EVALUATING THE IMPACT OF FARMER PRODUCER COMPANIES ON GOOD AGRICULTURAL PRACTICES: KNOWLEDGE, IMPLEMENTATION, AND BARRIERS

ABSTRACT

Aims: To investigate the impact of Farmer Producer Companies (FPCs) on the adoption of Good Agricultural Practices (GAPs) among farmers in Tamil Nadu, focusing on compliance and awareness levels across various GAP components.
Study Design: This study utilized a cross-sectional survey to assess the role of FPCs in promoting GAPs among farmers across different agro-climatic regions of Tamil Nadu.
Place and Duration of Study:The study was conducted across 32 districts of Tamil Nadu, India, encompassing 357 FPCs, and was carried out over a period of six months.
Methodology:A total of 160 farmers, selected randomly from the surveyed FPCs, participated in the study. Data were gathered through structured interviews, focusing on their awareness and implementation of GAPs, including water quality management, soil health management, field cleanliness, and hygienic facilities. The survey also examined the challenges faced by farmers in adopting GAPs, such as high production costs, residue testing, and certification issues.
Results: The findings revealed that 90% of the participants were aware of GAPs, but only 47% practiced water quality management, and 55% adhered to soil health management. Compliance was higher for field cleanliness (71%) and hygienic facilities (73%). Major barriers identified included high production costs (67%) and difficulties with residue testing and certification (68%). Awareness of potential contamination sources was low, with only 41% and 51% recognizing soil and water contamination, respectively. Cold storage awareness was particularly low at 26%.
Conclusion: The study underscores the need for enhanced GAP education among farmers to improve their understanding and implementation, thereby contributing to agricultural development in Tamil Nadu. Addressing the identified barriers is crucial for promoting sustainable farming practices and ensuring the broader adoption of GAPs across the region.

Keywords: *Rural Development, Agricultural Modernization, Knowledge Dissemination, Compliance Barriers and Contamination Awarenes*

1.INTRODUCTION

In 2022, an article published by The Economic Times (ET) magazine titled "Policy on Good Agriculture Practice (GAPs) Soon" highlighted the global concerns regarding sustainable agriculture, GAPs, and environmental issues. This prompted a study to examine the knowledge of Farmer Producer Companies (FPCs) in Tamil Nadu regarding the implementation of GAPs (The Economic Times, 2022) [1]. According to the Food and Agriculture Organization (FAO) of the United Nations, GAPs encompass a set of principles aimed at ensuring safe and healthy food and non-food agricultural products while considering economic, social, and environmental sustainability (FAO, 2016) [2]. The United States Department of Agriculture (USDA) developed GAPs as food safety audits to assess farm management practices and guide improvements (USDA, 2011) [3]. Foodborne pathogens are estimated to cause around 48 million illnesses and 3,000 deaths annually in the United States [4]. However, the situation in India differs, as many rural farmers lack access to critical agricultural information, modern technologies, and best practices. Enhancing knowledge exchange, providing affordable modern technologies, and bridging the digital divide can significantly improve GAPs in India [5].

The consumption of fresh produce in India has surged in recent years, reflecting a growing trend of direct consumer purchases from small-scale farmers[6]. Sales of fresh produce directly from producers to consumers have increased significantly, with farmers' markets becoming popular venues for these transactions (Centers for Disease Control and Prevention, 2011) [7]. To support small farmers, India introduced the concept of FPCs in the 2000s, enabling them to achieve economies of scale and improve market negotiation power. In 2019, the Indian government launched the "Formation and Promotion of 10,000 Farmer Produce Organisations" program, aiming to establish 10,000 new FPCs by 2024, with a budget allocation of Rs 6,865 crore. This initiative is implemented by agencies such as the Small Farmers Agri-Business Consortium (SFAC), National Cooperative Development Corporation (NCDC), and National Bank for Agriculture and Rural Development (NABARD). As of February 2023, the Union Ministry of Corporate Affairs reported a total of 16,000 FPCs in India, with a notable increase in registrations over the past three years (Down-to-Earth, 2023) [8].

Tamil Nadu currently has 904 registered FPCs, with 357 actively involved in farming, and 120 supported by Tamil Nadu Agricultural University (The Hindu Bureau, 2023) [9]. The University assists these FPCs by organizing buyer-seller meetings and facilitating connections with financial institutions. FPCs have become transformative in addressing challenges faced by smallholder farmers, such as limited market information and fragmented resources. By promoting collective action, FPCs enable farmers to pool resources, exchange knowledge, and strengthen their bargaining power [10].

Good Agricultural Practices (GAPs) are essential for enhancing the agricultural system's ability to produce safe, high-quality food while being environmentally sustainable [11].The increasing demand for safe and nutritious food in domestic and international markets underscores the need for GAPs across the entire agricultural value chain. GAPs encompass practices from production to post-harvest handling, packaging, transportation, storage, and marketing [12]. The FAO highlights four key pillars of GAP: economic viability, environmental sustainability, social acceptability, and food safety and quality [13].

Implementing GAP standards can improve smallholder farmers' access to markets, promote sustainable farming practices, and ensure the well-being of farmers and consumers. GAPs help farmers use natural resources responsibly, enhance soil fertility, preserve biodiversity, and build resilience against agricultural challenges. Additionally, GAPs address social aspects by preventing the misuse of agrochemicals and ensuring fair wages (The Himalayan Times, 2022) [14]. By adopting GAPs, smallholder farmers in Tamil Nadu can reduce foodborne diseases and enhance food safety.

Good Agricultural Practices (GAP) are crucial for addressing the immediate needs of farming households while ensuring their ability to sustainably produce food for an increasing population in the future (FAO, 2016) [12]. GAP provides sustainable strategies that empower farmers to use natural resources and agricultural inputs responsibly, enhance soil fertility, preserve biodiversity, and strengthen the resilience of farming households against external agricultural challenges (FAO, 2016) [12]. By adopting GAP, smallholder farmers in Tamil Nadu can efficiently use inputs, improve soil fertility, and preserve natural resources, contributing to the sustainability of agriculture.

The social dimension of GAP plays a vital role in protecting the well-being of farmers by preventing the misuse of agrochemicals and ensuring fair wages for their labor [15].Proper education is essential for farmers to manage and apply hazardous substances correctly [11]. Implementing GAP among smallholder farmers in Tamil Nadu can enhance the safety and well-being of both farmers and consumers, promote local and traditional food production knowledge, and increase the availability of safe agricultural food products.

Foodborne microorganisms, including bacteria, viruses, and parasites, pose significant biological hazards as they can transmit pathogens to humans, leading to foodborne illnesses. Chemical hazards stem from inadequate production and handling practices, such as improper pesticide use, untreated manure, contaminated water, or unsanitary handling procedures, all of which can negatively impact the health of agricultural workers and consumers. Physical hazards, such as foreign objects like wood or metal packaging materials, residual soil, and stones in fruits and vegetables, can also cause illnesses and injuries [16] . Adopting GAP by smallholder farmers and other participants in Tamil Nadu's agricultural value chain can reduce foodborne diseases and promote food safety and well-being.

GAP audits are voluntary evaluations that assess how fruits and vegetables are cultivated, packed, handled, and stored to mitigate microbiological food safety risks (NASDA., 2022) [17]. These audits ensure compliance with the guidelines outlined in the United States Food and Drug Administration's "Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables" and industry-recognized food safety processes. In 2021, the USDA conducted GAP audits across 50 states, Puerto Rico, and Canada, covering over 90 commodities [2].

GAP certification involves an independent certifying body verifying that agricultural methods or products meet specified GAP criteria. While certification is not mandatory, it is often requested by buyers such as fruit distributors and supermarkets. The USDA's main GAP program offers Good Agricultural Practices certification, which requires farmers to pass a USDA GAP audit, demonstrating compliance with both Good Agricultural Practices and Good Handling Practices as outlined in the USFDA's guidelines for reducing microbial food safety risks in fresh produce [18]

The current food safety practices and safety awareness of Farmer Producer Companies (FPCs) in Tamil Nadu are not well-documented. This study aims to assess the current GAP practices adopted by Tamil Nadu FPCs, evaluate their knowledge and attitudes towards food safety, and investigate their awareness of contamination sources on their farms.

2.MATERIALS AND METHODS

A field survey was conducted across 32 districts in Tamil Nadu to assess the adoption and implementation of Good Agricultural Practices (GAPs) among Farmers' Producer Companies (FPCs). The study aimed to evaluate food safety knowledge, current farming practices, perceived barriers to GAP certification, and attitudes towards food safety.

2.1.Questionnaire Development and Structure

The survey instrument comprised 31 questions organized into four main sections:

- Demographics: This section collected data on gender, education level, birth year, farm size, producer profile, and district of residence.

- Current Practices and Requirements: Questions focused on irrigation sources, types of crops cultivated, sales methods, and past or current involvement in GAP audits.

- Barriers and Drivers for GAP Adoption: Explored farmers' experiences and attitudes towards GAPs, identifying obstacles to meeting food safety standards and obtaining certification.

- Interest in Future GAP-related Training: Assessed participants' willingness and interest in future educational opportunities related to GAPs.

2.2.Questionnaire Validation

The questionnaire was developed and validated at the Directorate of Extension Education, Tamil Nadu Agricultural University (TNAU). Prior to data collection, a pre-test was conducted at two FPCs in Coimbatore and Ramnad districts to ensure clarity and comprehensibility. Feedback from professionals, agricultural extension officials, and academic faculty was incorporated to refine the questionnaire.

2.3.Data Collection

Data collection took place from October 2023 to April 2024, targeting a diverse range of FPCs across Tamil Nadu. The sampling strategy aimed for representation across Urban centers (e.g., Coimbatore, Madurai), Medium-sized districts (e.g., Dharmapuri, Villupuram), Smaller districts (e.g., Perambalur, Pudukkottai). This purposive sampling approach ensured a comprehensive representation of FPCs across urban, semi-urban, and rural areas of the state.
Participant Consent and Data Analysis:

Participants were informed about the voluntary and anonymous nature of the survey, with the option to withdraw at any time. Data analysis was conducted using SPSS software, with descriptive statistics such as means and standard deviations calculated for each variable.
Standard Deviation

$$\sigma = \sqrt{\frac{\sum (x_i - \mu)^2}{N}}$$

σ = population standard deviation

N = the size of the population

x_i = each value from the population

μ = the population mean

The Chi-Square test was employed to examine relationships between categorical variables, assessing differences in demographic factors and farming practices among FPCs utilizing GAPs versus those not utilizing GAPs.

$$X^2 = \Sigma [(O\_i – E\_i)^2 / E\_i]$$

where “O_i” is the observed frequency and
“E”_i is the expected frequen

Furthermore, correlations between socio-economic factors and interest in further GAP-related education were explored.

$$\Upsilon_{xy} = \frac{\Sigma xy - (\Sigma x)(\Sigma y)/n}{\sqrt{[\Sigma x^2 - \frac{(\Sigma x)^2}{n}][\Sigma y^2 - \frac{(\Sigma y)^2}{n}]}}$$

Where,

- ✓ n – Sample size
- ✓ $\Sigma xy - (\Sigma x)(\Sigma y)/n$ – Sum of products of xy
- ✓ $\Sigma x^2 - (\Sigma x)^2/n$ – Sum of squares of x
- ✓ $\Sigma y^2 - (\Sigma y)^2/n$ – Sum of squares of y

This study provides valuable insights into the current adoption and challenges of GAPs among FPCs in Tamil Nadu. By highlighting opportunities for enhancing food safety practices and promoting agricultural sustainability, the findings contribute to informed decision-making and policy development in the agricultural sector.

3.RESULTS

3.1.Demographic Characteristics of Respondents

A survey was conducted across 357 Farmers' Producer Companies (FPCs) in 32 districts of Tamil Nadu, yielding 160 completed responses (44.81%). The findings are summarized in Table 1.

Table 1.Socio-economic profile of the farmer members in FPC

(N = 160)

S. No.	Profile	n	%
1	**Gender**		
	Male	87	54.40
	Female	73	45.60
2	**Education**		
	High School or less	26	16.50
	Diploma / Certification Course	64	40.50
	College Degree	68	43.00
3	**Age**		
	Young Age 18 – 34 years	8	5.00
	Middle Age 35 – 50 years	122	76.25
	Old Age > 50 years	30	18.75
4	**Farm Size**		
	1 acre or less	20	12.70
	2 acres	34	21.70
	3 acres	24	15.30
	4 acres	25	15.90
	5-10 acres	39	24.80
	>10 acres	15	9.60
5	**FPC member experience**		
	Less than 5 years	51	32.50
	6 – 10 years	56	35.70
	11 – 20 years	33	21.10
	>20 years	17	10.80

The socio-economic profile of the participants demonstrated considerable diversity across gender, age, education, and farm size. A majority of respondents were male (54.40%) and held college degrees (43.00%). The age distribution was predominantly middle-aged, with 76.25% falling between 35 and 50 years old. Farm sizes varied widely, with 65.60% of respondents cultivating less than 5 acres of land. The largest cohort of farmers reported farming experience ranging from 6 to 10 years (35.70%).

Participants represented all 32 districts of Tamil Nadu, with significant concentrations from Pudukkottai, Tiruvannamalai, Vellore, Madurai, Coimbatore, and Salem collectively accounting for nearly half of all FPCs. Among these, Coimbatore, including Pollachi, had the highest representation at 17.50%, followed closely by Madurai, including Alanganallur, at 16.90%. Salem accounted for just over 16.00% of respondents, while Vellore was slightly less at 10.00%. Tiruvannamalai represented 6.30%, and Pudukkottai less than 5.00% of the total respondents in this study.

3.2. Association between Awareness of GAPs, Land Holding for Local Produce, Education Level, and Current Farming Practices

Among the surveyed FPCs, a significant majority (90.00%) indicated familiarity with GAPs. Subsequently, their awareness of GAPs was examined in relation to current farming practices (see Table 2).

Table 2. Relationship between awareness of GAPs and current farming practices

S. No.	GAP Practices	Managing Current Practices	Not Managing Current Practices	Chi^2
		n(%)	n(%)	
1	Water quality	64 (47.00)	71 (53.00)	0.00
2	Manures & Bio-fertilizers	74 (55.00)	61 (45.00)	2.50
3	Labor health & hygiene	82 (61.00)	53 (39.00)	2.40
4	Hygienic facilities	98 (73.00)	37 (27.00)	2.42
5	Field cleanliness	96 (71.00)	39 (29.00)	0.13
6	Packing facilities	81 (60.00)	54 (40.00)	2.22
7	Transportation	86 (64.00)	49 (36.00)	7.72**
8	I don't opt GAP	2 (1.00)	133 (99.00)	1.85

αRespondents were allowed to indicate more than one response (n = 135)
*= *P <.05*
**= *P <.01*
***= *P <.001*

A strong correlation ($\chi 2 = 7.72$, $P < 0.01$) was found between GAP awareness and transportation practices, with 64.00% of GAP-aware participants managing transportation. In terms of water quality oversight, less than half (47.00%) mentioned monitoring it, and approximately 29.00% used tested well water. Borewell water was the primary irrigation source for 70.30% of respondents, while rivers, ponds, dams, and canals collectively accounted for 15.90%. Rainfed irrigation was chosen by 53.60% of participants. Management of manures and bio-fertilizers was reported by 55.00%, with 54.00% using composted manure. The most adopted GAP practices were hygienic facilities and field cleanliness, both at 73.00%, followed by labor health and hygiene (61.00%) and packing facility sanitation (60.00%). Among those aware of GAPs, a statistically significant relationship ($\chi 2$ (1) = 19.1, $P < 0.001$) was observed between the extent of land allocated for GAP practices and the management of worker health and hygiene (see Table 3).

Table 3.Relationship between size of land used for locally grown produce and management of GAPs

S. No.	GAP Practices	Land allocated for adopting GAPs in the farm							
		1 ac	2 ac	3 ac	4 ac	5 - 10 ac	> 10 ac	Total (n = 150)	Chi^2
1	Managing water quality	9 (53.00)	13 (41.00)	15 (63.00)	13 (52.00)	15 (41.00)	6 (40.00)	71 (47.00)	4.23
2	Managing manure & municipal biosolids	9 (53.00)	11 (34.00)	18 (75.00)	16 (64.00)	20 (54.00)	5 (33.00)	79 (53.00)	12.7*

3	Managing worker health and hygiene	7 (41.00)	13 (41.00)	19 (79.00)	21 (84.00)	18 (49.00)	10 (67.00)	88 (59.00)	19.1***
4	Managing resources and its sanitation	8 (47.00)	25 (78.00)	21 (88.00)	21 (84.00)	20 (54.00)	11 (73.00)	106 (71.00)	15.8**
5	Managing field sanitation	12 (71.00)	19 (59.00)	20 (83.00)	19 (76.00)	25 (68.00)	11 (73.00)	106 (71.00)	4.4
6	Managing packing facility & sanitation	7 (41.00)	15 (47.00)	17 (71.00)	20 (80.00)	20 (54.00)	8 (53.00)	87 (58.00)	10.6
7	Managing transportation	7 (41.00)	15 (47.00)	17 (71.00)	19 (76.00)	24 (65.00)	15 (100.00)	150 (100.00)	9.3
8	I choose not to implement GAP	0 (0.00)	0 (0.00)	0 (0.00)	1 (4.00)	2 (5.00)	0 (0.00)	3 (2.00)	4.5

[α]Respondents were allowed to indicate more than one response (n = 150)
*= *P <.05*
**= *P <.01*
***= *P <.001*

Respondents dedicating 4 acres to GAP adoption were most likely (84.00%) to manage worker health and hygiene. Additionally, a significant association ($\chi 2$ (1) = 15.8, P < 0.01) was found between land allocation for GAP adoption and the management of resources and sanitation, with the highest adherence on 3 acres (88.00%). Respondents using 3 acres were significantly more likely ($\chi 2$ (1) = 12.7, P < 0.05) to manage manure and municipal biosolids.

Table 4.Relationship between level of education and management of GAPs

S. No.	GAP Practices	Higher Secondary or less	Diploma / Certificate	College Degree	Total	Chi^2
1	Managing water quality	13 (54.00)	28 (46.00)	29 (46.00)	70 (47.00)	0.54
2	Managing manure & municipal biosolids	11 (46.00)	32 (52.00)	36 (57.00)	79 (53.00)	0.93
3	Managing worker health and hygiene	12 (50.00)	33 (54.00)	41 (65.00)	86 (58.00)	2.31
4	Managing resources and its sanitation	15 (63.00)	39 (64.00)	51 (81.00)	105 (71.00)	5.35
5	Managing field sanitation	19 (79.00)	40 (66.00)	45 (71.00)	104 (70.00)	1.59
6	Managing packing facility & sanitation	9 (38.00)	33 (54.00)	44 (70.00)	86 (58.00)	8.15*
7	Managing transportation	13 (54.00)	37 (61.00)	39 (62.00)	89 (60.00)	0.45
8	I choose not to implement GAP	0 (0.00)	3 (5.00)	0 (0.00)	3 (2.00)	4.37

*= *P <.05*
**= *P <.01*
***= *P <.001*

Table 4 illustrates the link between respondents' educational levels and their GAP engagement. A significant relationship ($\chi 2$ (1) = 8.15, P < 0.05) was found between educational attainment and the practice of packing facility sanitation. Approximately 70.00% of college-educated participants adopted packing facility GAPs, compared to 54.00% with similar levels of education. Those with a high school education or lower reported the lowest adoption of packing facility GAPs, at 38.00%."

3.3.Evaluating FPCs' Awareness of Contamination Sources

Respondents were presented with a list of potential contamination sources and asked to identify those they perceived as risks to their farms. Each source corresponds to factors identified in the World Bank report titled '47 countries make 67 reforms to help farmers grow their business' [19]. Ideally, respondents should have selected all items on the list, but the survey revealed varying perceptions of these contamination sources among participants (see Table 5).

Table 5.Source of Contamination on Farm Identified by FPCs

S. No.	Sources	n	%
1	Soil	56	41.00
2	Irrigation water	69	51.00
3	Animal waste or Bio manure	87	65.00
4	Inadequate application of composted manure	59	44.00
5	Wild / Domestic animal damage	100	75.00
6	Workers hygiene	78	58.00
7	Harvesting equipment	56	42.00
8	Transportation containers	70	52.00
9	Washing and Rinsing of Produce after harvesting	48	36.00
10	Cold storage	35	26.00
11	Packing with ice box or packed refrigeration	60	45.00
12	Cross-contamination in storage or preparation	69	51.00

*Respondents were allowed to indicate more than one responseThe study found that wild/domestic animal intrusion onto farms was the most commonly cited contamination source, identified by 75.00% of respondents. Following closely, animal waste or bio-manure was acknowledged as a risk by 65.00% of respondents. In contrast, only 58.00% recognized workers' hygiene as a potential contamination source. Approximately half of the respondents identified transport containers (52.00%), while irrigation water (51.00%) and cross-contamination during storage or preparation (51.00%) were considered potential vectors by slightly over half of the respondents. Less than half believed that inadequate application of composted manure (44.00%), harvesting equipment (42.00%), or soil (41.00%) could contribute to contamination. A minority (36.00%) indicated washing and rinsing produce after harvesting as a potential source, and even fewer (26.00%) suggested contamination could arise from cold storage.

The study found no significant relationship between respondents' awareness of contamination sources and their educational level (see Table 6).

Table 6.Relationship between sources of contamination on farms identified by/of FPCs and their education level

S. No.	GAP Practices	Below Higher Secondary	Diploma / Certificate	College Degree	Total	Chi^2
1	Soil	10 (50.00)	19 (36.00)	27 (44.00)	56 (42.00)	1.48
2	Irrigation water	9 (45.00)	28 (53.00)	32 (52.00)	69 (51.00)	0.40
3	Animal waste or Bio manure	13 (65.00)	36 (68.00)	38 (62.00)	87 (65.00)	0.39
4	Inadequate application of composted manure	7 (35.00)	26 (49.00)	26 (43.00)	59 (44.00)	1.21

5	Wild / Domestic animal damage	12 (60.00)	37 (70.00)	51 (84.00)	100 (75.00)	5.51
6	Workers hygiene	8 (40.00)	32 (60.00)	38 (62.00)	78 (58.00)	3.25
7	Harvesting equipment	6 (30.00)	24 (45.00)	26 (43.00)	56 (42.00)	1.43
8	Transportation containers	6 (30.00)	31 (58.00)	33 (54.00)	7 (52.00)	4.88
9	Washing and Rinsing of Produce after harvesting	3 (15.00)	19 (36.00)	26 (43.00)	48 (36.00)	5.00
10	Cold storage	3 (15.00)	14 (26.00)	18 (30.00)	35 (36.00)	1.65
11	Packing with ice box or packed refrigeration	4 (20.00)	15 (28.00)	19 (31.00)	38 (38.00)	0.92
12	Cross-contamination in storage or preparation	5 (25.00)	27 (51.00)	28 (46.00)	60 (45.00)	4.01

*No significant differences were found at *P <.05*

While respondents with a college degree tended to identify contamination sources more frequently than those with a high school education or less, the difference was not statistically significant. It is notable that a minority of respondents recognized contamination risks across all categories. These findings, consistent with Table 6, underscore the ongoing need for enhanced awareness among FPCs regarding potential contamination risks in their farming operations."

3.4.Constraints in Implementing GAPs

FPCs were surveyed regarding the challenges they face in adopting Good Agricultural Practices (GAPs), as depicted in Fig. 1.

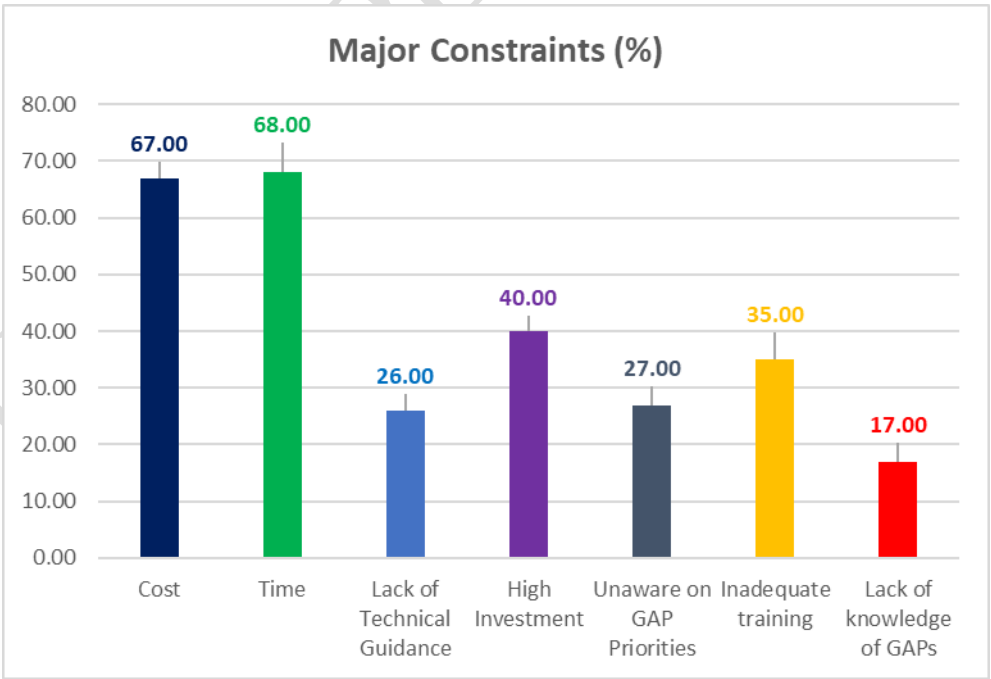

Figure 1. Constraints faced by the FPCs in implementing GAP in their farms

The most significant perceived barriers included a lack of time for undergoing audits (68.00%) and concerns about the cost of certification (67.00%). Approximately 40% of respondents

expressed skepticism regarding the return on investment from GAP certification, while 35.00% cited limited access to training and educational opportunities on GAPs as potential obstacles. Just over a quarter of respondents (27.00%) believed that uncertainty in prioritizing GAPs would hinder certification, whereas 26.00% identified a lack of technical solutions as a barrier to GAP audits. It's noteworthy that a relatively smaller proportion of respondents (17.00%) viewed a lack of knowledge about GAPs as a hindrance to certification.

4.Discussion

The study revealed a nuanced understanding of contamination awareness among FPCs in Tamil Nadu. While 12 categories of potential contamination sources were assessed, only six were recognized by a majority of respondents. Particularly concerning was the lack of awareness regarding soil as a conduit for microbiological contamination in fresh produce. Given that fruits and vegetables are often grown in open environments susceptible to chemical and microbiological hazards, addressing this knowledge gap is critical.

Interestingly, cold storage was identified as the least reported source of microbiological contamination, contrasting with wild animal intrusion, predominantly by wild boars, which was acknowledged by a majority of participants. This finding aligns with prior research vy Todd [20] emphasizing the significance of managing wild boar populations to mitigate agricultural damage M.Growers' perceptions of wild animal intrusion often reflect challenges such as perceived powerlessness or economic disincentives to effectively address these issues on their farms.

Respondents highlighted cost and lack of time as significant barriers to GAP certification, consistent with findings from previous studies (USDA, 2011) [21]. This contrasts with surveys where cost was perceived as a lesser barrier, underscoring the need for targeted education on the benefits of GAP certification. Moreover, over 85.00% of respondents expressed keen interest in training opportunities to enhance their knowledge of GAPs, particularly favoring online training and workshops. These findings emphasize the demand for educational materials and practical training programs tailored to producers, especially those directly engaging with consumers, to improve the safety standards of FPCs practicing GAPs.

While this study provides valuable insights, it is essential to acknowledge its limitations. The relatively low overall response rate and non-probability sampling method may restrict the generalizability of the findings. However, the purposive sampling strategy enabled the examination of diverse FPCs across various districts in Tamil Nadu, offering rich data for analysis. This geographical diversity enhanced the study's scope by including FPCs from different backgrounds and regions, contributing to a more comprehensive understanding of GAP implementation challenges and practices in Tamil Nadu.

5.CONCLUSION

This study revealed a diverse range of food safety practices and attitudes among Farmers' Producer Companies (FPCs) in Tamil Nadu, highlighting significant gaps in knowledge and implementation. The findings indicate that respondents have a limited understanding of microbial behavior in farm environments and potential contamination sources such as water, soil, and manure. The adoption of Good Agricultural Practices (GAPs) was found to be relatively low, with critical deficiencies in water management and soil safety practices.

The primary barriers identified were cost and time constraints, which hinder FPCs from pursuing GAP certification. Addressing these barriers is essential for promoting greater acceptance of GAPs within the FPC community. The study underscores the need for targeted educational outreach to enhance food safety knowledge and practices among Tamil Nadu farmers. Such efforts are crucial to ensuring the safety of fresh produce throughout the farm-to-home supply chain in the region.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

I (JAISRIDHAR P) 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.

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