7	II	III

#### Summary of knowledge findings:

Among all knowledge statements, "environmentally friendly" recorded the highest Mean Percent Score (MPS) of 86.2%, ranking first overall, indicating strong awareness of solar pumps' environmental benefits. "Reduction in irrigation costs" ranked

second overall (85.6%), followed by "future sustainability" (84.7%), "increased farm income" (83.1%), and "comprehensive knowledge of operation" (82.5%).

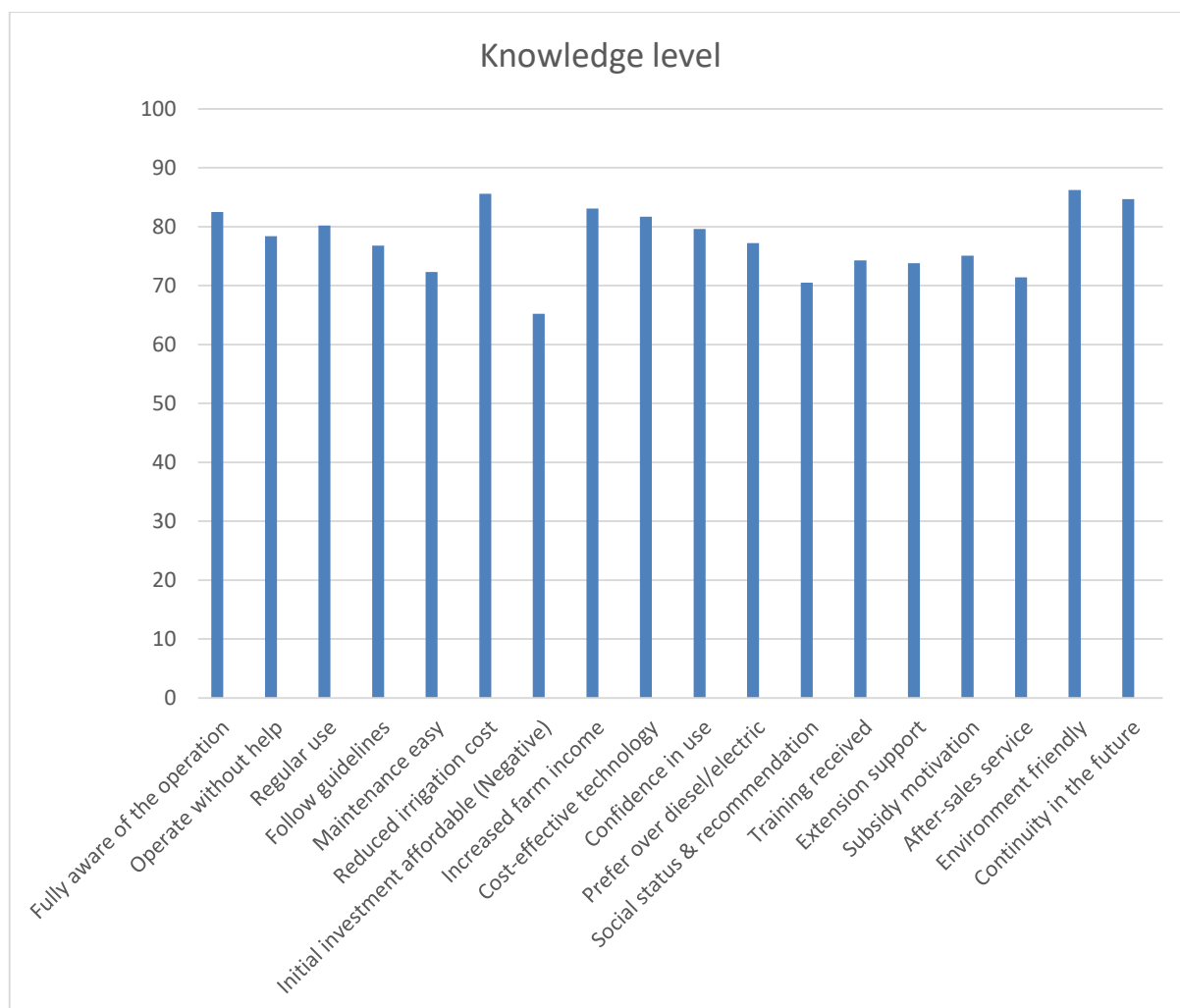
Within the technical knowledge category, "fully aware of solar pump operation" secured the highest MPS (82.5%) and ranked first, indicating that most farmers were familiar with the functioning of the system. "Regular use of solar pumps" obtained an MPS of 80.2% (second within technical knowledge), suggesting that beneficiaries were actively utilizing the technology. "Maintenance is easy" received the lowest MPS (72.3%) in this category, indicating some concerns about upkeep.

Within the economic knowledge category, "reduced irrigation cost" ranked first (85.6%), followed by "increased farm income" (83.1%) and "cost-effective technology" (81.7%). However, "initial investment is not affordable" received a low MPS (65.2%), reflecting farmers' perception of high upfront costs despite the subsidy.

Within the social and psychological knowledge category, "confidence in use" secured the highest MPS (79.6%), showing that beneficiaries felt comfortable operating the technology. "Preference for solar pumps over diesel/electric pumps" obtained an MPS of 77.2%, highlighting the growing acceptance of renewable energy technologies among farmers.

Within the institutional knowledge category, "subsidy motivation" ranked first (75.1%), indicating that government subsidies played a crucial role in motivating farmers to adopt solar pumps. "Training received" (74.3%) and "extension support" (73.8%) followed closely, suggesting moderate levels of institutional support.

Within the sustainability knowledge category, "environmentally friendly" achieved the highest overall MPS (86.2%), indicating that respondents strongly recognized the environmental benefits of solar agriculture pumps. "Continuity in the future" (future sustainability) ranked third overall (84.7%).



**FIGURE 2: Knowledge level of respondents about the Solar Agriculture Pump**

### 3.3 Adoption of Solar Agriculture Pump (PM-KUSUM Yojana) by Respondents

Table 3 indicates the adoption behaviour of respondents towards solar agricultural pumps (PM-KUSUM Yojana). The results show that most farmers had a positive response towards the use of solar pump technology.

**TABLE 3**  
**ADOPTION OF SOLAR AGRICULTURE PUMP (PM-KUSUM YOJANA) BY RESPONDENTS (N=100)**

S. No.	Statement	MPS (%)	Rank
1	Solar pump is difficult to operate	63.2	XVIII
2	Solar pump is better than diesel/electric	82.4	III
3	Useful in power shortage areas	79.6	VI
4	Provides additional income	78.3	VII
5	Improves living standards	76.5	IX
6	Farmers can sell surplus electricity	70.4	XIV
7	Ensures sustainable irrigation	83.6	II
8	Supports green revolution goals	81.2	IV
9	Performs poorly on cloudy days	68.3	XVI
10	Adequate sunlight essential	74.2	XI
11	Scheme beneficial for farmers	85.4	I
12	Reduces diesel/kerosene use	80.6	V
13	Increases crop production	77.1	VIII
14	Promotes crop diversification	75.4	X
15	Solar pump is eco-friendly	74.1	XII
16	Reduces irrigation costs	73.2	XIII
17	Allows flexible irrigation timing	71.4	XV
18	Wastes government funds	60.2	XX
19	Registration is time-consuming	65.1	XVII
20	Benefits are only available to selected farmers	61.8	XIX

#### Summary of adoption findings:

The highest Mean Percent Score was recorded for the statement "Scheme beneficial for farmers" (85.4%, Rank I), suggesting that respondents perceive solar pump schemes as highly advantageous in terms of reducing irrigation costs, improving access to water, and enhancing agricultural productivity.

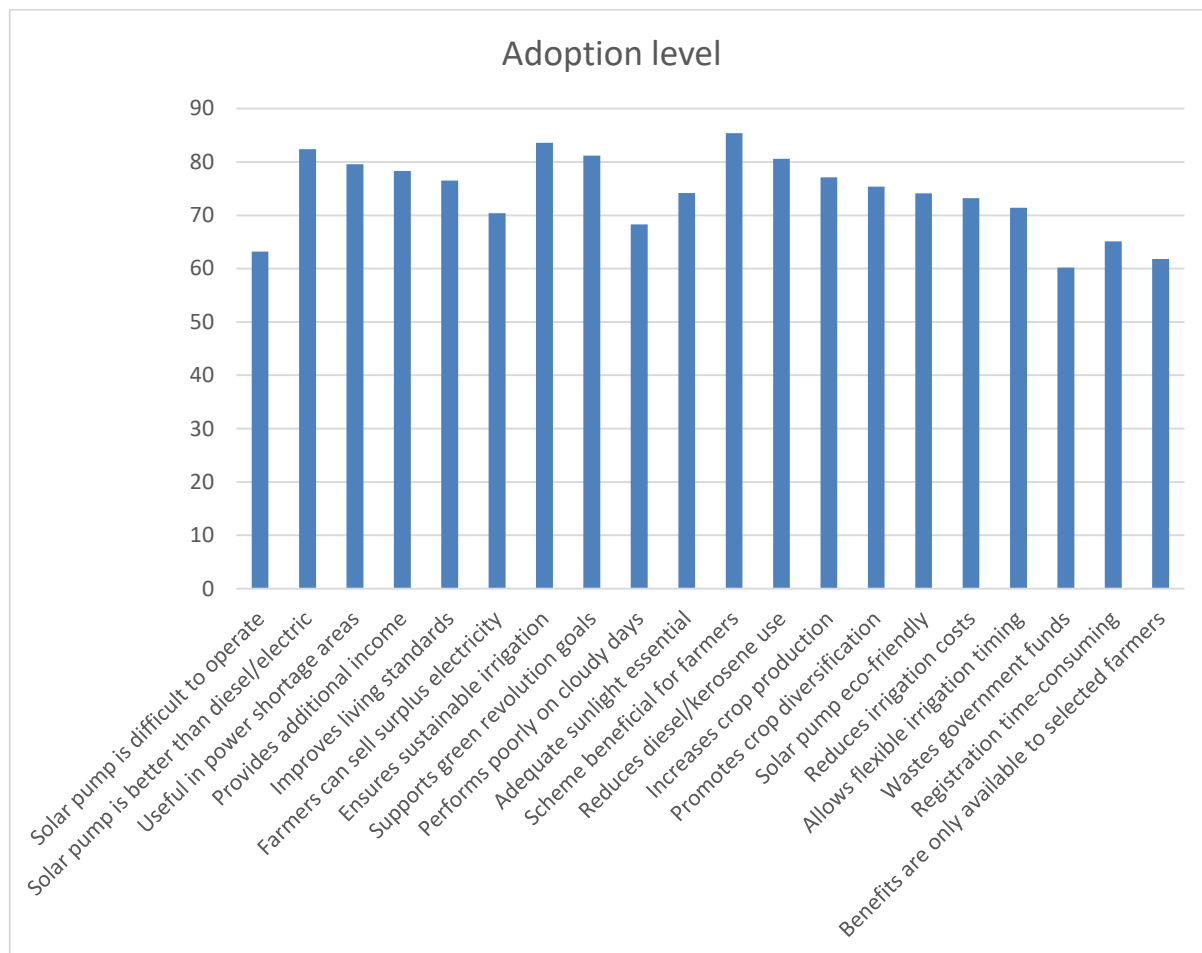
"Ensures sustainable irrigation" ranked second (83.6%, Rank II), demonstrating that farmers recognize the role of solar pumps in providing a reliable and environmentally sustainable source of irrigation, reducing dependence on conventional energy sources and ensuring water availability for crop production.

"Solar pump is better than diesel/electric" ranked third (82.4%, Rank III), followed by "Supports green revolution goals" (81.2%, Rank IV) and "Reduces diesel/kerosene use" (80.6%, Rank V). These rankings reflect farmers' awareness that solar pump technology contributes to modern agricultural development by promoting energy-efficient and eco-friendly farming practices.

Farmers also showed considerable acceptance regarding reduction in fuel consumption, better irrigation during electricity shortages, and improvement in agricultural production. A moderate level of adoption was observed for statements related to crop diversification, irrigation flexibility, environmental safety, and reduction in irrigation expenditure. Respondents also recognized the importance of adequate sunlight for the proper functioning of solar pumps.

Lower scores were found for statements such as "Solar pump is difficult to operate" (63.2%, Rank XVIII), "Registration is time-consuming" (65.1%, Rank XVII), and "Benefits are only available to selected farmers" (61.8%, Rank XIX). The statement "Wastes government funds" received the lowest Mean Percent Score (60.2%, Rank XX), showing that the majority of respondents did not agree with this opinion.

Overall, the findings reveal that farmers generally accepted the PM-KUSUM Yojana and considered solar pumps beneficial for agricultural and economic development.



**FIGURE 3: Adoption of the Solar Agriculture Pump**

**IV. DISCUSSION**

The findings of this study align with previous research on solar pump adoption in India. The high level of awareness regarding environmental benefits (MPS 86.2%) and reduction in irrigation costs (MPS 85.6%) is consistent with the objectives of the PM-KUSUM scheme, which aims to promote renewable energy and reduce farmer expenses.

However, several challenges identified in this study — including high initial investment costs (MPS 65.2% for "initial investment is not affordable"), delays in registration and subsidy disbursement (MPS 65.1% for "registration is time-consuming"), and reduced efficiency during cloudy weather (MPS 68.3% for "performs poorly on cloudy days") — highlight areas requiring policy attention. These findings are consistent with challenges reported in other studies on renewable energy adoption in agriculture.

The moderate levels of institutional support (training received: MPS 74.3%; extension support: MPS 73.8%) suggest that while government subsidies successfully motivated adoption (MPS 75.1%), there is scope for strengthening extension services and technical guidance to enhance farmer confidence and proper utilization of the technology.

The positive adoption indicators (scheme beneficial: MPS 85.4%; sustainable irrigation: MPS 83.6%; better than diesel/electric: MPS 82.4%) demonstrate that beneficiaries recognize the value of solar pumps despite the challenges. This suggests that the PM-KUSUM scheme has been largely successful in achieving its immediate objectives among adopters.

## V. CONCLUSION

The results of this study revealed that farmers covered under the PM-KUSUM scheme possessed a substantial level of awareness regarding solar agricultural pumps and their associated benefits. The majority of farmers recognized that solar pumps help reduce irrigation costs, decrease diesel consumption, and provide a reliable source of energy for agricultural operations. Farmers also perceived solar technology as beneficial for ensuring continued irrigation during power outages and for promoting environmentally sustainable farming practices.

The study further observed that, among the farmers who benefited from the scheme, the inclination toward adopting solar pumps was generally positive. Farmers believed that the scheme had led to improvements in irrigation facilities, boosted agricultural productivity, and reduced dependence on traditional energy sources. Many farmers viewed solar pumps as a cost-effective long-term investment, citing their low operational costs and high suitability for the rural agricultural environment.

Despite these benefits, farmers encountered certain challenges, including high initial investment costs, delays in registration and subsidy disbursement, limited technical guidance, and reduced efficiency during cloudy weather. These challenges acted as impediments to the widespread acceptance and adoption of this technology among certain segments of the farming community.

Overall, the PM-KUSUM scheme has made a significant contribution toward promoting renewable energy within the agricultural sector and improving the farming conditions of beneficiary farmers. The study suggests that enhanced extension support, timely financial assistance, streamlined administrative procedures, and regular technical maintenance services could prove instrumental in boosting both the effectiveness and the adoption rate of this scheme in rural areas.

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## CONFLICT OF INTEREST

The author, Vatan Vishwakarma, declares that there are no conflicts of interest regarding the publication of this paper.

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