



RESEARCH ARTICLE

Are institutional innovations helpful in reducing transaction costs? An empirical analysis of agri-based Farmer Producer Companies (FPCs) in Kerala, India

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Abstract

Transaction costs are incurred while conducting a transaction through an exchange in the open market. New institutional economics focuses on transaction costs and the institutions involved in their reduction. This study compares the transaction costs incurred by Farmer Producer Company (FPC) members and non-members in Kerala and identifies the factors affecting these transaction costs. The study revealed no significant difference in the transaction costs incurred by FPC members and non-members. This was mainly due to the significant and higher opportunity cost of time spent on information and decision-making by FPC members compared to non-members, which surpassed the lower costs incurred for selling their farm produce by FPC members compared to non-members. Based on this study, we recommend that FPCs concentrate more on the bottom-up collectivization of individual farmers to form large business organizations that facilitate market access for small and marginal farmers and reduce transaction costs.

Keywords

agriculture; Farmer Producer Organisation (FPOs); institutional economics; Kerala; marketing; transaction costs

Introduction

India is home to small and marginal farmers, accounting for 86.07% of the total farmers in the country (1). Therefore, India's sustainable agricultural growth and food security hinge on the performance of small and marginal farmers. Eighty-four percent of the world's 570 million farms are small holdings, defined as those less than 2 ha (2). These small holdings use 24 % of the agricultural land to produce 29 % of crops, providing 32 % of the world's food (3). This indicates that small farms are more efficient and productive. Research has established that small farms play a significant role in development and poverty reduction (4). Evidence shows that gross domestic product (GDP) growth from agriculture is at least twice as effective in reducing poverty as GDP growth from other economic sectors (5). Although smallholders play a vital role in advancing agricultural development and reducing poverty, they face several challenges.

Smallholders frequently deal with issues such as inadequate infrastructure, substandard public services, limited access to credit and insurance, a shortage of knowledge and information, market imperfections and weak market linkages. These challenges lead to high transaction costs and decreased market participation (6-8). They also lack economies of scale, which reduces their ability to bargain effectively and their insufficient income limits their capital investment in agriculture (9). Institutional interventions were necessary to support farmers in addressing these challenges, as the existing cooperative system, which was intended to support small and marginal farmers, faced criticism for its inability to evolve into financially stable and member-controlled enterprises. As an institutional innovation to overcome the limitations of cooperatives and to prioritize small and marginal farmers, a high-level committee chaired by Dr. Y. K. Alagh introduced the concept of Producer Companies. These entities combine the advantageous features of both the corporate and cooperative sectors for the benefit of primary producers (10, 11).

The FPC Act of 2003 is regarded as a significant initiative by the government, marking a paradigm shift in the agricultural sector. This act specifically addresses challenges in the agricultural sector and enhances the well-being of small and marginal farmers by strengthening their collective bargaining power and transforming their means of subsistence into profitable enterprises. A producer organization, being a member-owned, democratic institution, defends the rights of small and marginalized farmers, serving as an entity for the people, of the people and by the people. Producer companies aim to integrate smallholders into modern supply networks by minimizing transaction and coordination costs while benefiting from economies of scale (7, 12-14).

Generally, high transaction costs tend to reduce or eliminate market size, which may lead to market failure (15). New institutional economics, which includes transaction cost theories of exchange, has garnered increased attention in the last few years. The term "transaction costs" refers to "the cost of carrying out a transaction by means of an exchange on the open market" or "the cost of using the price mechanism" in Coase's original formulation (16, 17). Empirical research often measures transaction costs as the economic value of the resources used to locate trading partners and complete transactions. Firms that effectively reduce transaction costs through organizational activities tend to survive and thrive in competitive environments.

A transaction, which "occurs when a good or service is transferred across a technologically separate interface," is the unit of analyses used in transaction cost theory (18). Searching for a partner with whom to exchange, vetting possible trade partners to determine their reliability, negotiating with potential partners (and officials) to reach a deal, moving the product, keeping an eye on the agreement to ensure that its terms are met and enforcing the exchange agreement are all included in transaction costs (19).

Transaction costs are relevant when relationships are frequent and uncertain, especially if specific assets are involved. The "paradigm problem" of transaction cost economics is often referred to as vertical integration or the "make-or-buy" choice. Vertical integration occurs when a firm internalizes one or more stages in its production process. Decision-makers must compare

the production and transaction costs of carrying out a transaction within their own companies (insourcing) against those of external parties (outsourcing). If they choose to use the market, they must determine the most appropriate type of contract (20).

The theoretical foundation provided by new institutional economics, particularly the transaction cost economics framework, offers a robust basis for analysing the transaction costs incurred by actors participating in the formation and continuation of contractual arrangements, affiliations and other forms of governance structures in the agriculture sector (21). For economic analyses, it is essential to quantify transaction costs, which represent the actual resource costs. However, empirical applications of this theory to agricultural transactions are relatively rare (22). There is a dearth of research on transaction costs in Indian agriculture. To address this gap, this study aims to empirically assess the transaction costs involved in agricultural transactions of FPC members and non-members across the districts in Kerala. As institutions such as FPC were established to address the challenges faced by small and marginal farmers, including a reduction in transaction costs, the overall objective of this study was to compare the transaction costs incurred by FPC members and non-members. This study is based on the premise that institutions are arrangements that minimize transaction costs, are subject to change and evolve in response to shifts in the types and origins of transaction costs (18). This study analysed the transaction costs incurred by members and non-members and examined FPCs as an institutional innovation that could reduce transaction costs, as outlined in the FPC scheme guidelines, along with the factors affecting the transaction costs of FPC members and non-members. An assessment of these factors would enable development agencies to equip farmers with better strategies to counteract the pitfalls of the present scheme.

Materials and Methods

Study area and sampling

This study was conducted in Kerala, the southernmost state of India, in 2023, where the percentage of small and marginal farmers is the highest (99 %) in the country (1). FPCs formed during or before 31-03-2020 in Kerala constituted the study population. The respondents were selected using a multistage random sampling technique. Of the 82 and 18 FPCs formed under the National Bank for Agriculture and Rural Development (NABARD) and Coconut Development Board (CDB), respectively, 25 % of the FPCs were chosen randomly, resulting in a sample of 26 FPCS (21 from NABARD and 5 from CDB). As the number of shareholders in each FPC varied, a proportionate random sampling technique was employed rather than a fixed number of samples/FPCs. One percentage of shareholders from each FPC and an equal number of non-member farmers were randomly selected from the FPC service area, resulting in a total sample of 260 farmers, comprising 130 FPC members and 130 non-members. Pretested questionnaires were generated using Kobo Toolbox (KoboCollect v2024.1.3), an innovative open-source platform for collecting, managing and visualizing data, which was used for data collection. Data analyses was carried out using STATA software and MS Excel.

Analytical methods

Transaction costs are incurred at both the organizational/ system and farmer levels. In this study, we evaluated farmer-level transaction costs. The transaction process for farmers includes information and decision-making costs, contractual costs, monitoring and enforcement costs and actual costs involved in the transaction of inputs used and outputs produced by the farmers. Since the respondents were not involved in any contracts with any of the agencies, contractual costs and their connected monitoring and enforcement costs will not be included in the purview of the study.

Empirical estimation of transaction costs encompasses direct monetary and imputed measurements. Direct measurements involve the money farmers spend on transportation, as well as loading and unloading charges. Determining the time spent and assigning a suitable value to that time is a widely used proxy for addressing the opportunity cost of time expended. This approach has been used to estimate the implicit costs linked to transactions. The total transaction costs can be calculated as follows (23):

$$C_{total} = \sum_{i=1}^n (Wage_{rate}_i \times Time_i + Cash_i) \quad (\text{Eqn.01})$$

where,

C_{total} : The total transaction costs in Rs/ha/year

Time: The time spent in hours in different components of a transaction

Wage rate: The daily wage rate prevailing in different districts of Kerala in Rs/hr

Cash: The direct expense in transactions in rupees

A regression model is used to identify the factors affecting the transaction costs of FPC members and non-members. Many studies explicitly discuss the factors that influence transaction costs. Based on the literature review and conceptual framework, the model specification is as follows:

$$\begin{aligned} TCFPC = & \beta_0 + \beta_1 AGE + \beta_2 GENDER + \beta_3 EDN + \beta_4 EXP + \beta_5 AREA + \beta_6 CROPS \\ & + \beta_7 TRG + \beta_8 EXPVISIT + \beta_9 MTG + \beta_{10} EXTN + \beta_{11} IPPNO \\ & + \beta_{12} IPPDIST + \beta_{13} OPSNO + \beta_{14} OPSDIST + \beta_{15} MBM \\ & + \beta_{16} PERCENTAGE + \beta_{17} NOPS \end{aligned} \quad (\text{Eqn.02})$$

$$\begin{aligned} TCNFPC = & \beta_0 + \beta_1 AGE + \beta_2 GENDER + \beta_3 EDN + \beta_4 EXP + \beta_5 AREA + \beta_6 CROPS \\ & + \beta_7 TRG + \beta_8 EXPVISIT + \beta_9 MTG + \beta_{10} EXTN + \beta_{11} IPPNO \\ & + \beta_{12} IPPDIST + \beta_{13} OPSNO + \beta_{14} OPSDIST + \beta_{15} MBM \\ & + \beta_{16} PERCENTAGE + \beta_{17} NOPS \end{aligned} \quad (\text{Eqn.03})$$

where,

TC FPC: Transaction cost incurred by FPC members in Rs/ha/year

TC NFPC: Transaction cost incurred by FPC non-members in Rs/ha/year

AGE: Age of the farmers in years

GENDER: Gender of the farmers (Male=1, female=0)

EDN: Education of the farmers in completed years

EXP: Farming experience of the farmers in years

AREA: Farm size of the farmers in acres in the year 2022-23

CROPS: Number of crops cultivated by the farmers in the year 2022-23

TRG: Number of trainings attended by the farmers in the year 2022-23

EXP VISIT: Number of exposure visits attended by the farmers in the year 2022-23

MTG: Number of meetings attended by the farmers in the year 2022-23

EXTN: Number of extension agency contacts by the farmers in the year 2022-23

IPP NO: Number of times inputs were purchased by farmers in the year 2022-23

IPP DIST: Average distance travelled by the farmers in km to purchase inputs in the year 2022-23

OPS NO: Number of times outputs sold by the farmers in the year 2022-23

OPS DIST: Average distance travelled by the farmers in km to sell the produce in the year 2022-23

MBM: Membership of farmers in other groups

PERCENTAGE: Percentage of produce sold by the farmers in the year 2022-23

NOPS: Number of produces sold by the farmers in the year 2022-23

In addition to descriptive statistics, t-tests were used to analyse the variables.

Results and Discussion

Profile of sample farmers

A brief profile of the sample FPC members and non-members is presented in Table 1. The profiles of the sample FPC members and non-members are similar, except for the number of crops cultivated by them, where FPC members cultivate more crops, which is significant at the 1 % level in t-statistics. This may be due to the greater exposure that FPC members receive from training, meetings and exposure visits

Comparison of transaction costs of FPC members and non-members (Rs/ha/year)

Farmer Producer Companies (FPCs) are conceptualized as institutions designed to reduce the transaction costs of farmers by facilitating collective procurement of inputs and streamlined marketing of produce. These organizations aim to minimize

Table 1. Profile of sample farmers

Characteristics	FPC members	FPC non-members	t-test
Age of the respondent (years)	60.51	59.93	0.45
Education (in completed years)	12.18	11.48	1.604*
Experience in farming (years)	34	31.98	1.09
Area under cultivation (acres)	2.38	2.66	1.04
Number of crops cultivated (no.)	3	2	2.38***

Note: *p < 0.1, **p < .05, ***p < .01; Sample size: 260 (130 FPC members & 130 FPC non-members)

inefficiencies arising from individual operations. To evaluate the effectiveness of FPCs in achieving this objective, a comparative analyses of transaction costs incurred by FPC members (TCFPC) and non-members (TCNFPC) was conducted. The results, as revealed in Table 2, Fig. 1 and Fig. 2, indicated that a major share of transaction costs for both groups was related to selling their farm produce. The transaction cost on the sale of produce was highest for FPC non-members (₹ 3308.79/ha/year) compared to FPC members (₹ 2563.47/ha/year), comprising 46.25 and 62.51% of the total transaction cost incurred by them, respectively. In both cases, transportation cost is the major component in selling farm produce, contributing 26.30 and 24.55 % of the total transaction cost of FPC members and non-members,

respectively. Although not significant, transportation costs are higher for FPC members compared to non-members due to a greater number of transactions. The opportunity cost of time spent selling products is lower for FPC members (₹ 857.56/ha/year) than for non-members (₹ 1409.24/ha/year), which is significant at the 5% level in the t-statistic. A similar trend is observed with loading and unloading charges, where the difference is highly significant between FPC members and non-members. This may be mainly due to the efficient marketing of FPCs, which favor better speed and often eliminate unloading charges in many transactions. The t-statistic indicating a significant difference of 10% in the cost involved in the sale of farm produce between FPC members and non-members

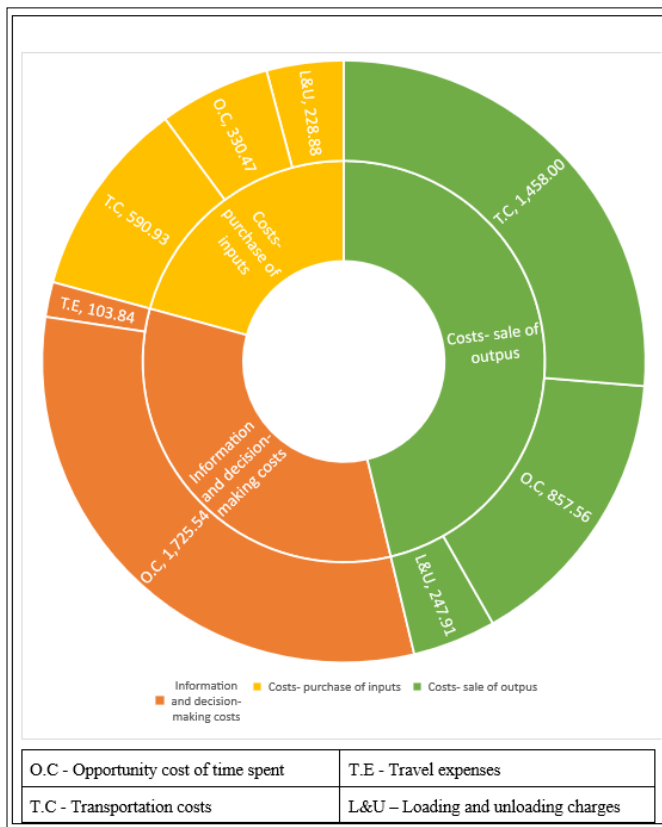


Fig. 1. Transaction costs of FPC members (Rs/ha/year).

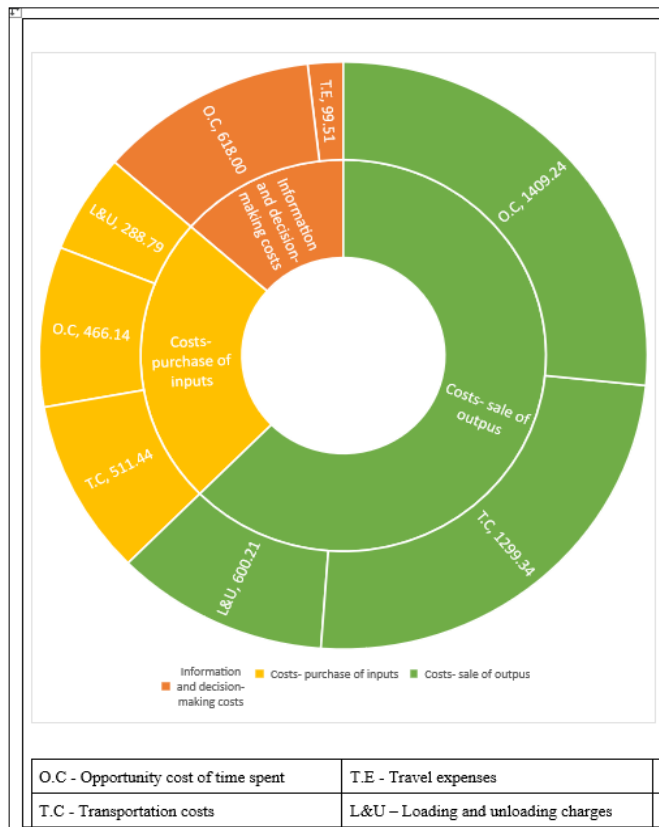


Fig. 2. Transaction costs of FPC non-members (Rs/ha/year).

Table 2. Comparison of transaction costs of FPC members and non-members (Rs./ha/year)

Sl No	Type of transactions	FPC members (Rs/ha/year)		FPC non-members (Rs/ha/year)		t-test
		Cost	Percent of total cost	cost	Percent of total cost	
Information and decision-making cost						
1	a. Opportunity cost of time spent on training, exposure visits and meetings	1725.54	31.13	618	11.68	3.36***
	b. Travel expenses	103.84	1.87	99.51	1.88	0.12
	Total	1829.38	33	717.51	13.56	3.24***
Costs involved in purchase of inputs						
2	a. Opportunity cost of time spent for purchase of inputs	330.47	5.96	466.14	8.81	-1.63*
	b. Transportation costs	590.93	10.66	511.44	9.66	0.59
	c. Loading and unloading charges	228.88	4.13	288.79	5.46	-0.52
Total	1150.28	20.75	1266.37	23.93	-0.48	
Costs involved in the sale of output						
3	a. Opportunity cost of time spent for sale of products	857.56	15.47	1409.24	26.62	-1.70**
	b. Transportation costs	1458.00	26.30	1299.34	24.55	0.62
	c. Loading and unloading charges	247.91	4.48	600.21	11.34	-2.88***
Total	2563.47	46.25	3308.79	62.51	-1.42*	
Total transaction cost	5543.13	100	5292.67	100	0.303	

Note: *p < 0.1, **p < .05, ***p < .01; Sample size: 260 (130 FPC members & 130 FPC non-members)

suggests a need for better intervention on the part of FPCs in the aggregation and marketing of farm produce. This aligns with the findings that output interventions are lacking in most FPCs, which is a crucial prerequisite for farmers (24). Even if farmers produce more from the same plot of land or at a lower cost, they do not gain any profit if they are unable to sell their products. If FPCs can concentrate on collectivisation at the local level, they can minimize the opportunity cost of time spent and the transportation costs for farmers, ultimately leading to efficient marketing and reduced transaction costs.

Information and decision-making costs are the second-largest component of transaction costs, followed by the cost involved in the sale of farm produce. The opportunity cost of time spent on information and decision-making is greater for FPC members (₹ 1725.54/ha/year) compared to non-members (₹ 618/ha/year), which is significant in the t-test. This may be due to the active role played by FPCs in conducting training and capacity-building programmes for members. The travel cost component is relatively low for both FPC members and non-members (₹ 103.84/ha/year and ₹ 99.51/ha/year, respectively), which may increase if the farmers fund their visits independently. In many cases, farmers participate in exposure visits and training as part of the programmes arranged by extension agencies such as the State Department of Agriculture, Agriculture Technology

Management Agency (ATMA) and State Horticulture Mission (SHM), along with the programmes arranged by FPCs. Consequently, the travel costs are met by the concerned agencies. This may lead to better knowledge of farming among small and marginal farmers, enabling them to adopt novel agricultural technologies and reap benefits. The transaction cost incurred in the purchase of inputs showed only a minor difference of ₹ 116.09/ha/year between FPC members and non-members. In summary, there is little difference between the transaction costs incurred by FPC members (₹ 5543.13/ha/year) and non-members (₹ 5292.67/ha/year). The lesser attention to the aggregation of farm produce by FPCs, along with the prevalence of parallel collective mechanisms that operate in the state such as Padasekhara Samithi for paddy, the Vegetable and Fruit Promotion Council (VFPC) for fruits and vegetables and Kudumbasree for women's groups, might have reduced the margin of transaction costs between FPC members and non-members.

Descriptive statistics of variables used in the econometric model of FPC members and non-members

From Table 3, it can be observed that the average age of the FPC members and non-members is approximately 60 years, which is higher than the average age of Indian farmers 50.1 years (25). The

Table 3. Descriptive statistics of the variables studied

Variable	Number of observations	Mean	Standard deviation	Minimum	Maximum
FPC members					
Age (years)	130	60.51	9.80	38	86
Gender	130	0.91	0.29	0	1
Education (in completed years)	130	12.18	3.44	3	20
Experience (years)	130	34	12.77	5	60
Area (acres)	130	2.38	1.50	0.08	6
Crops (no.)	130	2.48	0.96	1	4
TRG (no.)	130	0.83	0.72	0	2
EXP.visit (no.)	130	0.22	0.41	0	2
MTG (no.)	130	0.52	0.53	0	2
EXTN (no.)	130	1.6	0.73	0	3
IPP NO (no.)	130	3.39	2.24	0	9
IPP DIST (km)	130	4.94	3.08	0	12
OPS NO (no.)	130	10.46	8.41	1	36
OPS DIST (km)	130	5.22	3.72	0	16.56
Transaction cost (Rs/ha/year)	130	5543.13	6187.88	96.88	42273.92
FPC non-members					
AGE (years)	130	59.93	10.68	38	85
GENDER	130	0.88	0.33	0	1
EDN (number of completed years)	130	11.48	3.48	4	20
EXP (years)	130	31.98	14.11	5	60
AREA (acres)	130	2.66	2.08	0.12	8.5
CROPS (no.)	130	2.23	1.14	1	6
EXTN (no.)	130	1.16	0.61	0	4
TRG (no.)	130	0.45	0.68	0	2
EXP. VISIT (no.)	130	0.15	0.42	0	2
MTG (no.)	130	0.15	0.35	0	1
IPP NO (no.)	130	4.44	3.43	0	12
IPP DIST (km)	130	6.05	3.74	0	14
OPS NO (no.)	130	7.40	6.27	1	27
OPS DIST (km)	130	6.08	4.86	0	20
MBM (no.)	130	0.72	0.97	0	4
PERCENTAGE	130	98.85	8.15	25	100
NOPS (no.)	130	2.18	1.12	1	6
TRANSACTION COST (Rs./ha/year)	130	5293.31	6195.47	144.11	35656.2

labor-intensive nature and low income associated with agriculture are probable deterrents for youth participation in the sector. To modernize agriculture and enhance its profitability, the integration of technology such as precision farming, drones and AI-driven analytics is crucial. The FAO's 2022-2031 strategic framework emphasizes youth, gender and inclusion. In India, the Department of Agriculture & Farmers Welfare and the Ministry of Agriculture & Farmers Welfare have implemented schemes such as skill training for rural youth, Agri clinics, Agribusiness Centres (AC&ABC) and the ARYA (Attracting and Retaining Youth in Agriculture) initiative. Aligning agricultural initiatives with the aspirations of young individuals while focusing on technology, entrepreneurship and financial incentives can render the sector a more appealing career choice. The average area under cultivation by FPC members is 2.37 acres, whereas it is 2.67 acres for FPC non-members. Although marginal, it was observed that the average farm size of FPC members was slightly higher than that of non-members, which contradicted the previous findings (24, 26). It is noteworthy that the study area was pan-Indian in the first case and confined to Gujarat in the second. Additionally, it is important to highlight that the average farm size in Kerala is 0.18 ha, which is significantly below the national average of 1.08 ha and that of Gujarat (1.88 ha). This discrepancy could potentially explain the small farm sizes across both members and non-members; furthermore, the difference observed between them was minimal. The difference was more pronounced in the number of meetings, training sessions and exposure visits conducted, with FPC members participating in more activities. Although the difference between the minimum and maximum number of meetings, training sessions and exposure visits attended by FPC members and non-members was negligible, a greater number of FPC members participated in these activities. Increased training and exposure enable farmers to excel in their farming practices and income. This is supported by research indicating that the training programmes conducted by Krishi Vigyan Kendras (KVKs) and agriculture research stations helped farmers increase their productivity and reduce their costs (27). Furthermore, FPC members had more contact with

extension agencies (1.6) than did non-members (1.16).

FPC non-members made more visits (4.43) to purchase inputs compared to FPC members (3.39) and the average distance travelled for purchasing input was greater for FPC non-members (6.05 km) than for FPC members (4.94 km). This is because most FPCs own input shops and members primarily rely on FPC shops to obtain their inputs. This finding is supported by previous studies (28-30), which observed that most FPCs provide inputs to their members. Although FPC members sell their produce more frequently (10.46 times) compared to non-members (7.40 times), the average distance travelled to sell produce is shorter for members (5.22 km) than for non-members (6.08 km). These results align with those of previous research (31), which found that transactional input and output costs per hectare are lower for the Tamil Nadu Mango Growers Federation.

Factors affecting transaction cost of FPC members

A significantly negative impact of the area under cultivation (Table 4) on transaction costs reveals that, as the area increases, transaction costs decrease. This finding is in line with the concept of economies of scale. The researchers corroborate this by noting that larger farms can purchase inputs in bulk, thus obtaining them at reduced prices, which lowers transaction costs (32). Similarly, the significant negative impact of the age of FPC members on transaction costs indicates that older farmers are more knowledgeable about strategies to reduce transaction costs and implement them effectively.

Conversely, the significantly positive impact of exposure visits on transaction costs suggests that the number of visits significantly influences transaction costs, with costs increasing as the number of visits increases. These visits may provide farmers with insights into novel practices in other fields that they can adopt to increase their income. Additionally, the significant positive impact of the number of times inputs are purchased by FPC members indicates that transaction costs can be minimized by reducing the frequency of input purchases. Bulk purchasing and stocking of inputs can benefit farmers by lowering transaction costs.

Table 4. Factors affecting the transaction cost of FPC members

Sl no.	Independent variables	Coefficients
1	Age (years)	-62.21** (31.10)
2	Gender	321.64 (847.97)
3	Education (in completed years)	-31.72 (64.53)
4	Experience in farming (years)	12.93(22.92)
5	Farm size (acres)	-1426.30*** (153.51)
6	Number of crops cultivated	-1083.31(662.10)
7	Number of trainings attended	482.93 (340.47)
8	Number of exposure visits attended	2293.04*** (545.06)
9	Number of meetings attended	-123.12 (455.71)
10	Number of extension agency contacts	404.98 (331.87)
11	Number of times inputs purchased	345.48*** (119.40)
12	Average distance travelled for input purchase (km)	-61.58 (85.15)
13	Number of times output sold	132.00*** (32.43)
14	Average distance travelled for selling output (km)	127.06** (61.10)
15	Number of memberships in other groups	-162.85 (276.69)
16	Percentage of output sold	18.25 (28.73)
17	Number of products sold	587.05 (617.17)
18	Constant	6490.63* (3528.21)
	R ² value	0.5529

Note: *p < 0.1, **p < .05, ***p < .01; Sample size: 130 FPC members

Figures in the parentheses indicate standard errors

The number of times farm produce is sold and the average distance travelled by FPC members has a significantly positive impact on transaction costs. Pooling farm products and marketing them locally through FPCs can substantially reduce transaction costs. Therefore, FPCs should focus on aggregating farm produce and collective marketing to reduce individual transaction costs (26). Furthermore, farmers need to be educated about the concept of transaction costs and their role in increasing farming efficiency, emphasizing the need to address this component properly.

The factors affecting transaction cost of FPC non-members

The significant negative impact of area on transaction costs in Table 5 reveals that, as the area under crop cultivation increases, transaction costs decrease. This may be due to economies of scale in each production unit, as supported by previous study (32). The number of exposure visits by farmers has a significant positive effect; as the number of visits increases, transaction costs also increase because of the increased opportunity cost of the time spent. Additionally, the number of times farm produce is sold and the average distance travelled to sell the produce have a significant positive effect. This indicates that FPC non-members can reduce transaction costs through collectivization, either by forming a new FPC or joining an existing one.

Conclusion

This study used a sample of 260 farmers, comprising an equal number of FPC members and non-members, to investigate the transaction costs incurred and the factors influencing the magnitude of the transaction costs of sample farmers in Kerala during the year 2022-23. Although FPCs were primarily formed to collectivize small and marginal farmers, assist them in market access and reduce transaction costs, contrary to expectations, there was no significant difference in transaction costs incurred by FPC members and non-members. This lack of difference is mainly due to the higher information and decision-

making charges faced by FPC members. Therefore, there is a need to concentrate on the aggregation of farm products at the local level. Based on this study and discussions with FPCs, a three-tier system is recommended to streamline the agricultural production and marketing activities of FPCs. At the base level, individual FPCs should focus on integrating farmers, aggregating and sorting produce and ensuring traceability for quality assurance (e.g., organic or hormone-free). They also provide price information to reduce the transaction costs. At the district level, where base-level FPCs are shareholders or members, they can pool their produce and perform grading, which minimizes negotiation costs by setting transparent prices based on quality grades. The apex FPCs at the state level handle large-scale marketing and export activities, allowing the base-level FPCs to concentrate on production and integration. This system can reduce transaction costs and optimize the role of each tier. Future studies on organizational transaction costs and the scope for horizontal and vertical integration can provide more clarity on this idea.

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Authors' contributions

KMD conducted the survey, collected data, analysed it and prepared the manuscript. DSK guided the research, helped in formulating the concept and approved the final manuscript. AV, SCB, KU, BK and MKK all contributed by shaping the research concept, interpreting results and giving final approval for the manuscript. All authors read and approved the final manuscript.

Table 5. Factors affecting transaction cost of FPC non-members

Sl no.	Independent variables	Coefficients
1	Age (years)	1.77 (21.60)
2	Gender	390.06 (605.90)
3	Education (in completed years)	1.97(56.33)
4	Experience in farming (years)	-20.58 (15.83)
5	Farm size (acres)	-646.48*** (101.11)
6	Number of crops cultivated	1177.29 (722.64)
7	Number of trainings attended	61.15 (340.77)
8	Number of exposure visits attended	1952.85*** (519.10)
9	Number of meetings attended	-78.13 (577.18)
10	Number of extension agency contacts	196.48 (384.54)
11	Number of times inputs purchased	112.86 (67.97)
12	Average distance travelled for input purchase (km)	41.26 (58.21)
13	Number of times output sold	93.45** (36.57)
14	Average distance travelled for selling output (km)	156.36*** (42.56)
15	Number of memberships in other groups	-47.30 (248.35)
16	Percentage of output sold	-25.70 (22.74)
17	Number of products sold	-993.27 (784.50)
18	Constant	4634.85** (2619.98)
	R ² value	0.4538

Note: *p < 0.1, **p < .05, ***p < .01; Sample size: 130 FPC members

Figures in the parentheses indicate standard errors

Compliance with ethical standards

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Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the author(s) used [Paperpal] to [check grammar and spelling errors]. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

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