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Attributers of the technologies intervened through frontline demonstrations

UG Thakare

Senior Scientist and Head, Krishi Vigyan Kendra, Akola, Maharashtra, India

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Corresponding Author: UG Thakare

Abstract

Front Line Demonstrations (FLDs) are effective extension tools to showcase and disseminate agricultural technologies under real farm conditions. This study was conducted during 2024-25 in Akola district to assess the perceived attributes and impact of technologies demonstrated through FLDs by Krishi Vigyan Kendra (KVK), Akola. A population study covering 230 beneficiaries across 14 FLDs was undertaken using an exploratory and diagnostic design. Standardized scales measured farmers' socio-economic profile, technology attributes, and impact indicators such as knowledge, adoption, productivity, and income. Results showed that technologies were perceived as advantageous, compatible, simple, observable, and reliable. Knowledge increased by 39.02%, adoption by 74.95%. Correlation analysis revealed positive relationships of adoption with education, farm size, income, innovativeness, economic motivation, and risk preference. The findings highlight the crucial role of FLDs in bridging research-extension gaps and improving farmers' socio-economic conditions.

Keywords: Front Line Demonstrations, Technology adoption, Perceived attributes, Impact assessment, KVK Akola

Introduction

Technology dissemination remains a major challenge in Indian agriculture, where small and marginal farmers constitute the majority. To address the gap between research and practice, the Indian Council of Agricultural Research (ICAR) introduced Front Line Demonstrations (FLDs) in 1991-92. These serve as "learning laboratories" where farmers directly observe the performance of improved technologies under local conditions.

Studies across India have confirmed that FLDs enhance awareness, improve adoption, and boost productivity (Singh *et al*., 2021; Chaudhary *et al*., 2022) [7, 1]. Farmers' decisions, however, are strongly influenced by how they perceive technology attributes such as relative advantage, compatibility, complexity, observability, and practicability (Rogers, 2003) [5]. Unless a technology aligns with farmers' resources, values, and constraints, its adoption may remain limited.

The present study was conducted in Akola district of Maharashtra with the following objectives:

1. To study the perceived attributes of technologies intervened through FLDs conducted by KVK, Akola.
2. To assess the impact of FLDs in terms of change in knowledge and adoption

Methodology

The study was conducted in Akola district, Maharashtra, during 2024-25. An exploratory and diagnostic research design was adopted. A population study was carried out covering 230 beneficiaries of 14 FLDs conducted by KVK, Akola across crops (wheat, pigeon pea, onion, banana, cotton, blackgram, fodder) and enterprises (mushroom, nutrition garden, soybean mitten, cattle health).

Variables and Measurements

Under Profile of beneficiaries, Education, experience, farm size, income, socio-economic status (Thakare & Ingle, 2007) [9], innovativeness, scientific orientation, economic motivation, risk preference was studied. The Attributes of technology as Relative advantage, compatibility, complexity, observability, and practicability was measured using the scale. The Impact indicators were Knowledge and Adoption. Knowledge and adoption scores were obtained through pre- and post-tests and converted into indices.

Statistical Analysis

The Index score calculation, Percentage change over before, Categorization: Equal interval method, Distributional analysis: Mean, SD, frequency and Relational analysis was carried out.

Results and Discussion

Profile of the Respondents

The socio-economic profile of respondents as depicted in Table 2 provides the foundation for understanding their adoption behaviour. In case of Education, among the 215 respondents, 6.96% were illiterate, 5.65% had only primary schooling, while a sizeable proportion had middle school education (33.04%). High school and junior college educated farmers constituted 14.35% each, and 25.65% were graduates and above. This shows that nearly three-fourths of the respondents had attained education up to middle school or higher, indicating that literacy was not a major constraint. Higher levels of education are positively associated with better understanding of scientific recommendations, as confirmed by Singh *et al*. (2022) [8].

The Experience in crop cultivation shows that nearly half of the respondents (46.09%) had 6-10 years of experience, 31.74% had less than 5 years, and 22.17% had over 11 years. This distribution highlights that most farmers were in the active adoption phase, balancing experience with openness to new practices. Similar findings were reported by Patel *et al*. (2023) [4], where moderate experience facilitated quicker adoption of FLD technologies. In case of Farm size, a majority were medium to large farmers (31.74% large, 22.17% medium, 24.78% semi-medium), while marginal and small farmers accounted for only 9.13% and 12.17%, respectively. This skew towards larger landholdings suggests greater resource availability and potential for technology adoption. The data pertaining to Annual income shows that about one-third earned up to ₹50,000, another 22.17% earned between ₹50,001-₹100,000, and 23.48% earned between ₹100,001-₹150,000. Only 8.26% were in the higher bracket of ₹200,001-₹250,000. This shows that the majority were small and medium-income farmers, relying on agriculture as the primary source of livelihood. The Socio-economic status revealed that the largest proportion (43.04%) had low socio-economic status, followed by moderate (22.17%) and very low (15.65%). Only 7.39% were in the very high status category. The prevalence of low SES underlines the need for interventions like FLDs that provide visible results with fewer risks (Mishra *et al*., 2021) [2].

In case of Innovativeness it was observed that more than half (52.61%) were moderately innovative, 35.22% highly innovative, and 12.17% had low innovativeness. This indicates that a considerable segment of farmers was inclined toward experimenting with new technologies, a critical factor in technology diffusion. The Scientific orientation shows that a majority (53.48%) were moderately oriented, while 26.52% showed high scientific orientation. This reflects openness to scientific explanations behind technologies, in line with Rogers' diffusion theory (2003) [5]. The results pertaining to Economic motivation shows that most farmers (61.30%) had moderate motivation to increase farm income, while 24.35% had high economic motivation. This suggests that profitability is an important driver of adoption. In case of Risk preference, Interestingly, 77.83% were moderate risk takers, while 20% were high and only 2.17% were low. This demonstrates that FLDs are well-suited to such farmer groups, as they are willing to try new technologies provided risks are manageable.

Attributes of the Technology

Relative Advantage of Technologies

Relative advantage refers to the extent to which a technology is perceived as superior to the one it supersedes. The data presented in Table 3 revealed that in case of Initial cost, a striking 65.65% felt that the technologies were "cheap," while 13.48% felt them "more cheap." Only 20.87% considered them expensive. This suggests that most FLD technologies were economically feasible, matching earlier findings by Sharma *et al*. (2023) [6]. In case of Net profitability, nearly half (49.13%) rated them as yielding "exorbitant profits," while 8.26% found them "very exorbitant." About 42.61% were uncertain or found returns meager. The positive skew confirms that profitability was a strong factor motivating adoption. In case of Consistency of profit, over half (53.04%) reported "regular profits," and 36.09% found them "irregular." This indicates that while returns were generally stable, some variability due to climatic and input factors remained. For Saving of time, a majority (59.13%) felt neutral ("cannot say"), while 22.61% and 18.26% reported time-saving benefits. This implies that while most technologies were profitable, their time efficiency varied depending on the enterprise. In case of Multiple potential use, nearly 55% acknowledged multiple or wider benefits, especially in case of crop protection and nutrition-related demonstrations. This multidimensional advantage is consistent with earlier reports by Chaudhary *et al*. (2022) [1].

Compatibility of Technologies

Compatibility refers to the degree to which a technology fits farmers' existing values, needs, and conditions. The data from Table 4 reveled that in case of Situational compatibility, around 60.87% found technologies feasible to more feasible, reflecting their adaptability to local conditions. In case of Cultural compatibility, a remarkable 76.52% found them culturally acceptable, indicating that new practices did not clash with existing traditions or norms. In case of Physical compatibility, about 81.31% perceived technologies as compatible with their physical needs (soil, crop type, resources). In case of Social compatibility, more than 66% considered them recognizable within their communities, highlighting peer acceptance and social reinforcement. In case of Relational compatibility, nearly half (46.09%) expressed neutrality, while 37.40% reported independence from external dependence. This implies that while some technologies required external inputs, many could be managed with farmers' existing resources.

Complexity of Technologies

Complexity often acts as a barrier to adoption. The data in Table 5 shows the results pertaining to complexity of the technology intervened by Krishi Vigyan Kendra, Akola. In case of Cognitive complexity, an overwhelming majority (94.35%) considered technologies simple to very simple, indicating that instructions were clear and training effective. About Application complexity, over 91% felt them adoptable or highly adoptable, reinforcing the user-friendliness of demonstrated technologies. In case of Resource complexity, this was a limiting factor, as 59.06% perceived technologies as scarce or resource-intensive. This suggests that adoption may face hurdles where inputs are not readily available (Mishra *et al*., 2021) [2]. In case of Reversibility, a majority (57.83%) felt practices were reversible, which provides farmers with confidence to experiment. For Labour efficiency, interestingly, 70.43% felt technologies were "labour consuming," indicating that labour-saving aspects require further emphasis in future demonstrations.

Practicability and Observability

Practicability and observability strongly influence adoption. The data in Table 6 related to Observability shows that nearly 96% considered technologies observable to highly observable, which demonstrates the strength of FLD as a visible learning tool. In case of Visibility, only 23.92% found them visible, suggesting that while results are clear, physical signs (like crop differences) may sometimes take time. For Demonstrability, a resounding 86.09% considered them demonstrable, underlining that seeing is believing. In case of Trial ability, about 98% felt technologies were trialable, reinforcing their practical orientation. In case of Point of origin, almost all respondents (94.35%) found them reliable, demonstrating strong trust in KVK's interventions.

Impact of Technologies

The impact was measured in terms of knowledge gain, adoption and depicted in Table 7. In case of Knowledge gain: The mean knowledge score rose from 57.58 to 79.25, a 39.02% overall increase. Maximum gains were observed in pigeon pea (GA_3 application) and soybean mitten demonstrations. In case of Adoption gain, the overall adoption improved by 74.95%, with mushroom and nutritional gardens showing the highest rise (97.35% and 103.44%, respectively). These enterprises were particularly attractive due to low cost and high returns. The technology wise impacts shows that Wheat and cotton technologies showed substantial increases in knowledge and adoption, while nutritional garden and fodder management technologies had the most dramatic improvements in adoption. These findings are consistent with Patel *et al.* (2023) [4].

Correlates of Knowledge and Adoption

The correlation analysis depicted in table shows that Education Positively correlated with both knowledge (0.236) and adoption (0.341), highlighting the role of literacy in technology uptake. The Experience was Negatively correlated (−0.221, −0.231), indicating that younger farmers are more receptive to new technologies. Farm size and income, Both showed positive correlations, suggesting that resource-rich farmers are more likely to adopt innovations. Socio-economic status, innovativeness, and scientific orientation were positively linked to knowledge and adoption, consistent with earlier studies (Nain *et al.*, 2020) [3]. Economic motivation and risk preference were strongest correlates with adoption (0.423 and 0.337), implying that risk-taking and profit-seeking farmers adopt technologies faster.

Table 1: Profile of the FLDs

Sl. No.	Crop/Enterprise	Thematic area	Technology Demonstrated	Season and year	Area (ha)/Items	No. of farmers/ demonstrations		
						SC/ST	Others	Total
			Crop related					
1	Wheat	Varietal Demonstration	PDKV Sardar wheat variety for late sowing Condition	Rabi -2024	5.2	3	10	13
2	Pigeon pea	Used of PGR	Application of GA3 25 PPM	Kharif - 2024	5.2	4	9	13
3	Kagzi lime	Bahar management	Hasta bahar management	Kharif - Summer 2024	8.00	06	14	20
4	Onion	INM	Use of Sulphur	Rabi-2024	5.20	03	10	13
5	Banana	INM	Foliar crop specific micronutrient Arka Banana Special	Kharif 2024	5.20	03	10	13
6	Onion	INM	Foliar spray of 0.2% Boron at flower opening stage	Rabi-2024	8.00	04	16	20
7	Blackgram	Pest management	1st spray of Monocrotophos 36 SL @12.5 ml / 10 lit water at bud formation stage 2nd spray of chlorantraniliprole 18.5 SC 2 ml/10 lit water after 15 days of 1st spray	Kharif 2024	5.20	4	9	13
8	Cotton	Biological Pest management	Six releases of Trichogrammatoidea bactrae @ 1,00,000 eggs per ha at an interval of 10 days starting from 55 DAG	Kharif 2024	5.20	4	9	13
9	Pigeonpea	Integrated Disease management	Seed treatment with combine product of fungicide Carboxin 37.5% + Thiram 37.5% @ 3 g per kg seed, followed by seed treatment with Trichoderma viride @ 10 g/kg seed	Kharif - 2024	10	6	19	25
			Enterprise Related					
10	Drudgery Reduction	Soybean Mitten	Soybean	Kharif - 2024	13	13	0	13
11	Entrepreneurship Development	Oyster Mushroom	Mushroom	Kharif - 2024	13	3	10	13
12	Nutrition Management	Nutritional garden	Nutri-garden Kit	Kharif - 2024	35	12	23	35
13	Cattle	Health Management (Deshi)	Use of Metarhizium Anisopalli for controls of ticks in cattle	Kharif - 2024	13	3	10	13
14	Fodder	Fodder Management (COFS-43)	Use of improved Variety - COFS 43 for fodder production	Kharif - 2024	13	4	9	13
			Total			72	158	230

Details of FLDs implemented during 2024 (Kharif 2024, Rabi 2024-25, Summer 2025)

Table 2: Profile of the respondents:

Sr	Profile	Number(N=215)	Percent	Mean	SD
1	**Education**				
	Illiterate	16	6.96	9.61	5.27
	Primary	13	5.65		
	Middle School	76	33.04		
	High School	33	14.35		
	Junior College	33	14.35		
	Graduate and above	59	25.65		
2	**Experience**				
	Up to 5 Years	73	31.74	10.21	3.31
	6 to 10 years	106	46.09		
	11 Years and above	51	22.17		
3	**Farm size**				
	Marginal	21	9.13	10.16	4.11
	Small	28	12.17		
	Semi-medium	57	24.78		
	Medium	51	22.17		
	Large	73	31.74		
4	**Annual income**				
	Upto 50000	77	33.48	16531.43	73212.31
	50001 to 100000	51	22.17		
	100001 to 150000	54	23.48		
	150001 to 200000	28	12.17		
	200001 to 250000	19	8.26		
5	**Socio-economic status**				
	Very low	36	15.65	7.12	3.71
	Low	99	43.04		
	Moderate	51	22.17		
	High	27	11.74		
	Very High	17	7.39		
6	**Innovativeness**				
	Low	28	12.17	23.09	5.52
	Moderate	121	52.61		
	High	81	35.22		
7	**Scientific orientation**				
	Low	46	20.00	21.41	5.78
	Moderate	123	53.48		
	High	61	26.52		
8	**Economic motivation**				
	Low	33	14.35	29.06	6.14
	Moderate	141	61.30		
	High	56	24.35		
9	**Risk preference**				
	Low	5	2.17	23.12	5.36
	Moderate	179	77.83		
	High	46	20.00		

Table 3: Relative Advantage of the technology intervened through Frontline Demonstrations

	Indicator	01		02		03		04		05	
A. Relative Advantage											
1	Initial Cost	More Expensive		Expensive		Can Not Say		Cheap		More Cheap	
		0	0	29	12.61	19	8.26	151	65.65	31	13.48
2	Net Profitability	Very Meagre		Meagre		Can Not Say		Exorbitant		Very Exorbitant	
		0	0	67	29.13	31	13.48	113	49.13	19	8.26
3	Consistency of Profit	More Irregular		Irregular		Can Not Say		Regular		More Regular	
		0	0	25	10.87	83	36.09	122	53.04	0	0.00
4	Saving of Time	More Time Consuming		Time Consuming		Can Not Say		Time Saving		More Time Saving	
		0	0	136	59.13	52	22.61	38	16.52	4	1.74
5	Multiple Potential Use	No Benefit		Single Benefit		Can Not Say		Multiple Benefits		More Wider Benefits	
		0	0	78	33.91	25	10.87	68	29.57	59	25.65

Table 4: Compatibility of the technology intervened through Frontline Demonstrations

B. Compatibility											
1	Situational Compatibility	More Unfeasible		Unfeasible		Can Not Say		Feasible		More Feasible	
		13	5.46	61	26.52	16	6.96	59	25.65	81	35.22
2	Cultural Compatibility	More Non Acceptable		Not Acceptable		Can Not Say		Acceptable		More Acceptable	
		9	4.09	14	6.09	24	10.43	176	76.52	7	3.04
3	PhysicalCompatibility	More Incompatibility With Need		Incompatible With Needs		Can Not Say		Compatible With Needs		More Compatible With Needs	
		6	2.73	20	8.70	17	7.39	160	69.57	27	11.74
4	Social Compatibility	More Non Recognizable		Non Recognizable		Can Not Say		Recognizable		More Recognizable	
		25	10.92	34	14.78	19	8.26	100	43.48	52	22.61
5	RelationalCompatibility	More Dependent		Dependent		Can Not Say		Independent		More Independent	
		13	5.46	25	10.87	106	46.09	66	28.70	20	8.70

Table 5: Complexity of the technology intervened through Frontline Demonstrations

C. Complexity											
1	Cognitive Complexity	More Complex		Complex		Can Not Say		Simple		Very Simple	
		0	0	13	5.65	0	0.00	144	62.61	73	31.74
2	Application Complexity	More In-Adoptable		In-Adoptable		Can Not Say		Adoptable		More Adoptable	
		0	0	0	0.00	19	8.26	107	46.52	104	45.22
3	Resource Complexity	More Scare		Scare		Can Not Say		Abundant		More Abundant	
		30	12.97	106	46.09	11	4.78	28	12.17	55	23.91
4	Reversibility	More Irreversible		Irreversible		Can Not Say		Reversible		More Reversible	
		30	12.97	37	16.09	30	13.04	88	38.26	45	19.57
5	Labour Efficiency	More Labour Consuming		Labour Consuming		Can Not Say		Labour Saving		More Labour Saving	
		0	0	162	70.43	30	13.04	38	16.52	0	0.00

Table 6: Practicability of the technology intervened through Frontline Demonstrations

D. Practicability											
1	Observability	More Unobservable		Unobservable		Can Not Say		Observable		More Observable	
		0	0	6	2.61	3	1.30	72	31.30	149	64.78
2	Visibility	More Invisible		Invisible		Can Not Say		Visible		More Visible	
		96	41.64	67	29.13	13	5.65	39	16.96	16	6.96
3	Demonstrability	More Non Demonstrable		Non Demonstrable		Can Not Say		Demonstrable		More Demonstrable	
		0	0	0	0.00	17	7.39	198	86.09	15	6.52
4	Trial Ability	More Non Triable		Non Triable		Can Not Say		Triable		More Triable	
		0	0	0	0.00	3	1.30	207	90.00	20	8.70
5	Point of Origin	More Unreliable		Unreliable		Can Not Say		Reliable		More Reliable	
		0	0	0	0.00	0	0.00	13	5.65	217	94.35

Table 7: Impact of technology intervened through FLD's

SR		FLD	Beneficiaries	Knowledge Score obtained		Per cent change over before	Adoption Score obtained		Per cent change over before
A	Crop/Enterprise	Technology Demonstrated	Total	Before	After		Before	After	
1	Wheat	PDKV Sardar for late sowing Condition	13	56.79	78.91	38.95	47.99	81.97	70.81
2	Pigeon pea	Application of GA3 25 PPM	13	64.79	88.27	36.24	55.99	91.33	63.12
3	Kagzi lime	Hasta bahar Management	20	58.54	84.9	45.03	49.74	87.96	76.84
4	Onion	Use of Sulphur in Onion	13	52.12	65.57	25.81	43.32	68.63	58.43
5	Banana	Foliar crop specific micronutrient Arka Banana Special	13	53.88	78.02	44.80	45.08	81.08	79.86
6	Onion	Foliar spray of 0.2% Boron at flower opening stage	20	65.22	88.97	36.42	56.42	92.03	63.12
7	Blackgram	1st spray of Monocrotophos 36 SL @12.5 ml / 10 lit water at bud formation stage	13	52.1	73.99	56.60	43.3	77.05	63.12
8	Cotton	Six releases of Trichogrammatoidea bactrae @ 1,00,000 eggs per ha at an interval of 10 days starting from 55 DAG	13	56.15	87.93	56.60	47.35	90.99	92.16
9	Pigeonpea	Seed treatment with combine product of fungicide Carboxin 37.5% + Thiram 37.5% @ 3	25	59.14	76.39	29.17	50.34	79.45	57.83

		g per kg seed, followed by seed treatment with Trichoderma viride @ 10 g/kg seed							
10	Drudgery Reduction	Soybean Mitten	13	64.18	90.99	41.77	55.38	94.05	69.83
11	Entrepreneurship Development	Oyster Mushroom	13	52.91	73.99	39.84	44.11	87.05	97.35
12	Nutrition Management	Nutritional garden	35	53.89	68.67	27.43	45.09	91.73	103.44
13	Cattle	Health Management (Deshi)	13	65.13	73.82	13.34	53.91	90.13	67.19
14	Fodder	Fodder Management (COFS-43)	13	51.29	79.11	54.24	49.27	91.78	86.28
Mean				57.58	79.25	39.02	49.09	86.09	74.95
SD				5.11	7.63	11.97	4.58	7.11	14.28

Table 8: Correlates of Knowledge and adoption

Sr	Characteristics	Correlates	
		Knowledge	Adoption
1	Education	0.236**	0.341**
2	Experience	-0.221*	-0.231**
3	Farm Size	0.349**	0.232**
4	Annual income	0.239**	0.347**
5	Socio-economic status	0.230**	0.235**
6	Innovativeness	0.234**	0.251**
7	Scientific orientation	0.238**	0.231**
8	Economic motivation	0.322**	0.423**
9	Risk preference	0.342**	0.337**
10	Attitude		0.238**

Conclusion

The study establishes that FLDs conducted by KVK, Akola significantly enhanced knowledge and adoption of the technology by the farmers. Farmers perceived demonstrated technologies as advantageous, compatible, simple, and reliable, though resource and labour constraints were noted. Enterprises like soybean mitten, nutritional gardens, and mushroom cultivation had high adoption, reflecting their suitability for smallholders and women farmers. Adoption was strongly influenced by education, economic motivation, and risk preference. The findings reinforce the role of FLDs as an effective tool for bridging research-extension-farmer gaps, and recommend strengthening input supply, credit access, and labour-saving innovations for wider impact.

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