

## ASSESSING THE PERCEIVED EFFECTIVENESS OF IARI'S TECHNOLOGY TRANSFER APPROACHES: KRUSKAL-WALLIS H TEST APPLICATION

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### ABSTRACT

*Effectiveness of any programme is concerned with the realisation of the programme's purpose and long-term consequences. The purpose of this study was to assess the perceived effectiveness of the 3 IARI extension approaches viz., IARI Model Village (IMV), IARI-National Extension Programme (NEP), and IARI-Voluntary Organizations (VOs) approach. This research was carried out in Uttar Pradesh state during 2022, where 30 stakeholders and 120 farmers were chosen through stratified multiple-stage sampling method. The majority of farmer respondents believed that the IARI-VO approach ( $\bar{X}=18.4$ ) was more successful than the IARI Model Village (IMV) and IARI-NEP programme. The results also revealed that for each extension approach the dimension 'farm expenditure' had the highest mean index score while the dimension 'family savings' had lowest mean index score. It became apparent that the perceived effectiveness of the IARI extension approaches was positively and significantly correlated with land holding and scientific orientation. The results of multiple regression analysis showed that land holding and economic motivation positively and estimated annual income negatively contributed the perceived effectiveness of IARI-NEP approach, while scientific orientation significantly and favourably influenced how effective the IARI Model Villages (IMV) concept was perceived to be.*

**Keywords:** economic motivation, IARI extension approaches, perceived effectiveness, scientific orientation, stratified multiple-stage sampling.

### INTRODUCTION

According to Samset (2003), effectiveness is the degree to which the goal has been accomplished, or the first-order impact of the project on market in terms of production, etc., and it determines the completion of the project's goal or its long-term effects. Effectiveness, according to Williams (2010), focuses on what extension functionaries achieve in terms of the tasks they have planned for themselves as well as how resources, such as money, labor, products and services, training, and technologies have been used to carry out the program.

Since its founding in 1905, the Indian Agricultural Research Institute (IARI) has created a variety of cutting-edge extension approaches for technology transfer to farmers. IARI has developed and implemented a number of innovative extension strategies since 2008. These include the IARI-VOs Partnership Extension Model, the IARI-National Extension Programme (NEP) Extension Model, and IARI Model Villages (IMV) for the distribution of technology to farmers who are located far away (Raj, 2018). These technology

transfer programs have already been in place for fourteen years, consequently, an assessment of each of these IARI extension approaches was conducted to understand their level of perceived effectiveness. By keeping this concept in mind, the present investigation has been undertaken to assess the perceived effectiveness of IARI-VO, IARI-NEP and IMV extension approaches (Mukherjee *et al.*, 2021).

### OBJECTIVE

To assess the perceived effectiveness of the selected extension approaches of IARI

### METHODOLOGY

The current study utilized *Ex post facto* research design (Mallick *et al.*, 2023; Samadder *et al.*, 2024; Shukla *et al.*, 2024; Lal *et al.*, 2024). Before the actual start of this research work, a pre-test was conducted in Badholi Village, Meerut, Uttar Pradesh and the interview schedule was revised, reworded and corrected in light of the information acquired in the pre-test. For this investigation, stratified multistage sampling and purposive sampling were used.

Since all of the approaches were implemented in various parts of Uttar Pradesh, the study was exclusively carried out there. By following Stratified Multistage Sampling methods, three districts (one district for every IARI extension approach that was chosen) were selected where operations under these approaches have been or are being carried out (Saha, 2022). Thus, Saharanpur, Chitrakoot, and Aligarh were the districts chosen. Baghpat was the control district where programmes under these approaches were not being implemented. Additionally, one adopted village was chosen at random from each district for each extension strategy. Consequently, the chosen villages were Bidwi (IARI-NEP), Anandpur (IARI-VO), Rajpur (IMV) and Daha (non-adopted village). 30 beneficiary farmers were chosen at random from each of the adopted villages at the final sampling step. 30 farmers were chosen from the village that was not adopted. As a result, 120 farmers made up the entire sample. Additionally, 10 stakeholders (scientists and officials of participating organizations) were chosen as responders for each of the three extension approaches of IARI. Thus, the study's overall sample size was 150 (120+30); 150.

In the current investigation perceived effectiveness of selected extension approaches was operationally defined as the ability of programme that can impact the farm production, productivity and incomes of the farmers. Using an effectiveness index created specifically for this purpose, the perceived effectiveness of IARI extension strategies was assessed. It was based on following nine dimensions viz. (i) Yield, (ii) Income, (iii) Capacity Development, (iv) Timeliness of Information, (v) Extension Contact, (vi) Family Savings, (vii) Farm Expenditure, (viii) Usefulness and Satisfaction and (ix) Change in Social Prestige. All the dimensions were measured by using schedule and the items were scored on a three-point continuum.

After calculating scores of all the nine dimensions, effectiveness index for each respondent was calculated in the following way —

### Effectiveness Index

$$\frac{Y \times W_1 + I \times W_2 + CD \times W_3 + TI \times W_4 + EC \times W_5 + FS \times W_6 + FE \times W_7 + US \times W_8 + SP \times W_9}{W_1 + W_2 + W_3 + W_4 + W_5 + W_6 + W_7 + W_8 + W_9}$$

Where,

Y = Yield, I = Income, CD = Capacity Development, TI = Timeliness of Information, EC = Extension Contact, FS = Family Saving, FE = Farm Expenditure, US = Usefulness and Satisfaction, SP = Social Prestige, W1 = Weightage for the Yield as given by judges, W2 = Weightage for the Income as given by judges, W3 = Weightage for the Capacity Development as given by judges, W4 = Weightage for

the Timeliness of Information as given by judges, W5 = Weightage for the Extension Contact as given by judges, W6 = Weightage for the Family Savings as given by judges, W7 = Weightage for the Farm Expenditure as given by judges, W8 = Weightage for the Usefulness and Satisfaction as given by judges and W9 = Weightage for the Social Prestige as given by judges.

Since the nine indicators do not contribute the same degree of effectiveness, weightages were given to them. For this purpose, a five-point rating scale was prepared ranging from Very High, Above Average, Average, Below Average and Very Low with corresponding weights of 1, 2, 3, 4, and 5. Based on the importance of each dimension in measuring perceived effectiveness of IARI's chosen extension strategies, weightages were obtained from 36 specialist judges by Google Form survey and personally in hand.

The mean value of the scores was calculated and these were considered weights for the 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup>, 6<sup>th</sup>, 7<sup>th</sup>, 8<sup>th</sup>, and 9<sup>th</sup> dimensions, respectively which were represented as W1, W2, W3, W4, W5, W6, W7, W8, and W9. By using the Effectiveness Formula mentioned above, EI score was calculated for every respondent farmer. Then based on their effectiveness index score Very low, low, medium, high, and very high were the five categories into which the respondents were divided using the cumulative cube root frequency (CCRF) approach.

Using IBM-SPSS 27 software, the collected data in this study were tabulated in MS Excel (2019) sheets and evaluated with the use of suitable descriptive statistics and inferential statistics (such as correlation, regression, student's t-test, Kruskal-Wallis H test, and Mann-Whitney U test) for data interpretation and analysis.

## RESULTS AND DISCUSSION

### Overall effectiveness index of the selected extension approaches of IARI

The IARI-VO adopted village's farmer respondents had the highest average overall effectiveness index score (18.4). This implies that majority of farmer respondents perceived that IARI-VO extension approach was more effective than IARI-NEP and IARI Model Village (IMV) extension approaches. The present study revealed that majority of the farmer respondents (33.33%) perceived that IARI-NEP extension approach was low in effectiveness, while majority (66.67%) of farmers perceived that IARI-VO extension approach was highly effective and majority of the respondents (50.0%) perceived that IARI Model Village (IMV) extension approach was medium effective. It may be due to more grass root reach of voluntary organisation.

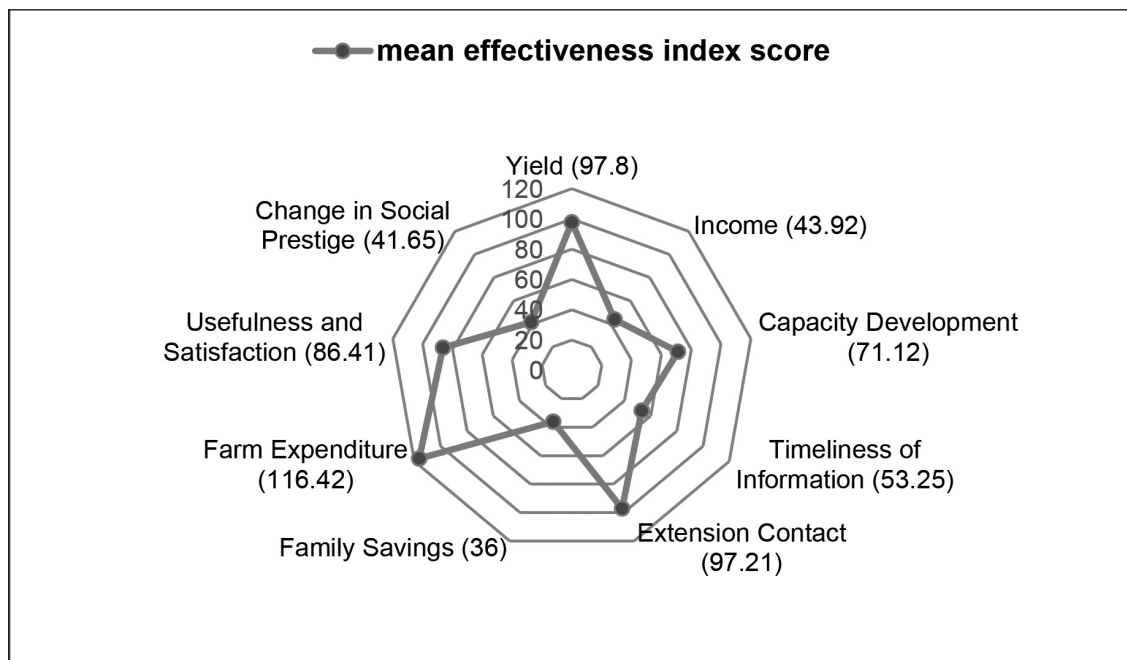
This result was consistent with that of Sollows *et al.* (1993), who found that NGOs are at the forefront of creating novel dissemination strategies based on interactions between farmers, either individually or in groups, which eventually improves the effectiveness of their work. The result of effectiveness of the IARI Model Village (IMV), IARI-VO and IARI-NEP extension approaches, perceived by majority of the farmer respondents, was in agreement with the findings

of Carney (1998) They came to the conclusion that the public extension system is not enough to satisfy the increasing needs of clients due to increased fiscal deficits. Additionally, our findings concur with those of Singh and Narain (2008), which showed that private extension systems continued to outperform public extension systems in two districts of Uttar Pradesh in terms of guaranteeing the supply of vegetable seeds and planting materials.

**Table 1: Distribution of farmer respondents on the basis of overall effectiveness index score**

Effectiveness of the selected extension approaches of IARI	Adopted farmers					
	IARI-NEP		IARI-VO		IMV	
<b>Mean</b>	17.35		18.4		15.94	
<b>Frequency distribution</b>						
Category	Freq	%	Freq	%	Freq	%
<b>Very Low</b> (<14.18)	01	3.33	0	0	06	20.00
<b>Low</b> (14.18-16.15)	10	33.33	01	3.33	07	23.33
<b>Medium</b> (16.15-17.69)	05	16.67	04	13.33	15	50.00
<b>High</b> (17.69-19.23)	07	23.33	20	66.67	02	06.67
<b>Very High</b> (>19.23)	07	23.33	05	16.67	0	0
<b>Total</b>	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>

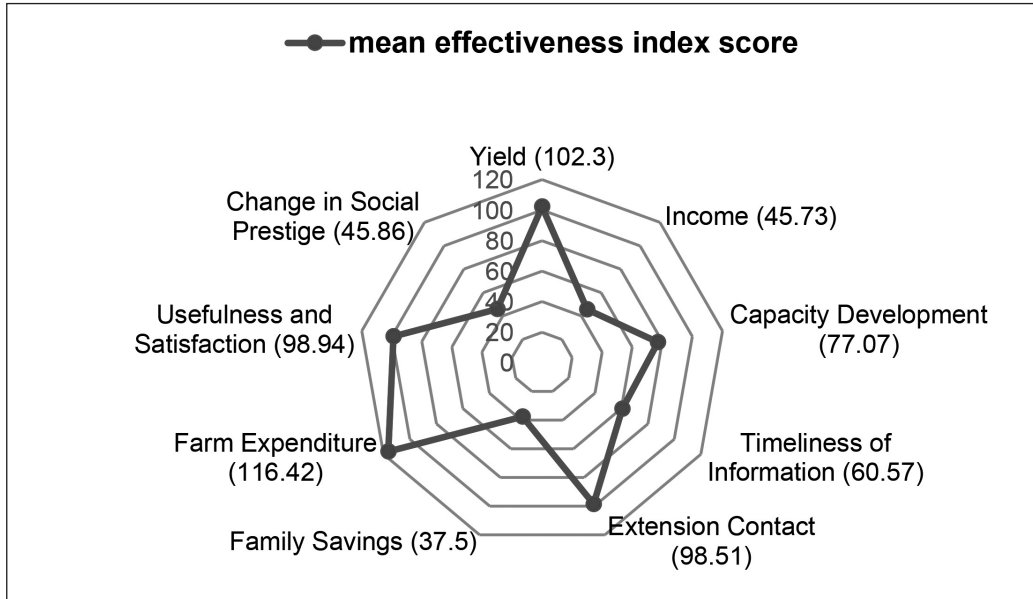
**Radar chart representing the dimension-wise average level of effectiveness index score**



**Fig 1: Radar chart showing the dimension-wise mean level of effectiveness index score in case of IARI-NEP extension approach**

Fig.1 displayed, as a radar chart, the average level of effectiveness index score as per each dimension for the IARI-NEP extension strategy. This diagram reveals that the dimension 'farm expenditure' had the highest mean index score of 116.42, followed by the dimension 'yield' with mean index score of 97.8 and the dimension 'extension

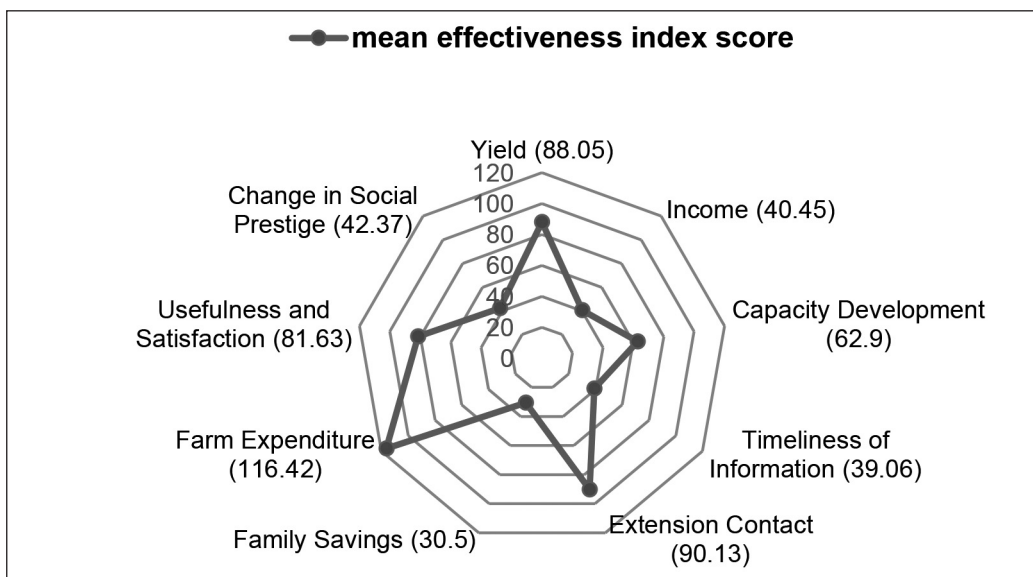
contact' with mean index score of 97.21. It is observed that the dimension 'family savings' had lowest mean index score of 36, followed by 'change in social prestige' (41.65) and 'income' (43.92). Therefore, it can be inferred that IARI-NEP extension approach needs lot of improvement.



**Fig 2: Radar chart showing the dimension-wise mean level of effectiveness index score in case of IARI-VOs partnership extension model**

In case of IARI-VOs partnership extension model the average level of effectiveness index score for each dimension was displayed as a radar chart in the fig. 2. The diagram reveals that the dimension 'farm expenditure' had the highest mean index score of 116.42, followed by the dimension 'yield' with mean index score of 102.3 and the

dimension 'usefulness and satisfaction' with mean index score of 98.94. It is observed that the dimension 'family savings' had lowest mean index score of 37.5, followed by 'income' (45.73) and 'change in social prestige' (45.86). Therefore, it can be inferred that IARI-VOs partnership extension model needs lot of improvement.



**Fig 3: Radar chart showing the dimension-wise mean level of effectiveness index score in case of IARI Model Villages (IMV) extension approach**

For the IARI Model Villages (IMV) extension strategy, figure 3 portrayed the average level effectiveness index score as per each dimension as a radar chart. This diagram reveals that dimension ‘farm expenditure’ had the highest mean index score of 116.42, followed by the dimension ‘extension contact’ with mean index score of 90.13 and the dimension ‘yield’ with mean index score of 88.05. It is observed that the dimension ‘family savings’ had lowest mean index score of 30.5, followed by ‘timeliness of information’ (39.06) and ‘income’ (40.45). Therefore, it can be inferred that IARI Model Villages (IMV) extension approach needs lot of improvement.

The three results mentioned above were comparable to Chambers’ (1990) results that concluded that any extension model must be able to increase production and productivity while also being readily available and accessible to clients in order to be considered effective. The results somewhat concurred with the observations of Chiru *et al.* (2021) and Krushnpalsinh and Vinaya (2020) which depicted that the primary factor influencing how effective public extension services were seen by farmers is their perception of a change in awareness. The degree of satisfaction, awareness and behavior changes were the main contributors influencing how effective the private extension service was as per the perception of the farmers (Sulaiman *et al.*, 2005).

**Comparison of perceived effectiveness of IARI extension approaches**

**Table 2: Comparison of perceived effectiveness of IARI extension approaches by Kruskal-Wallis H test**

Group	N	Mean rank
IARI-NEP	30	47.87
IARI-VO	30	62.73
IMV	30	25.90
Test Statistics		Value
$\chi^2$ statistic (Kruskal-Wallis H)		30.187**
df		2
Asymp. Sig. (2-tailed)		0.0001

\*\*Significant at the 0.01 level; \*at the 0.05 level (both 2-tailed)

The IARI-NEP extension strategy, IARI-VOs collaborative extension approach, and IARI Model Villages (IMV) approach were tested to find out a statistically

significant difference using the Kruskal-Wallis H test. The difference was from each other in terms of overall perceived effectiveness index scores. In Table 3, Test statistics ( $\chi^2$  statistic = 30.187, asymptotic significance (2-tailed)  $p$ -value = 0.0001) shows that the IARI-NEP extension strategy, IARI Model Villages (IMV) approach and IARI-VOs partnership extension model, all had statistically significant differences in their overall perceived effectiveness index scores. Being an omnibus test statistic, the Kruskal-Wallis H test shows that at least two extension strategies differed from one another in terms of overall perceived effectiveness index score, but it cannot be concluded that which specific extension approaches were statistically significantly different from each other in terms of perceived effectiveness. For being aware of that a Mann-Whitney U test, often known as a post hoc test, was conducted.

Further to ascertain that which specific extension approaches were statistically significantly different from each other in terms of perceived effectiveness Mann Whitney U test was applied. The findings are displayed in Table 4. Test statistics (Mann-Whitney U = 331.000, Z score = -1.759, asymptotic significance (2-tailed)  $p$ -value = 0.079) shows that the IARI-NEP extension strategy and the IARI-VOs extension approach did not vary statistically significantly in terms perceived effectiveness. Whereas Test statistics (Mann-Whitney U = 260.000, Z score = -2.809, asymptotic significance (2-tailed)  $p$ -value = 0.005) shows that compared to the IARI Model Villages (IMV) extension approach, the IARI-NEP extension approach was statistically much more effective. Similarly, Test statistics (Mann-Whitney U = 52.000, Z score = -5.884, asymptotic significance (2-tailed)  $p$ -value = 0.0001) shows that compared to the IARI Model Villages (IMV) extension approach, the IARI-VOs partnership extension model was statistically much more effective. Therefore, the IARI-NEP extension strategy and the IARI-VOs extension model did not differ statistically significantly in terms of perceived effectiveness, according to the results of the Mann-Whitney U test, a post hoc analysis of the Kruskal-Wallis H test, however, the effectiveness of both extension strategies was statistically substantially higher than that of the IARI Model Villages (IMV) extension strategy. The result was in line with the finding of Korten (1987) who concluded that agricultural and rural development strategies would be more effective by increased partnership between government sectors organizations and voluntary organizations.

**Table 3. Difference in perceived effectiveness of the farmers towards different extension approaches of IARI by Mann Whitney U test**

Groups	Group of approaches	Mean rank	N	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
A	IARI-NEP	26.53	30	331.000	796.000	-1.759 <sup>Ns</sup>	0.079
	IARI-VO	34.47	30				
B	IARI-NEP	36.83	30	260.000	725.000	-2.809**	0.005
	IMV	24.17	30				
C	IARI-VO	43.77	30	52.000	517.000	-5.884**	0.0001
	IMV	17.23	30				

**Association between effectiveness of IARI extension approaches perceived by the respondents and selected independent variables:**

**Table 4: Correlation between effectiveness of IARI extension approaches perceived by the respondents and selected independent variables**

Sr. No.	Independent variables	IARI-NEP		IARI-VO		IMV	
		r	p-value	r	p-value	r	p-value
X <sub>1</sub>	Age	-0.154	0.418	0.122	0.522	-0.317	0.088
X <sub>2</sub>	Education	0.138	0.467	0.335	0.070	0.285	0.127
X <sub>3</sub>	Family size	0.406*	0.026	0.266	0.156	0.091	0.634
X <sub>4</sub>	Farming experience	-0.141	0.459	0.185	0.328	-0.406*	0.026
X <sub>5</sub>	Social participation	0.372*	0.043	0.379*	0.039	0.334	0.071
X <sub>6</sub>	Land holding	0.680**	0.000036	0.508**	0.004	0.509**	0.004
X <sub>7</sub>	Estimated annual income	0.332	0.073	0.277	0.138	0.407*	0.026
X <sub>8</sub>	Contact with IARI	0.191	0.312	0.411*	0.024	-0.027	0.889
X <sub>9</sub>	Innovativeness	0.355	0.054	0.419*	0.021	0.442*	0.014
X <sub>10</sub>	Economic motivation	0.821**	0.000001	0.357	0.053	0.507**	0.004
X <sub>11</sub>	Scientific orientation	0.770**	0.000001	0.458*	0.011	0.682**	0.000033

r = Pearson correlation coefficient

Table 4 shows that the perceived effectiveness of the IARI-NEP extension technique was positively and statistically substantially connected with family size, land ownership, social participation, economic motivation, and scientific orientation. It was discovered that the perceived effectiveness of IARI-VO's partnership extension model was favourably and statistically substantially correlated with social involvement, land holding, interaction with IARI, innovativeness, and scientific orientation. There was a negative correlation between farming experience and the perceived effectiveness of the IARI Model Villages (IMV) extension approach, while there was a positive and statistically significant correlation between land holding, estimated annual income, innovativeness, economic motivation, and scientific orientation.

Table 5 demonstrated that the independent variables chosen for the study could account for about 86.5% of the variance in the perceived effectiveness of the IARI-NEP extension strategy, as indicated by the R<sup>2</sup> value of 0.865. At the significance level of 1 per cent ( $p = 0.00001$ ), the F-ratio

of 10.521 demonstrates that the regression model as a whole fit the data well and statistically substantially predicts the perceived effectiveness of the IARI-NEP extension technique. The perceived effectiveness of this extension strategy was shown to be strongly influenced by three independent factors. At the 5% significance level, *land ownership* and *economic motivation* significantly and favourably influenced how effective the IARI-NEP extension strategy was seen to be, while at the 5% level of significance, it is discovered that the effectiveness is adversely affected by *predicted yearly income*. The R<sup>2</sup> value of 0.588 indicates that the independent variables used for the study could account for 58.8% of the variance in the perceived effectiveness of IARI-VO's partnership extension model. The total regression model statistically substantially predicts the perceived effectiveness of IARI-VO's partnership extension model, as indicated by the F-ratio of 2.337. It also fits the data well at the 5% level of significance ( $p = 0.05$ ). However, it was discovered that no independent variable was statistically substantially influencing how effective IARI-VO's partnership extension strategy was seen to be. The independent variables used for the

Table 5: Multiple regression analysis with perceived effectiveness as dependent variable in different extension approaches of IARI

Independent variables	IARI-NEP					IARI-VO					IMV				
	B	SE	$\beta$	t-statistic	p-value	B	SE	$\beta$	t-statistic	p-value	B	SE	$\beta$	t-statistic	p-value
Constant	6.881	2.567		2.681	0.015	11.619	2.878		4.037	0.001	9.086	3.102		2.929	0.009
Age	-0.059	0.108	-0.316	-0.544	0.593	-0.025	0.038	-0.293	-0.653	0.522	-0.032	0.054	-0.240	-0.585	0.566
Education	-0.025	0.082	-0.037	-0.304	0.765	0.051	0.075	0.130	0.683	0.503	0.028	0.048	0.109	0.584	0.566
Family size	0.004	0.077	0.010	0.056	0.956	0.050	0.054	0.163	0.915	0.372	-0.018	0.055	-0.057	-0.328	0.747
Farming experience	0.050	0.108	0.275	0.467	0.646	0.036	0.043	0.410	0.850	0.407	0.016	0.050	0.137	0.326	0.748
Social participation	0.159	0.142	0.138	1.120	0.277	0.075	0.077	0.201	0.974	0.343	0.230	0.280	0.141	0.822	0.422
Land holding	0.094	0.037	0.497	2.520*	0.021	0.060	0.057	0.349	1.067	0.300	0.203	0.142	0.348	1.425	0.171
Estimated annual income	-1.158E-6	0.000	-0.363	-2.295*	0.034	-1.346E-6	0.000002	-0.252	-0.810	0.428	-1.003E-6	0.000003	-0.061	-0.289	0.776
Contact with IARI	-0.059	0.080	-0.111	-0.736	0.471	0.188	0.159	0.237	1.183	0.252	-0.050	0.069	-0.118	-0.732	0.474
Innovativeness	0.068	0.083	0.100	0.820	0.423	0.071	0.065	0.198	1.084	0.293	-0.006	0.125	-0.011	-0.046	0.964
Economic motivation	0.292	0.133	0.406	2.195*	0.042	0.078	0.085	0.165	0.924	0.368	0.107	0.196	0.134	0.545	0.593
Scientific orientation	0.149	0.088	0.311	1.691	0.108	0.033	0.079	0.083	0.416	0.682	0.183	0.081	0.452	2.248*	0.037

\*\*Significant at the 0.01 level; \*at the 0.05 level (both 2-tailed)R<sup>2</sup> = 0.865

R<sup>2</sup> = 0.588

R<sup>2</sup> = 0.621 F ratio = 10.521\*\*

F ratio = 2.337\*

F ratio = 2.679\*

study could account for around 62.1% of the variance in the perceived effectiveness of the IARI Model Villages (IMV) extension approach, as indicated by the  $R^2$  value of 0.621. The total regression model has an excellent fit for the data at the 5% level of significance ( $p = 0.031$ ), as indicated by the F-ratio of 2.679, which statistically substantially predicts the perceived effectiveness of the IARI Model Villages (IMV) extension method. The IARI Model Villages (IMV) extension approach's perceived effectiveness was found to be strongly influenced by only one independent variable. *Scientific orientation* had a favourable and noteworthy effects on the IARI Model Villages (IMV) extension approach's perceived effectiveness at the significance level of 5%. The results are in line with the findings of Zade et al. (2024a), Bharath et al. (2024), Zade et al. (2024b), Tankodara et al. (2022).

## CONCLUSION

This study examined the effectiveness of the IARI-NEP, IMV and IARI-VO extension methodologies, from the perspective of the farmers in Uttar Pradesh's project villages. The IARI-VO adopted village's farmer responders had the highest mean overall effectiveness index score. This implies that majority of farmer respondents perceived that IARI-VO extension approach was more effective than IARI-NEP and IARI Model Village (IMV) extension approaches. Regarding the IARI Model Villages (IMV) extension strategy, the IARI-NEP extension approach, and the IARI-VOs partnership extension model the dimension 'farm expenditure' had the highest mean index score. For each selected extension approaches it is observed that the dimension 'family savings' had lowest mean index score. The IARI-VOs extension strategy and the IARI-NEP extension approach did not vary statistically significantly in terms perceived effectiveness; however, the effectiveness of both extension strategies was statistically substantially higher than that of the IARI Model Villages (IMV) extension strategy. The perceived effectiveness of all chosen IARI extension strategies was shown to be favourably and statistically substantially connected with land ownership and scientific orientation. The findings of the multiple regression analysis indicate that estimated annual income contributed negatively, whereas land holding and economic motive contributed positively to the perceived effectiveness of IARI-NEP extension approach, while an important and favourable factor in the perceived effectiveness of the IARI Model Villages (IMV) extension strategy was scientific orientation.

## POLICY IMPLICATIONS

The study implies that majority of farmer respondents perceived that IARI-VO extension approach was more effective than IARI-NEP and IARI Model Village

(IMV) extension approaches. It was also found that the effectiveness of both IARI-VOs extension strategy and the IARI-NEP extension approach was statistically substantially higher than that of the IARI Model Villages (IMV) extension strategy. Therefore, the government policies should focus on promoting Public-Private Partnership (PPP) approach which involves collaboration between government agencies and private sector to deliver extension services aiming to improve the livelihood of the rural people.

## CONFLICT OF INTEREST

All authors declare that they have no conflict of interest.

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