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Measurement Tool for Training Needs of Farmers for Solar Power Water Pump System

Rohtash Kumar[1*], Ashok Kumar[2], Tribhuwan Singh Rajpurohit[1], Shubham[1] and Hansa Kantwa[3]

Department of Agricultural Extension Education, CCS HAU, Hisar (Haryana)

ABSTRACT

An alternative to traditional grid-based or diesel-powered water pumps is the utilization of solar photovoltaic panels to generate electricity from captured sunlight, enabling solar-powered pumps. The availability of portable solar water pumps allows for easy relocation in accordance with seasonal or water demand fluctuations, all while maintaining lower operational costs. The technology employed for harnessing solar energy to power water pumps mirrors the methods previously used with electricity and diesel. In the years 2021-2022, a comprehensive scale was developed to assess the training needs of farmers who have adopted or not adopted solar-powered water pumping systems. This scale was constructed using the Likert method, incorporating a concise rating scale and standardized procedures. A total of 32 items were collected, and a thorough relevancy analysis was conducted by experts. Subsequently, a 23-item schedule was employed for preliminary interviews based on the results of the relevancy analysis. After subjecting the items to further scrutiny for their ability to differentiate, the final scale comprised 17 elements. Its validity and reliability were established using the split-half test reliability method and content validity, respectively. The scale's improved internal consistency was demonstrated by a commendable dependability coefficient of 0.890.

Key Words: Authenticity, Scale Construction, Solar Power, Renewable Energy and Trustworthiness.

INTRODUCTION

Solar water pumps are particularly efficient during peak solar array production, coinciding with high water demand on long, sun-drenched summer days. In India, the Ministry of New & Renewable Energy (MNRE) has been instrumental in promoting the growth of solar water pumping systems. Their initiative, launched in 1993, aimed to deploy 50,000 solar PV water pumping systems across the nation, as reported by Rathore *et al* (2018). Rajasthan, known for its abundant solar radiation with over 325 sunny days annually, boasts significant solar energy potential, up to 6-7 Kwh/M^2/day. To demonstrate the system's effectiveness, the state government installed 14 PV pumps on its own farm in 2009–2010 and an additional 50 solar pumps in a farmer's field in 2010–11. Building on this success, a $515 million program was initiated in 2011 to provide subsidized solar PV pumping systems to 10,000 farmers across the state. The expected result is a significant annual savings of nine crore units of electricity when all 10,000 solar power systems are operational. Rajasthan set a precedent by offering an 86% subsidy in 2010–11 to horticultural farmers utilizing drip irrigation and farm ponds. This initiative provides an additional 1% subsidy on the initial capital cost of the pump, with financial support coming from two sources: the state government's Rashtriya Krishi Vikas Yojana (RKVY) and the Indian government's Ministry of New Renewable Energy, which oversees the Jawaharlal Nehru National Solar Mission (JNNSM), as noted by Kishore *et al* (2014). The present study aims to develop a scale for assessing the training requirements of farmers who have embraced solar-powered water pumping systems and those who have not. In the context of this study, perception, following Fisher's (2002) definition, refers to the process of selecting, organizing, and interpreting sensory data regarding a specific object or concept,

Corresponding Author's Email:ext.rohtashchhimpa@gmail.com

1Research Scholar, Department of Agricultural Extension Education, CCS HAU, Hisar

2Assistant Director, Extension Education, CCS HAU, Hisar

3 M.Sc. Student, Department of Agricultural Extension Education, AU, Jodhpur

with operational implications related to understanding farmers' training needs. The primary goal of this scale was to explore the relationship between farmer perception and its influence on their adoption behavior concerning the training requirements for solar-powered water pumping. Existing research by Mottaleb (2018), Chatterjee *et al* (2022), and Vecchio *et al* (2022) has demonstrated a positive association between farmers' perceptions and their adoption behavior. This scale aims to bridge the gap and contribute to the expanding body of knowledge in this field.

MATERIALS AND METHODS

The development of this scale followed Likert's (1932) summated rating approach, established as a standard practice. The scale's creation encompassed several key processes, including item collection, editing, relevancy analysis, item assessment, and scale standardization. A comprehensive array of items pertaining to various concerns associated with solar water pumping systems, as experienced by farmers, was compiled from a wide range of literature sources, including books, theses, journals, newspapers, and online resources. After consultation with academics, extension specialists, and farmers, an initial list of 40 items was generated. Subsequently, the 14 criteria proposed by Edward & Kilpatrick (1948) and Edwards (1969) for building attitude scales were employed to screen these items. From the initial pool of collected items, 32 items that conformed to informal scaling criteria were ultimately chosen.

For the purpose of relevancy analysis, these items were distributed via email to a panel of 80 judges who were instructed to critically evaluate each item's relevance using a three-point continuum: most relevant (HR), relevant (R), and non-relevant (NR), as per Kumar *et al* (2016), Kumar *et al* (2021), and Gupta *et al* (2022). Over a two-month period, 59 of the 80 judges responded, while the responses of four judges were excluded due to their lack of clarity and completeness. Based on the criteria of a relevancy percentage exceeding 70%, a mean relevancy weightage surpassing 0.70, and a mean relevancy score equal to or greater than the overall mean relevancy score of 2.83 (Raghuvanshi and Ansari, 2019), each item's relevance percentage, mean relevancy weightage, and mean relevancy score were computed individually. Consequently, 23 items were selected through this process and later revised and refined in response to feedback from the judges.

A set of 23 items was employed for in-person interviews with 30 farmers from a non-sampled area, utilizing a three-point scale for responses: most necessary (MN), necessary (N), and unnecessary (UN), corresponding to scores of 3, 2, and 1, respectively. The scoring formula was reversed for negative items. The perception score for each respondent was derived by summing the scores for all the items. Subsequently, respondents were grouped in ascending order according to their individual perception scores. To evaluate the ability of specific items to discriminate between respondents, two criteria groups were formed, each comprising 25% of respondents with the highest and lowest total scores, consisting of eight farmers in each group, following Edwards (1969). The distinction between the high and low groups was determined using the crucial ratio, or "t" value, with a higher 't' value indicating a more pronounced distinction. Items with a 't' value of 1.69 or higher were chosen for inclusion in the final scale.

To ensure reliability and content validity, the scale was standardized using the split-half approach. The scale was administered to 30 farmers, divided into two sets based on odd and even item numbers. This yielded two sets of scores. To assess the reliability of the half test, the Karl Pearson product-moment correlation coefficient was calculated between these two sets of scores. The reliability coefficient of the full set was computed using the Spearman-Brown method, further adjusting and confirming the scale's reliability and suitability for use across diverse contexts.

RESULTS AND DISCUSSION

Validity and reliability analysis

In accordance with Thorndike's (1971) perspective, a test's validity is contingent on its ability to effectively measure the variables it aims to assess. Content validity pertains to the extent to which a test comprehensively analyzes all aspects of the subject, behavior, or concept it is designed to gauge. The development of the present scale, incorporating

Table 1. Standardized scale for the measurement of training needs of farmers for SPWP.

Sr. No.	Statement	PR	MRW	MRS	t-Value
1	Maintenance and repairing of solar pump.	90.90	0.90	2.72	1.79
2	Training on when solar panel is free in off season	94.54	0.93	2.8	1.73
3	Training on selection of inverters and batteries for better performance.	96.36	0.95	2.87	1.80
4	Government Scheme and policies on solar powered water pumps and its accessories	94.54	0.93	2.81	2.64
5	Training on using of solar power system	92.72	0.92	2.76	3.74
6	Ability to install and set up solar -powered water pumping systems.	90.90	0.87	2.63	2.64
7	Proficiency in operating and controlling the system, including understanding the control panel, sensors, and switches.	100	0.96	2.90	2.47
8	Basic understanding of solar energy and its conversion into mechanical energy.	90.90	0.90	2.70	1.89
9	Awareness of the components and functioning of solar -powered water pumping systems.	96.36	0.95	2.87	2.64
10	Familiarity with the benefits and potential applications of solar-powered water pumping systems.	96.36	0.95	2.85	1.87
11	Troubleshooting skills to identify and address common operational issues	94.54	0.93	2.8	2.64
12	Knowledge of water requirements for various crops and farming practices.	90.90	0.87	2.63	2.55
13	Understanding of irrigation scheduling and optimizing water usage with solar-powered pumping systems.	90.90	0.89	2.67	2.64
14	Awareness of routine maintenance tasks such as cleaning solar panels and checking connections.	96.36	0.91	2.74	2.21
15	Ability to diagnose and fix common system faults, including issues with pumps, valves, or electrical connections	100	0.98	2.94	2.04
16	Awareness of potential financial incentives, grants, or subsidies available for adopting renewable energy technologies.	92.72	0.92	2.76	2.93
17	Willingness to adopt new technologies and adapt farming practices accordingly.	92.72	0.92	2.76	2.64

Table 2. Reliability analysis of selected items.

<table>
<tr><td colspan="2" rowspan="2">Cronbach's Alpha Value</td><td>Set 1 (Odd items)
Item No. 15</td><td>0.832</td></tr>
<tr><td>Set 2 (Even items)
Item No. 15</td><td>0.862</td></tr>
<tr><td colspan="2">Correlation between forms</td><td colspan="2">0.872</td></tr>
<tr><td rowspan="2">Spearman-Brown Coefficient</td><td>Equal length</td><td colspan="2">0.890</td></tr>
<tr><td>Unequal length</td><td colspan="2">0.890</td></tr>
</table>

insights from a literature review and professional opinions, adequately addresses the full spectrum of training requirements in the context of Solar Water Pumping Systems (SWPS). All items align with the procedural criteria of Likert's summated rating scaling technique and exhibit strong discriminative properties. Consequently, it was reasonable to endorse the scale as a reliable measurement tool. As per Anastasi's (1968) definition, reliability signifies the consistency of results when the same test is administered to a respondent on multiple occasions. The scale's dependability was assessed using the split-half method. Thirty farmers from outside the sampled area were administered the scale, which was divided into two sets based on odd and even item numbers, resulting in two sets of scores. To ascertain the reliability coefficient (r) for the complete set, the Spearman's Brown formula was applied to adjust the correlation coefficient between the set providing the half-test reliability, which measured 0.872. The scale's 'r' value was 0.890, significant at the 1% level of significance, affirming the scale's robust dependability. Consequently, it can be concluded that the test is both valid and dependable for evaluating farmers' training needs in the context of SWPS. Detailed results of the reliability analysis can be found in Table 1. The final scale comprises 17 items, with a three-point scale for respondents: Most Necessary (MN), Necessary (N), and Un-Necessary (UN), scored 3, 2, and 1, respectively, with 62 representing the highest and 52 the lowest scores.

CONCLUSION

Amidst the pressing concerns of climate change and environmental preservation, the notion of addressing the training requirements for Solar-Powered Water Pumping (SPWP) is gaining substantial support. This surge of interest is primarily driven by the imperative need to curb exorbitant diesel costs, exacerbated by the heavy reliance on this fuel within the population. Recognizing that farmers' training needs will play a pivotal role in the widespread adoption of SPWP, the development of this assessment tool is pivotal. The objective behind creating this scale is to furnish researchers, policymakers, and stakeholders with a practical instrument that can facilitate informed decision-making regarding SPWP training needs. Utilizing the SPWP approach, the scale is designed to enable these parties to conduct surveys aimed at devising policies and programs that can enhance productivity, profitability, and environmental sustainability. Notably, the reliability coefficient of the developed scale stands at 0.890, affirming its high degree of reliability and its utility across a range of settings.

REFERENCES

Anastasi, A (1968). Psychological testing. MacMillian Company, London.

Edwards, A L (1969). Techniques of attitude scale construction. Vakils Feffer and Simons Pvt Ltd, Bombay.

Edwards, A L, & Kilpatrick, F P (1948). A technique for the construction of attitude scales. *J App Psycho* ***32***(4), 374.

Gupta S K, Nain, M S, Singh, R, & Mishra, J R (2022). Development of scale to measure agripreneurs attitude towards entrepreneurial climate, *Indian J Ext Edu* ***58***(2), 153-57.

Kishore, A, Shah, T, & Tewari, N P (2014). Solar irrigation pumps: Farmers' experience and state policy in Rajasthan. *Eco and Pol Weekly* 55-62.

Kumar, A, Bareth, L S, Ghaswa, R, & Yadav, J P (2021). Attitude of farmers towards groundnut cultivation in Bikaner district of Rajasthan. *Indian J Ext Edu* ***58***(1), 157-160.

Kumar, V, Jat, H S, Sharma, P C, Gathala, M K, Malik, R K, Kamboj, B R, & McDonald, A (2018). Can productivity and profitability be enhanced in intensively managed cereal systems while reducing the environmental footprint of production? Assessing sustainable intensification options in the breadbasket of India. *Agri Ecos & Environ 252*, 132-147.

Likert, R A (1932). A technique for the measurement of attitudes. *Arch of Psycho* ***22***(140), 1-55.

Mottaleb, K A (2018). Perception and adoption of a new agricultural technology: Evidence from a developing country. *Tech in Soc 55*, 126-135.

Raghuvanshi, R, & Ansari, M A (2016). Farmer's awareness about climate change and adaptation practices: A Review. *Research &Reviews: J Agri Sci and Techno* ***5***(3), 41-51.

Rathore, P K S, Das, S S, & Chauhan, D S (2018). Perspectives of solar photovoltaic water pumping for irrigation in India. *Energy Strategy Reviews 22*, 385-395.

Thakur, D, Chander, M and Sinha, S K (2017). A scale to measure attitude of farmers towards social media use in agricultural extension. *Indian Res J Ext Edu* ***17***(3), 10-15.

Thorndike, R L (1971). *Educational measurement.* American Council on Education.

Vecchio, Y, De Rosa, M, Pauselli, G, Masi, M, & Adinolfi, F (2022). The leading role of perception: the FACOPA model to comprehend innovation adoption. *Agri and Food Eco* ***10***(1), 1-19.

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