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Assessment of the Group Efficiency of the Farmers Producer Organization in the Old Alluvial Zone of Eastern India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

A Farmer Producer Organization (FPO) is a collective of farmers who join together to form an organization to improve their agricultural production and marketing efforts. This study investigates the group efficiency of Farmer Producer Organizations (FPOs) in the Malda District of West Bengal, focusing on factors influencing their performance and collaboration networks. The study was conducted from 2020 to 2022 in the old alluvial zone, the study used a combination of simple and

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purposive sampling methods to gather data from 90 respondents across 9 villages. Statistical analyses included descriptive statistics, correlation, regression, and advanced tests like ANOVA and Kruskal-Wallis, supported by factor analysis to identify efficiency drivers. Results highlight critical factors such as women's participation, respect for opinions, and access to up-to-date information as pivotal for FPO effectiveness. Network analysis reveals stronger institutional collaborations in Group A compared to Groups B and C, underscoring their impact on group efficiency. Findings emphasize the importance of inclusive decision-making processes and supportive external networks for enhancing FPO performance in rural contexts.

Keywords: Farmer Producer Organizations (FPOs); group efficiency; collaboration networks; decision-making; rural development.

1. INTRODUCTION

Farmers' organizations (FOs) are crucial for the empowerment and advancement of rural producers. These organizations help in reducing transaction costs and production risks, enabling farmers to benefit from market opportunities. The establishment of FOs aims to provide both backward (input, credit, technology) and forward linkages (production facilities, market, value addition). FOs can be community-based and resource-oriented or commodity-based and market-oriented. This study focuses on the group efficiency of FPOs in the Malda District of West Bengal. Farmers' organizations are essential institutions for the empowerment, poverty alleviation, and advancement of farmers and the rural poor [1]. According to NCF [2], "FOs should be promoted to combine the advantages of decentralized production and centralized services, post-harvest management, value addition, and marketing." The International Fund for Agricultural Development [3] opines, "In rural areas, FOs are the nearest and often the only institutions providing essential goods and services to the rural poor and helping them to break out from the poverty cycle." Studies have shown that well-functioning FPOs can reduce input costs, increase bargaining power, and provide access to better markets. The role of leadership, member participation, and external support are crucial factors influencing the efficiency of FPOs. However, there is limited research specifically focusing on the group efficiency of FPOs in the context of West Bengal. Velanganni [4] discovered that the majority of member farmers (50.05%) had a high level of social participation. Sawairam [5] indicated that dedication, honesty, and quality of leadership of farmers, as well as their acceptance within the community and the market environment, are the most critical factors of producer enterprise performance. Darshan [6] discovered high group cohesion among members of FPOs under the VLRC. Msimango and Oladele [7] highlighted the influence of financial and extension services on active engagement in cooperatives. Farmers' needs and desires vary by region and location, and research organisations like ICAR and extension systems like KVKs play a significant role in addressing farmers' location-specific needs and aspirations for agricultural growth. Farmers clubs have been demonstrated to be an effective tool for bringing about change at the grassroots level [8-10]. Informal groups such as Farmers clubs have proven to be a powerful means of bringing about change at the grassroots level through organised forms of training and demonstration. In Eastern parts of India where although there are successful FPOs but still a considerable portion of farmers is yet to register with FPOs. But its need to be known the efficiency of this FPOs for their long-term sustaining. Based on these circumstances a study was conducted in the Malda District of West Bengal to find out the group efficiency of the Farmer Producer organizations.

2. METHODOLOGY

The study was conducted in the old alluvial zone of West Bengal from 2020 to 2022:

1. **Sampling Methods:** The study utilized both simple and purposive sampling methods. Simple sampling involved randomly selecting respondents from each selected village, ensuring a representative sample from the population. Purposive sampling was used to specifically select 3 Farmer Producer Organizations (FPOs) based on their relevance to the study's objectives.
2. **Sample Size and Composition:** A total of 90 respondents were included in the study. This comprised 45 member-respondents who were actively involved in the selected FPOs, and 45 non-member respondents

who were farmers from the same villages but not affiliated with any FPO. This balanced approach allowed for comparative analysis between FPO members and non-members.

3. **Study Design:** The study employed an ex-post facto design, which involves analyzing existing data and conditions without direct manipulation by the researcher. Additionally, an after-with-control design was used to compare outcomes before and after certain interventions or conditions.
4. **Data Collection:** Data collection involved gathering information through structured surveys and interviews conducted with both member and non-member respondents. The surveys likely included questions related to demographics, farm practices, involvement with FPOs, perceptions of group efficiency, and other relevant factors.
5. **Statistical Analysis:** Various statistical methods were applied to analyze the collected data:
   - Descriptive statistics such as Frequency, Percentage, Mean, and Standard deviation were used to summarize the data.
   - Measures like Coefficient of variation were likely employed to assess variability.
   - Correlation and Regression analyses were conducted to explore relationships between variables.
   - Inferential statistics including Z-test, ANOVA, and Kruskal-Wallis test were utilized to test hypotheses and determine significant differences among groups.
6. **Factor Analysis:** Factor analysis was employed to identify underlying factors or components from a set of observed variables (e.g., efficiency indicators) that explain the data's variance. This method helped in understanding the key factors influencing the efficiency of the studied FPOs.

3. RESULTS AND DISCUSSION

3.1 Group Efficiency Characteristics of the Selected Farmer Producer Organisations in Malda District of West Bengal

The study assessed various efficiency criteria using a 4-point scale (0 to 4) to identify key factors influencing efficiency and determine the most effective Farmer Producer Organization (FPO) group. Factor analysis was utilized to extract latent factors and reduce the dimensionality of the data, providing deeper insights into the underlying factors driving FPO efficiency.

Table 1 presents the perceived group efficiency scores across various indicators as rated by members of their respective Farmer Producer Organizations (FPOs). The most critical factor, according to respondents, is encouraging women's participation in the group (mean score 2.31), seen as pivotal given the shift of men from agriculture to non-farm activities. Respect towards others' opinions (mean score 2.29) follows closely, reflecting the importance of mutual respect within the group. Providing up-to-date information (mean score 2.27) is also highly valued, as members join to stay informed about technological advancements and marketing strategies. The ability for members to freely contribute to decision-making (mean score 2.24) is another significant concern, ensuring inclusivity and shared responsibility. Equitable distribution of benefits and effective marketing of products (mean score 2.22) are jointly perceived as crucial, addressing issues of fair returns and market access. Other factors, such as leadership capabilities, information sharing, and addressing internal group dynamics, also contribute to overall efficiency perceptions. Kruskal-Wallis test results indicate significant differences in efficiency among the studied FPOs ($\chi 2=10.06$; $p=.007$), with FPO A (Sabhuj Bahini Agro Producer Company Limited) rated as the most efficient, followed by FPO B (Gazole Agro Producer Company Limited) and FPO C (Malda Farmer Producer Company Limited).

Table 2 presents Pearson's correlation coefficients between efficiency scores and extracted factors related to personal and socio-economic characteristics of respondents. It reveals that Family-Group involvement has a significant positive correlation at the 1% significance level, indicating that greater family participation enhances group efficiency. Conversely, member strength within the family shows a significant negative correlation at the 5% level, suggesting that larger family sizes may decrease efficiency, possibly due to fewer family members actively participating in the groups. Factors such as Family character and Personal education and experience do not show significant relationships with group efficiency scores. Additionally, the study area respondents exhibit

low levels of formal information and skill access, as well as limited neighborhood information and access, which could influence group dynamics and efficiency outcomes.

Table 3 indicates that family-group involvement and family character positively impact efficiency scores, highlighting their significant contributions to group performance. Conversely, member strength within the family has a negative impact on efficiency, suggesting that larger family sizes may hinder optimal group performance. The R-square value, which indicates the proportion of variability explained by the selected variables, is 50.2%. This implies that while family dynamics and involvement are important factors influencing efficiency, there are other latent factors beyond those studied that also contribute to group efficiency. These findings underscore the complexity of factors affecting FPO efficiency, suggesting potential avenues for further research to uncover additional influential factors.

Table 1. Comparative efficiency of different groups over different criteria

Sl. No.	Criteria	Mean scores of Groups			Overall Mean Score	Rank
		A	B	C		
1	Respect towards others opinion	2.67	2.27	1.93	**2.29**	**II**
2	Impartial leadership	1.60	1.73	1.40	**1.58**	**XV**
3	Capability of the leaders	2.33	2.33	1.67	**2.11**	**VI**
4	Autocracy in leadership (-)	1.20	1.47	1.20	**1.29**	**XVII**
5	Leaders share information to all members	2.20	2.20	1.60	**2.00**	**VII**
6	The leader delegates power and responsibility to the members to work independently	2.00	1.33	1.60	**1.64**	**XII**
7	Feeling for each other	2.20	1.53	1.80	**1.84**	**X**
8	Bother for other's needs	1.47	1.20	1.20	**1.29**	**XVII**
9	Extend help to other members in need	1.27	2.00	1.73	**1.67**	**XI**
10	The members can give their input in the decision-making process freely.	2.20	2.47	2.07	**2.24**	**IV**
11	Benefits are shared among the members equally.	2.40	2.40	1.87	**2.22**	**V**
12	Some members feel deprived in the group (-)	1.93	1.33	1.60	**1.62**	**XIII**
13	Some members try to develop sub-groups (-)	2.20	1.87	1.73	**1.93**	**VIII**
14	Arranging funds/credits for your livelihood	1.93	1.93	1.80	**1.89**	**IX**
15	Providing information in your need	2.40	2.20	1.73	**2.11**	**VI**
16	Organizing agricultural workshops	1.20	0.00	1.00	**0.73**	**XVIII**
17	Supply of agricultural inputs	1.93	1.73	1.13	**1.60**	**XIV**
18	Marketing of your products	2.53	2.47	1.67	**2.22**	**V**
19	Encourage women participation.	2.73	2.27	1.93	**2.31**	**I**
20	Provide up-to-date information	2.67	2.53	1.60	**2.27**	**III**
21	Provide low cost and accessible technologies	1.80	1.00	1.33	**1.38**	**XVI**
Overall mean score		**2.04**	**1.82**	**1.60**	**1.82**	**--**
Kruskal-Wallis (χ2-value) =10.06 (p=.007)						

A = Sabhuj Bahini Agro Producer Company Limited
B = Gazole Agro Producer Company Limited
C = Malda Farmer Producer Company Limited.

Table 2. Relationship between socio-personal factors and group efficiency

Variables	Coefficient of Correlation (Efficiency score)
Family character	0.258
Personal education and experience	0.146
Family-Group involvement	0.584**
Formal information and skill access	-0.010
Neighbourhood information and access	-0.007
Member strength in family	-0.307*

***. Correlation is significant at the 0.01 level (2-tailed).*
**. Correlation is significant at the 0.05 level (2-tailed).*

Table 3. Step-wise Regression between group efficiency score and socio-economic and personal factors

Variables	Coefficient(β)	Std. Error	t	Sig.
(Constant)	38.244	0.654	58.513	0.000
Family-Group involvement	3.502	0.661	5.298	0.000
Member strength in family	-1.841	0.661	-2.786	0.008
Family character	1.547	0.661	2.340	0.024

a. Dependent Variable: Efficiency score
b. Predictors: (Constant), Group influence on family, Member strength in family, Family character.
R square = 0.502, Adjusted R Square = 0.465

Table 4 depicts the network analysis results across three groups (Group A, Group B, and Group C) involving 10 institutional nodes. Group A shows a higher total number of ties (83), average degree (8.300), network density, and closure compared to Groups B and C, indicating stronger relationships and interconnectedness among its institutional actors. In contrast, Groups B and C exhibit slightly lower total ties (71 and 70 respectively) and average degrees (7.100 and 7.000), suggesting relatively fewer connections between their nodes. This disparity underscores the stronger collaborative network and cohesion within Group A, likely contributing to its higher efficiency and effectiveness in achieving group objectives.

3.2 Diagrammatic Representation of the Collaboration Network among the Institutional Actors of Group A

From the diagram (Fig. 1) depicting the collaboration network of Group A's actors, it is evident that ADA/KPS, banks, BDOs, FPOs, panchayats, and input dealers play significant roles in the network. These institutions are central in facilitating collaborations among the stakeholders involved in agricultural activities. Progressive farmers, KVKs, NGOs, and others also participate in the network, albeit to a lesser extent. However, the diagram highlights a concerning finding regarding KVKs (Krishi Vigyan Kendras), indicating that they are perceived to have limited effectiveness in the network. This limitation is attributed to the distance of FPOs from KVKs, which complicates transportation and limits member engagement with KVK services. As a result, KVKs are seen as playing a less impactful role compared to other key stakeholders in the collaboration network of Group A.

3.3 Diagrammatic Representation of the Collaboration Network among the Institutional actors of Group B

From the diagram (Fig. 2) depicting the collaboration network of Group B's actors, it is clear that institutions like banks, ADA/KPS, progressive farmers, panchayats, input dealers, FPOs, and BDOs are central to the collaboration network. These actors are pivotal in facilitating interactions and partnerships among stakeholders involved in agricultural activities within Group B. Others, KVKs, and NGOs are also part of the network, but their involvement appears less prominent compared to the key stakeholders. The diagram underscores the significant role of banks, particularly in collaboration with BDOs, which enhances their impact within the FPO of Group B. Similar to Group A, KVKs are highlighted as having a limited role in the network due to transportation challenges and distance from FPOs, which

Table 4. Comparative analysis of collaboration network among institutional actors of Group A, Group B and Group C

Sl. No	Network analysis	Sabhuj Bahini Agro Producer Company Limited (Group A)	Gazole Agro Producer Company Limited (Group B)	Malda Farmer Producer Company Limited (group C)
1	Number of Nodes	10	10	10
2	Number of Ties	83	71	70
3	Avg. Degree	8.300	7.100	7
4	Density	0.922	0.789	0.778
5	Network Closure	0.951	0.930	0.900

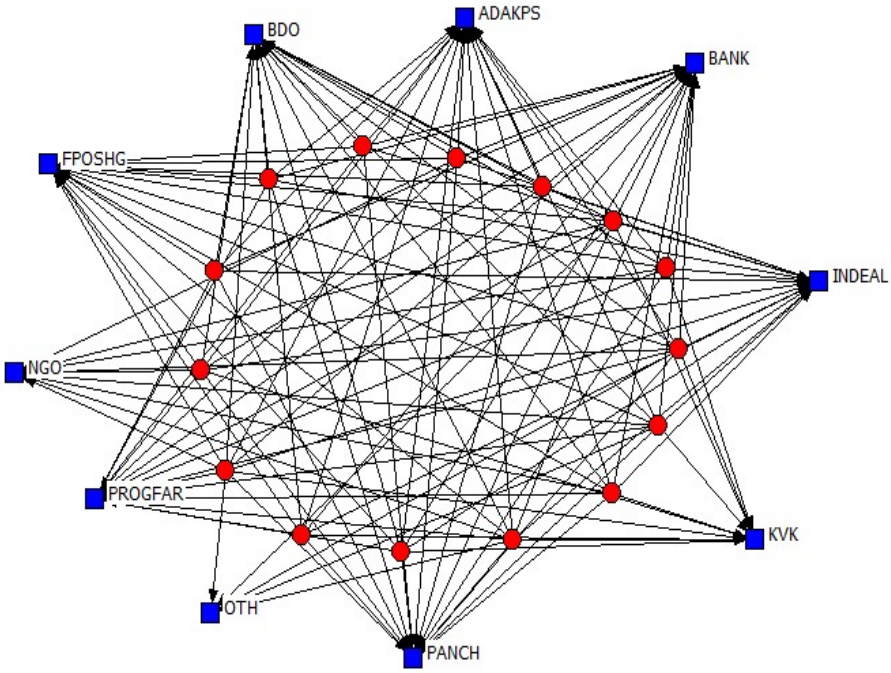

Fig. 1. Collaboration network among the institutional actors of Group A.

restrict member engagement and interaction with KVK services. This finding suggests that improving accessibility and engagement strategies with KVKs could potentially enhance their effectiveness within Group B's collaboration network.

3.4 Diagrammatic Representation of the Collaboration Network among the Institutional actors of Group C

From the collaboration network diagram (Fig. 3) of Group C's actors, it is evident that ADA/KPS, banks, FPOs, input dealers, BDOs, and panchayats are central to the network. These institutions play significant roles in fostering collaboration and partnerships among stakeholders involved in agricultural activities within Group C. Progressive farmers, others, NGOs, and KVK are also part of the network, but their involvement appears less prominent compared to the primary stakeholders. The diagram highlights the important role of banks, particularly in their collaboration with BDOs, which strengthens their influence within Group C's FPO network. Like in Groups A and B, KVKs are noted as having a limited role in the network due to transportation challenges and distance from FPOs, which hinders member engagement and interaction with KVK services. This emphasizes the need for improved accessibility and engagement strategies with KVKs to potentially enhance their effectiveness within Group C's collaboration network.

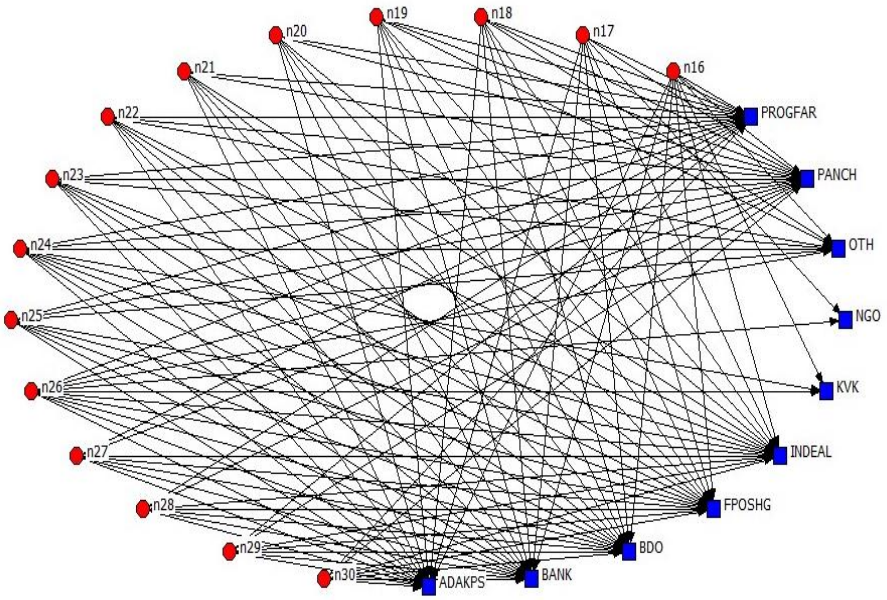

Fig. 2. Collaboration network among the institutional actors of Group B.

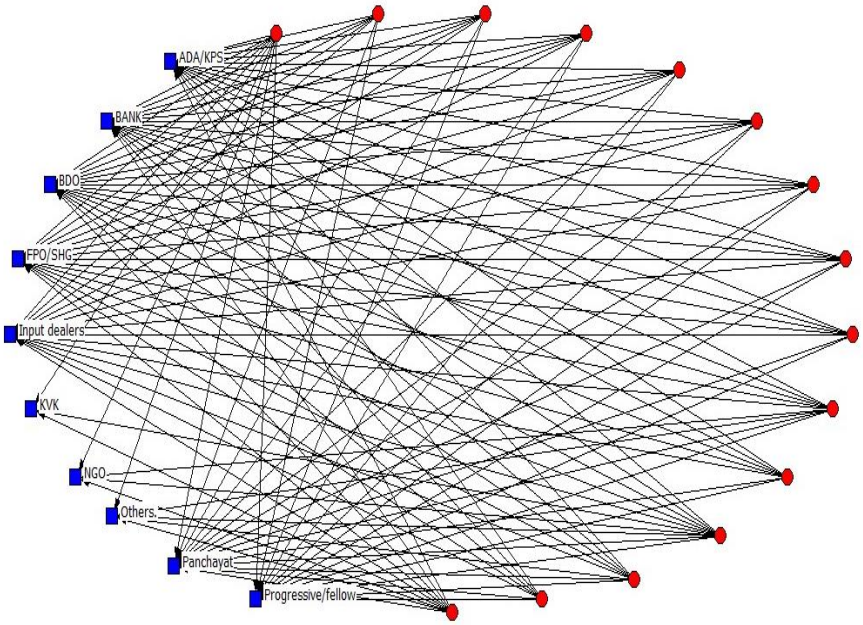

Fig. 3. Collaboration network among the institutional actors of Group C.

3.5 Factor Analysis to Extract Component Factors out of Group Efficiency Indicators

In the study, factor analysis was employed to derive new components from the 21 preference factors that were evaluated for group efficiency. Principal component analysis (PCA) was specifically used as the extraction method, where components with eigenvalues greater than 1 were considered for extraction. This approach allows for reducing the dimensionality of the dataset by identifying the underlying factors that explain the variance in the original variables related to group efficiency. By extracting these principal components, the study aimed to identify

the most influential factors contributing to the efficiency of the Farmer Producer Organizations (FPOs) under investigation in Malda District, West Bengal.

Table 5 provides insights into the results of eigenvalues, extracted factors, and factor loadings from the factor analysis conducted in your study. Seven principal components were extracted based on their initial eigenvalues, which exceeded the threshold of 1. These components collectively accounted for 69.379% of the total variance present in the original preference factors considered for assessing group efficiency. This finding suggests that these seven components capture a significant portion of the underlying factors influencing the efficiency of the Farmer Producer Organizations (FPOs) studied in Malda District, West Bengal. Understanding these components helps in identifying key drivers of efficiency and can guide strategies to enhance the performance and sustainability of FPOs in agricultural development initiatives.

Table 6 presents the rotated component matrix from the factor analysis, highlighting the composition and explanatory power of each factor in relation to group efficiency indicators. Here's a breakdown of the factors identified:

1. **Leader Capability:** This factor includes variables such as respect towards others' opinions, providing up-to-date information, leader capability, and sharing information with all members. It accounts for 21.077% of the variance in group efficiency indicators, emphasizing the importance of effective leadership qualities.
2. **Group Support to Members:** Encompassing variables like arranging funds/credits, equitable benefit sharing, product marketing, providing necessary information, supplying agricultural inputs, and encouraging women's participation, this factor explains 13.138% of the variance. It underscores the role of group support mechanisms in enhancing efficiency.
3. **Group Functioning:** This factor includes providing affordable technologies, enabling member input in decision-making, and organizing agricultural workshops. It accounts for 9.501% of the variance, focusing on operational aspects crucial for group functioning.
4. **Member Empathy:** Comprising variables like empathy among members, delegation of power by leaders, and concern for others' needs, this factor explains 8.030% of the variance. It highlights the importance of mutual understanding and support among group members.
5. **Members' Negative Feelings:** This factor includes items related to members feeling deprived or forming sub-groups, accounting for 6.222% of the variance. It addresses negative dynamics that can impact group cohesion and efficiency.
6. **Leadership Styles:** Involving variables such as autocratic leadership and impartial leadership, this factor explains 6.008% of the variance. It reflects different leadership approaches and their influence on group dynamics.
7. **Mutual Sharing Attitudes:** This factor, consisting of extending help to other members in need, accounts for 5.403% of the variance. It underscores the importance of mutual support and cooperation among group members.

Table 5. Initial eigenvalues, rotation sums of squared loadings

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Eigenvalue	% of Variance	Cumulative %	Eigenvalue	% of Variance	Cumulative %
1	4.426	21.077	21.077	3.092	14.726	14.726
2	2.759	13.138	34.214	2.539	12.089	26.814
3	1.995	9.501	43.715	2.332	11.107	37.921
4	1.686	8.030	51.746	2.150	10.239	48.160
5	1.307	6.222	57.968	1.776	8.459	56.618
6	1.262	6.008	63.976	1.413	6.727	63.346
7	1.135	5.403	69.379	1.267	6.033	69.379

Extraction Method: Principal Component Analysis.

Table 6. Rotated Component Matrix

Preference factors	Components							Name of extracted components
	1	2	3	4	5	6	7	
Respect towards others opinion	**.792**							Leader capability.
Provide up-to-date information	**.737**							
Capability of the leaders	**.737**			.281				
Leaders share information to all members	**.650**	.259		.269				
Arranging funds/credits for your livelihood		**.684**	-.297					Group-support to members
Benefits are shared among the members equally.	.316	**.603**					-.272	
Marketing of your products	.527	**.598**						
Providing information in your need	.251	**.584**				-.260		
Supply of agricultural inputs		**.574**	.300			.270		
Encourage women participation.	.484	**.491**		-.289				
Provide low cost and accessible technologies			**.813**					Group functioning
The members can give their input in the decision-making process freely.		.298	**-.799**					
Organizing agricultural workshops	-.336		**.721**	.286				
Feeling for each other				**.864**				Member Empathy
The leader delegates power and responsibility to the members to work independently				**.726**				
Bother for other's needs		.310		**.589**			.304	
Some members feel deprived in the group (-)					**.902**			Members negative feelings
Some members try to develop sub-groups (-)					**.866**			
Autocracy in leadership (-)				-.258	.265	**.755**		Leadership Styles
Impartial leadership		.254				**.692**		
Extend help to other members in need							**.892**	Mutual shearing attitudes.

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

These factors collectively provide a comprehensive framework for understanding the drivers of group efficiency within Farmer Producer Organizations (FPOs) in Malda District. They offer actionable insights for improving leadership qualities, support mechanisms, group functioning, and member dynamics to enhance overall efficiency and sustainability [10].

4. CONCLUSION

The efficiency of FPOs was found to be influenced significantly by factors such as leader capability, group support mechanisms for members, effective group functioning including decision-making processes and technological access, and member empathy and cohesion. These factors collectively accounted for a

substantial portion of the variance in group efficiency indicators. Leadership qualities, particularly the capability of leaders to respect others' opinions and share information transparently, emerged as pivotal in driving group efficiency. Supportive structures that ensure equitable benefit sharing, access to resources like funds and agricultural inputs, and encouragement of women's participation were also crucial factors contributing to FPO effectiveness. However, challenges such as negative member feelings and inadequate leadership styles, such as autocracy, were identified as detractors from group efficiency. Additionally, institutional collaborations with key stakeholders like banks, ADA/KPS, and panchayats played significant roles in enhancing FPO network effectiveness. Overall, the findings underscore the importance of fostering inclusive leadership, strengthening support mechanisms for members, improving group functioning through accessible technologies and participatory decision-making, and promoting positive member interactions within FPOs. Addressing these aspects can potentially enhance the sustainability and impact of FPOs in agricultural development, thereby benefiting rural communities in Malda District and similar regions.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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