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MULTI-CRITERIA DECISION ANALYSIS OF CONSTRAINTS OF FARMER FIRST PROGRAMME USING ANALYTICAL HIERARCHY PROCEDURE

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ABSTRACT

Farmer FIRST Programme was an Indian Council of Agricultural Research's flagship programme aimed at promoting sustainability by integrating indigenous technologies with modern day scientific technologies. The present study was conducted during 2024-25 in ATARI Zone-X, where two adopted and two non-adopted villages were selected from each of the five Institutes. From the adopted villages, 30 beneficiary farmers were randomly selected, and from the non-adopted villages, 10 non-beneficiary farmers were randomly selected, making a total sample size of 400. To measure the constraints faced by beneficiary farmers of FFP a multi criteria decision making method i.e. Analytical Hierarchy Procedure was applied and the data was collected using pairwise comparison scale. The study revealed that social constraints was the most critical constraints with priority value of 0.2016 followed by personal constraints (0.2015) with little difference, geographical constraints (0.1997), organizational constraints (0.1994) and technical constraints (0.1977). Further, the consistency of the judgements was also checked using consistency ratios which were below the acceptable values (CR<0.1) for all the constraints which revealed that the prioritization was reliable and valid. Although, FFP was successful in achieving in some of its objectives, these constraints perceived by beneficiaries could be integrated into policy to make the programme location-specific and more effective.

Keywords: *constraints, farmer FIRST, analytical hierarchy procedure, agriculture*

INTRODUCTION:

Farmer FIRST (Farm, Innovation, Resources, Science and Technology) Programme is an ICAR initiative launched during 2015 for promoting sustainable agriculture by encouraging farmers to integrate their indigenous knowledge with modern technologies. It was implemented on a pilot basis through 51 institutes all over India (Ashok *et al*., 2021). Through this programme they aimed to promote farmer-scientist interaction for the development of agricultural technologies which are location-specific, demand-driven, and farmer-friendly technological solutions that are crucial for sustainable agricultural progress (Manjeet *et al*., 2019 & Venkatesan *et al*., 2023). Each institute has undertaken some of the location specific and sustainable interventions in their respective adopted villages over the time of seven years. In the current study an attempt has been done to study the constraints faced by beneficiary farmers in availing the benefits of FFP in ATARI Zone-X. This helps to answer the specific constraints and make the programme effective and accessible to everyone by development of specific strategies tailored to the unique needs and conditions of different farming communities, ensuring more effective and practical solutions for achieving sustainability in agriculture. The Analytic Hierarchy Process (AHP) helped to identify the most felt constraints based on prioritization of constraints affecting program implementation by structuring them into five groups: Geographical, Organizational, Technical and Personal and Social constraints.

OBJECTIVE

To elicit the constraints faced by Farmer FIRST beneficiary farmers and to prioritize them using Analytical Hierarchy Procedure

METHODOLOGY

Study area

The present study was conducted during 2024-25 in ATARI Zone-X using a multi-stage random sampling method. All the five Institutes in ATARI Zone-X i.e., ICAR-Indian

Institute of Millet Research (IIMR), ICAR-Indian Institute of Oilseed Research (IIOR), ICAR-Central Research Institute for Dryland Agriculture (CRIDA), ICAR-Indian Institute of Oil Palm Research (IIOPR) and Tamil Nadu Veterinary and Animal Sciences university (TANUVAS) where Farmer FIRST Programme was implemented were selected as the researcher is familiar with the culture and language of the ATARI Zone.

Populations and sampling frame

The sample was collected from the population comprised of beneficiary and non-beneficiary farmers residing in villages covered under the Farmer FIRST Programme in ATARI Zone-X. The sampling frame included all farmers from the selected adopted and non-adopted villages under the programme.

Sample size and sampling procedure

Using a multistage random sampling technique in the first stage, all five ICAR institutes implementing the Farmer FIRST Programme in ATARI Zone-X were selected purposively. In second stage, under each institute two treated villages and two control villages were selected randomly making a total of 10 treated villages and 10 control villages and from each treated village 30 farmers and from control village 10 farmers were selected randomly in the final stage making a sample size of 300 beneficiary and 100 non-beneficiary farmers resulting in a sample size of 400. Constraints faced by beneficiary farmers were collected using a pairwise comparison scale under five different categories from 300 beneficiary farmers.

Research design

The study followed an ex-post facto research design as the variables under investigation had already occurred and were studied without manipulation by the researcher.

An extensive review of literature and preliminary field survey were conducted during pre-survey to generate relevant statements pertaining to constraints faced by farmer FIRST beneficiaries. The statements were scrutinized and validated by experts from State Agricultural Universities, ICAR institutes, and experts associated with the Farmer FIRST Programme. The statements were arranged into different pairs in a questionnaire which resulted into 10 pairs under each section of five different categories of constraints i.e., Geographical, Organizational, Technical and Personal and Social constraints. Validity was tested using face validity through expert opinions.

Data collection procedure

Primary data were collected personally from the selected respondents using a pre-tested structured interview schedule during 2024–25. The respondents were interviewed individually to obtain reliable information regarding their perception of sustainable agricultural practices and constraints faced under the Farmer FIRST Programme.

Data analysis method

The data was collected from 300 beneficiary farmers of Farmer FIRST Programme using a structured schedule comprising pairwise comparison questions and was analyzed using Ms Excel through Analytical Hierarchy Procedure to find out the major constraints faced by farmers. The AHP is a multi-criteria decision-making technique proposed by Thomas Saaty in 1980, designed to establish priorities for making the most suitable decisions (Saaty, 1980). Here, it was employed to calculate the weights of various constraints to decide the major constraints faced by beneficiaries of farmer FIRST programme. The problem was structured hierarchically into the overall goal, criteria, and constraint alternatives. Pairwise comparisons were carried out among criteria and alternatives using Saaty's nine-point scale, and relative weights were derived using the geometric mean method to obtain normalized eigenvectors.

To calculate the maximum eigenvalue (λ max) each element in a row of the comparison matrix was multiplied by the corresponding element in a column of "relative weights" (x-values). Products for each row are summed up to get a value "y" for that row. The maximum eigenvalue (λ max) is the sum of all these "y" values from each row.

To calculate Consistency Index (CI) the following formula was used

$$CI = (\lambda \max - n) / (n - 1)$$

Where n is the total number of items being compared.

To determine how random the judgments might be, the Consistency Ratio (CR) was calculated using the following formula

$$CR = CI / RI$$

where RI is the "random consistency index," a number that depends on the number of items compared.

The CR value tells us the acceptability of comparisons.

If $CR \leq 0.1$, the judgments are considered consistent.

If CR is above 0.1, it might be acceptable up to 0.2 in some cases, but anything higher than that means the judgments are too inconsistent.

In this case, CR value was ≤ 0.1and were considered acceptable.

To calculate the global priority, the local priority (Pl_m) by the weight (V_m) for each criterion, was multiplied and these values were then summed up across all criteria.

$$Pl = \Sigma (Pl_m V_m) \text{ for } m = 1 \text{ to } M$$

The consistency of judgments was assessed using the Consistency Index (CI) and Consistency Ratio (CR), the statements with CR values ≤ 0.10 were considered acceptable. Global priorities were computed by aggregating local priorities with corresponding criterion weights to obtain the final ranking of constraints (Saaty and kearns, 1985).

Software used

All analyses were performed using MS Excel.

RESULTS AND DISCUSSION

In this study, various constraints affecting program implementation were prioritized by structuring them into five main groups: Geographical, Organizational, Technical and Personal and Social constraints. Each group was assigned a "Group Priority", indicating its relative importance compared to the other groups. Within each group, specific issues were further ranked using "Priority within the Group" values, which show how significant each issue is inside its own category. By multiplying the Group Priority and the Priority within the Group, a "Global Priority" was calculated for each individual constraint, allowing direct comparison across all groups. Then the constraints were ranked from most to least critical based on their Global Priority. Additionally, the consistency of the judgments was checked using the Consistency Ratio (CR) and since all CR values were below the acceptable value (CR < 0.1), the prioritization is considered reliable and valid.

Social constraints ranked I with a priority value of 0.2016. Among the social constraints, Community conflicts over resource use (P1) was the major constrained expressed by farmers (0.5602) revealing conflict over use of common resources followed by Caste and class-based Discrimination (P2) (0.4053) pointing out that social inequality also affects participation, Unequal participation (0.1739) (P3), Lack of collective action among beneficiaries (P4) (0.0715) and Limited trust in FFP facilitators (P5) (0.0615).

Personal constraints were the second most critical constraints faced by beneficiaries with a group priority of 0.2015. Among the financial constraints, small land holdings and low profitability (F1) holds the highest priority (0.4377) followed by Lack of time to attend program's activities (F2) with a priority of 0.2425 showing that it severely limited participants' ability to engage with the program because marginal farmers find it economically unviable to invest in new technologies. Insufficient education to understand program's activities completely (F3) scored 0.1539, indicating that large upfront expenses are another major hurdle. Low profit margin of recommended technologies (F4) (0.1046) and Lack of awareness about the programme interventions (F5) (0.0613) were comparatively less pressing but still contribute to overall financial stress.

Geographical constraints ranked III and have a group priority of 0.1997. Within this group, Lack of proper transportation facilities to the program's area (G1) ranked first with a priority of 0.5574, emphasizing that transportation is a major operational barrier. Remote location and poor road connectivity (G2) comes next at 0.1927, indicating difficult accessibility. Distance from knowledge centers (G3) has a lower priority of 0.1096, showing that being far from support hubs matters but is not the main issue. Water scarcity and dependence on rainfed agriculture (G4) (0.0755) and inadequate irrigation facilities (G5) (0.0646) were ranked IV and V respectively.

Organizational constraints ranked IV with a group priority value of 0.1993. The main organizational issue expressed by beneficiaries of FFP is short term of the project (O1) with a high priority of 0.5571. Lack of proper monitoring and follow-up (O2) ranks second at 0.1926, indicating that weak supervision affects outcomes. Inadequate staff to carry out program activities (O3) holds a priority of 0.1099. Political interference (O4) (0.0749) and Inadequate farmer-scientist interactions (O5) (0.0652) have smaller roles but are still present as organizational risks. The findings are also supported by Challa (2024), who reported that limited access to digital extension services, inadequate technical guidance, and infrastructural deficiencies constrained effective utilization of agricultural information services.

Technical constraints ranked V with a group priority value of 0.1977. Within this group, Low technical literacy among farmers (T1) leads with a priority value of 0.5539, suggesting that there is a need to train all the farmers on how to use new technologies or machineries supplied. Incompatibility of new technologies with traditional practices (T2) follows at 0.1942, indicating concerns with material standards. Inadequately trained field staff (T3) stands at 0.1102, emphasizing the urgent need for stronger field-level training. Low quality of supplied inputs (T4) (0.0771) and inadequate technical support (T5) (0.0643) are smaller but still important technical barriers.

Among all, as shown in the figure social constraints were the most concerned with a priority value 0.2016 (20.16%)

Table 1: Distribution of beneficiary farmers according to the constraints faced by them (n=400)

Constraints	Group Priority	Priority within the group	Global Priority	Rank
Personal Constraints (λ_{max}=5.241; CI=0.060 and CR=0.0539)				
F1- Small Landholdings and Low Profitability	(II) 0.2015	0.4377	0.2596	I
F2- Lack of time to attend program's activities		0.2425	0.1304	II
F3- Insufficient education to understand program's activities completely		0.1539	0.0833	III
F4- Low profit margin of the recommended technologies		0.1046	0.0505	IV
F5- Lack of awareness about the programme interventions		0.0613	0.0251	V
Geographical Constraints (λ_{max}=5.031; CI=0.007 and CR=0.0070)				
G1- Lack of proper transportation facilities to program's area	(III) 0.1997	0.5574	0.0588	I
G2- Remote location and poor road connectivity		0.1927	0.0203	II
G3- Distance from Knowledge centres		0.1096	0.0115	III
G4- Water Scarcity & Dependence on Rainfed Agriculture		0.0755	0.0079	IV
G5- Inadequate irrigation facilities		0.0646	0.0068	V
Organizational Constraints (λ_{max}=5.012; CI=0.003 and CR=0.0027)				
O1- Short term of the project	(IV) 0.1993	0.5571	0.0587	I
O2- Lack of proper monitoring and follow-up of the project		0.1926	0.0203	II
O3- Inadequate staff to carry out programme's activities		0.1099	0.0116	III
O4- Political Interference		0.0749	0.0079	IV
O5- Inadequate interactions between farmer-scientists		0.0652	0.0068	V
Technical Constraints (λ_{max}=5.020; CI=0.005 and CR=0.0045)				
T1- Low technical literacy among farmers	(V) 0.1977	0.5539	0.0584	I
T2- Incompatibility of new technologies with traditional practices		0.1942	0.0204	II
T3- Inadequately trained field staff		0.1102	0.01164	III
T4- Low quality of supplied inputs		0.0771	0.0081	IV
T5- Inadequate technical support		0.0643	0.0067	V
Social Constraints (λ_{max}=5.745; CI=0.049 and CR=0.0437)				
P1- Community conflicts over resource use	(I) 0.2016	0.5602	0.0591	I
P2- Caste and class-based Discrimination		0.1739	0.0183	III
P3- Unequal participation		0.4053	0.0427	II
P4- Lack of collective action among beneficiaries		0.0715	0.0075	IV
P5- Limited trust in FFP facilitators		0.0615	0.0064	V

followed by personal constraints with the priority value 0.2015 (20.15%), geographical constraints were next with the priority value 0.1997 (19.97%) followed by organizational constraints with priority value 0.1994 (19.94%) and technical constraints with the priority value 0.1977 (19.77%). Similar findings were observed in the present study, where financial and institutional constraints received higher priority weights, corroborating the results of Pokiya *et al*. (2024). The results were also similar to the results reported by Vinaya *et al. (*2017); Sagar *et al*. (2022), Adhikari *et al*. (2022), Lekha *et al*., (2025), Kalariya and Gulkari (2024), Bandhavya (2023); Singh *et al*. (2016); Kemekar *et al. (*2023); Kemekar *et al. (*2024).

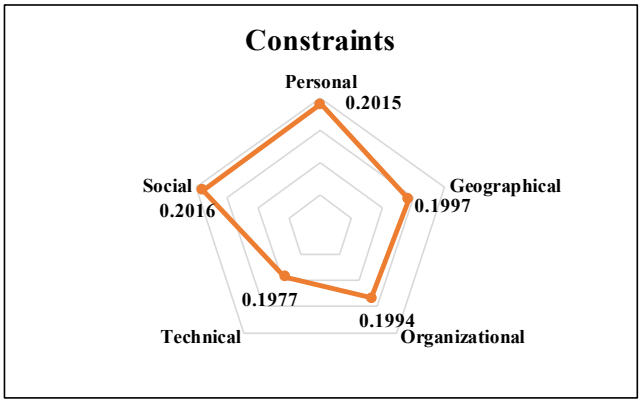

Fig. 1: Ranking of different categories of constraints

CONCLUSION

The prime objective of the Farmer FIRST Programme was to integrate indigenous and traditional technologies with the technologies developed by the agricultural institutes to promote productivity as well as sustainability which is the need of the hour for the planet's survival. The current study was conducted in ATARI Zone-x which consisted of Telangana, Andhra Pradesh and Tamil Nadu states. Social and organizational constraints, especially lack of collective action and short project duration, suggested that enhancing group dynamics through farmer groups or cooperatives and advocating for longer project cycles could help in increasing the impact of FFP further. The constraints related to transportation and distance from knowledge centers indicated an urgent need for decentralized extension centers or mobile units to improve access.

RECOMMENDATION

The results of the study indicated a lack of collective action and decentralized extension centres. Strengthening collective farmer institutions, extending the Farmer FIRST Programme duration, decentralizing extension services, and improving rural connectivity to enhance programme effectiveness could solve these problems to certain extent. Strengthening extension support and facilitating access to resources can reduce adoption barriers, as suggested by Ghasura *et al*. (2024). Further, establishment of village-level knowledge centres, mobile extension units, and digital advisory platforms can significantly improve the effectiveness and impact of Farmer FIRST Programme in ATARI Zone-X.

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CONFLICT OF INTEREST

There is no conflict of Interest and No external sources of funding

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