Original Article
ISSN (Online): 2582-7472

ShodhKosh: Journal of Visual and Performing Arts
June 2024 5(6), 505–516

EXPLORING THE POTENTIAL: A COMPREHENSIVE ANALYSIS OF THE TAPIOCA MICRO FOOD PROCESSING INDUSTRY IN SALEM DISTRICT, TAMIL NADU

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ABSTRACT

Tapioca, a key crop in Tamil Nadu, could support sustainable growth in micro food processing enterprises in the Salem district. The district accounts for 12% of the state's area and produces 13.36% of the state's sago, with high-quality starch production. Micro food processing businesses in the Salem district contribute to the local economy, providing employment and contributing to overall growth. The study revealed district is dominated by processing unit owners over 50 years old, with 20% owned by women and 80% by men. Most processors have 21-30 years of experience and belong to nuclear families. New mechanical methods have increased efficiency in making sago and extracting starch. Sago processing units in Salem face challenges such as equipment shortage, labor scarcity, loan availability, price fluctuations, quality deterioration, and drying issues. Most processing unit owners prefer to market their products through Channel III, which includes Farmer, Processor, Sago-serve, Trader, Wholesaler, and Retailer. The majority sell their products to Sago-serve Cooperative Society Ltd in Salem. Investing in infrastructure and supporting small-scale food processing enterprises is crucial for promoting economic growth and development in the district.

Keywords: Tapioca, Sago, Micro Industry, Food Processing, Sago-Serve

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DOI
10.29121/shodhkosh.v5.i6.2024.1761

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

1. INTRODUCTION

Tapioca is a staple food-cum industrial crop (Anitha & Jayalakshmi, 2019). Tapioca is perishable in nature. It cannot be stored for a long time without processing. Availability of tapioca in plenty coincides with harvesting season. The harvesting of tapioca falls in the Kharif season from Mid-September to early December and in the Rabi season April to June depending upon the variety grown.

In India, Tapioca is primarily utilized for animal feed, industrial uses, and human consumption. Roughly 60% of all tapioca grown in India is utilized as a feedstock for dry chips, sago, and starch.

Tapioca is grown in 88,683 ha area with a production of 33,30,275 tones and an average productivity of 37.55 t/ha during 2022-2023 in Tamil Nadu (Season and Crop Report, 2022-2023, Tamil Nadu). Tapioca is largely cultivated in Namakkal (20.16%) followed by Kallakurichi (17.465%) and Salem (13.36%) which accounts for about 50.98 % of state production during five years ending 2022-2023. However, in Tamil Nadu the productivity of tapioca is highest in Coimbatore (44.93 t/ha) followed by Namakkal (43.91 t/ha) and Kallakurichi (42.10 t/ha) during 2022-2023 is presented in table 1 (Season and Crop Report, 2022-2023, Tamil Nadu).

Tamil Nadu tops the states in India with the production of 33,30,275 tones followed by Kerala (23,90,395 tones) and Andhra Pradesh (47,124 tones) during 2022-23 is presented in table 2. Tamil Nadu ranks first in tapioca area and production in India. Tapioca contributes 20.31% of the total agricultural produce of Salem district during the triennium ending 2022-2023 (Season and Crop Report, 2022-2023, Tamil Nadu).

Table 1

Table 1 Five year Ending Average (2022-2023) and 2022-23 APY of Tapioca in Major Districts of Tamil Nadu

Year	District	Area (ha)	Production (tones)	Yield (t/ha)
Five-year average ending 2022-23	Salem	11096	437570	36.008
		-12.45%	-13.36%	
	Namakkal	18491	660070	35.697
		-20.74%	-20.10%	
	Kallakurichi	13068	571452	43.729
		-14.66%	-17.45%	
	Tamil Nadu	89136	3274016	36.731
		-100	-100	
2022-23	Salem	13117	538936	30.88
		-14.79%	-16.18%	
	Tamil Nadu	88683	3330275	37.552
		-100	-100	

Source Season and Crop Report FYA Ending 2022-23

The districts of Namakkal (20.74%), Salem (12.45%), and Kallakurichi (14.66%) are estimated to provide a combined 48% of the overall production. In order to build a tapioca cluster in and around these places, it may be beneficial to streamline the transfer of raw materials from these districts to adjacent processing units.

Table 2

Table 2 2012-23 APY of Tapioca in the Major States of India

2022-2023	Area (ha)	Production (tones)	Yield (t/ha)
Tamil Nadu	88683	3330275	37.55
	-59.81%	**-57.72%**	
Kerala	55713	2390395	42.91
	-37.58%	-41.40%	
Andhra Pradesh	3739	47124	12.6

	-2.52	-0.82%	
India	**148257**	**5768996**	**38.91**
	-100	**-100**	

Source www.indiastat.com

Agro-processed products are promoted through the production and processing of agricultural and horticultural-based crops produced from specific districts (Ghosh, 2010). Tapioca processing units could be established centralizing these districts for the sustainable functioning of the tapioca-based micro food processing enterprises. Though the processing and production centers for different value-added products of tapioca namely, starch, sago, alcohol, animal feed and wafers etc., and improved cultivation is necessary following good agricultural practice in order to meet the quality raw material in the tapioca value chain for the production and processing of tapioca agro-based products (Krishnakumar, 2021). Hence, to tap the export potential, high-yielding tapioca crop varieties should be promoted among the farmers.

Salem District in Tamil Nadu, India, accounts for 12.2% of the state tapioca area and 13.36% of the state production, which is used for sago industries (Season and Crop Report- 2022-2023, Tamil Nadu). Tamil Nadu produces 90% of cassava starch and 60-70% of sago in India from Tamil Nadu (Prakash, 2021). The starch market in Tamil Nadu is semi-organized. Sago products include kitchadi, Pappad, Vadai, Halwa, Puri, Kheer, Uppuma, Laddu, Pakoda, Chikki, Murukku, Vermicelli, Fry Noodles, sago rice, and Sundal. The potential to establish starch and sago clusters in the vicinity of Panamarathupatti and Attur blocks presents numerous opportunities for rural businesses. Sago and starch are staple foods in northern India, and it is crucial to encourage farmers to cultivate suitable varieties to meet market demand (Trisia, 2021).

In the beginning, produced sago and starch using a conventional process. The conventional approach to producing starch and sago was known to be a labour and time-intensive procedure, which led to extremely low output levels in terms of both quantity and quality. Then, as a result of ongoing advancements in industrial technology, the sago businesses developed mechanical equipment for the manufacturing of sago and starch. Both the traditional and mechanical approaches to the production of starch and sago use essentially the same concepts and procedures; the only differences are in the equipment and operational size (Pandiyan, 2017). In addition to being useless and inefficient, the conventional method of extracting starch from roots produces starch of poor quality.

By expanding their production to include tapioca, farmers can tap into a wide range of industries that rely on this versatile starch. This diversification not only provides a steady source of income throughout the year but also opens up new market opportunities for farmers. Additionally, the by-products created from tapioca cultivation, such as tapioca flour and pearls, can further increase revenue streams for farmers (Mohamed, 2023). Furthermore, with the increasing demand for natural and sustainable products in various industries, tapioca presents itself as an environmentally friendly alternative to synthetic materials. By promoting the use of tapioca starch in these sectors, farmers can contribute to a more sustainable supply chain and help reduce the environmental impact of traditional raw materials. Overall, diversifying sago cultivation to include tapioca production is not only beneficial for farmers in terms of revenue generation but also aligns with current market trends towards sustainability and eco-friendly practices. It is essential for

farmers to explore these opportunities and leverage the potential of tapioca to enhance their overall agricultural business.

We will address the complex issues that come up at the nexus of food processing using three different approaches in this thorough analysis. We will first go in-depth into the characteristics, analysis, and uses of the tapioca micro food processing businesses, following their technological developments and overall influence on the sector. We hope to uncover areas where technical developments may be deficient or falling short by closely investigating the role and function of micro food processing enterprises within the larger food processing environment.

Through our meticulous analysis, it becomes apparent that the health-related design principles are not receiving adequate support from micro food processing industries. This realization prompts us to question how new and emerging technologies can bridge these gaps and align more effectively with the nutritional requirements of food products. Lastly, we conducted a thorough examination for the need and gap assessment of micro food processing industries specifically within the Salem district. By shedding light on these critical areas, we hope to provide valuable insights that can inform future strategies and advancements within the industry.

2. METHODOLOGY

The study is conducted in cluster of Attur and Thalaivasal blocks in Salem district, Tamil Nadu. This area plays an important role in tapioca processing industry. Primary and Secondary data was used. A systematic interview schedule was used to gather primary data on around 75 sago micro food processing firms in the Salem district. The selection method of micro food processing firms involved snowball sampling. The District Industries Center's and the Department of Agricultural Marketing and Agribusiness's list of industries—the project's nodal agency—were utilized to identify and choose the micro food processing companies that produce sago. The main information about the company's location, demographics, labour force, source and use of raw materials, production or processing techniques, including associated costs under different headings, machinery and technology used, branding and packaging, source of capital and investment details, infrastructure, processing, and marketing limitations, etc., and suggestions for better performance as well as aids were collected. The secondary data on details of the food processing industries was collected from district industrial center at Salem. The primary data collected were tabulated, processed and subjected to statistical analysis.

3. SIMPLE PERCENTAGE ANALYSIS

A percentage is a number or ratio that can be expressed as a fraction of 100. If we have to calculate percent of a number, divide the number by the whole and multiply by 100. Hence, the percentage means, a part per hundred. The word per cent means per 100. It is represented by the symbol “%”. To determine the percentage, we have to divide the value by the total value and then multiply the resultant by 100. This study utilizes percentage analysis to evaluate the basic industrial profile of micro food processing units in the Salem district.

Percentage formula = (Value/Total value) × 100

4. GARRETT'S RANKING TECHNIQUE

The processors were asked to rank their firm level issues in marketing of sago and starch. In Garrett's ranking technique, these ranks were converted into per cent position by using the formula (Shanjeevika V., 2022)

Percent position =100 X (Rij – 0.5)

Where, Nj

Rij = Ranking given to the ith attribute by the jth individual

Nj = Number of attributes ranked by the jth individual.

By referring to the Garrett's table, the per cent positions estimated were converted into scores. Thus, for each factor the scores of various respondents were added and the mean values were estimated. The mean values thus obtained for each of the attributes were arranged in descending order. The attributes with the highest mean value were considered as the most important one and the others followed in that order (Sathya, 2022).

5. RESULTS AND DISCUSSION

5.1. DEMOGRAPHIC PROFILE STUDY OF THE MICRO FOOD PROCESSING INDUSTRIES IN THE SALEM DISTRICT

The Salem sago and starch cluster aims to establish itself as a reputable production hub for branded sago and starch, as well as their derivatives, serving both domestic and global consumers. The results of demographic profile for the micro food processing units in the Salem district is displayed in Table 3.

Table 3

Table 3 Demographic Profile of the Micro Food Processing Units Present in the Salem District

Particulars	No. of units Responded
Age	
Below 35	3
	-4
36-50	27
	-36
Above 50	45
	-60
Total	75
	-100
Gender	
Male	60
	-80
Female	15
	-20
Total	75
	-100
Experience	
Below 10	10
	-13.33
Nov-20	15

	-20
21 to 30	30
	-40
Above 30	20
	-26.67
Total	75
	-100
Family Structure	
Nuclear	55
	-73.33
Joint	20
	-26.67
Total	75
	-100

Source Figures in Parentheses Indicate Percentage to Total

Age: Age played a role since it can indicate a person's mental development and ability to make judgments that will help him meet his needs. 60% of respondents were over 50, according to the statistics shown in the table, with 36% falling between the 36 to 50 age ranges. Merely 4% of those surveyed were younger than 35 years old. As a result, it was clear that most responders were older than 50.

Gender: Analysis of the data revealed that 20% of processing units were owned by women, and 80% of units were owned by men.

Experience: With the implementation of current processing technology and the decision-making process, experience plays a crucial role. The table shows that unit owners with 21 to 30 years of experience had the highest processing experience (40%) followed by those with over 30 years of experience (26.67%), those with 11 to 20 years of experience (20%), and those with less than 10 years of experience (13.33%). Also, unit owners with 21 to 30 years of experience were the most experienced.

Family structure: The size of the contribution made by family laborers to processing would depend on the type of family, nuclear or joint. According to the findings, 73.33% of the respondents belonged to the nuclear family type. It is determined that the most common family structure was the nuclear one, with 26.67% of the units belonging to a joint family.

The ownership pattern and workforce of the micro food processing units in the Salem district are displayed in Table 4.

Table 4

Table 4 Ownership Pattern and Work Force of the Micro Food Processing Units in Salem District

Particulars	**No. of units Responded**
Ownership Pattern	
Proprietorship	62
	-82.67
Partnership	13
	-17.33
Total	75
	-100
Land Ownership	

Own Land	70
	-93.33
Rental	0
Lease	5
	-6.67
Total	75
	-100
Work force: Total No. of Laborers	
Up to 10 laborers	10
	-13.33
11-20 laborers	10
	-13.33
21-30 laborers	20
	-13.33
Above 30 laborers	35
	-46.67
Total	75
	-100

Source Figures in Parentheses Indicate Percentage to Total

- **Ownership Structure:** According to the data, 82.67% of tapioca processing facilities are run as sole proprietorships, with partnerships accounting for the remaining 17.33%. Most unit owners would rather keep total control over their companies since it facilitates better decision-making. Owners may make choices more swiftly and effectively because to this ownership structure, which eventually boosts the company's success.
- **Land Ownership:** According to the survey results, only 6.67% of processing units rented property in order to start their processing industries, whereas 93.33% of processing units did so. This shows that processing units really prefer to own the land that they operate on.
- **Total Workforce:** The total number of workers engaged in the production of final goods and products is known as the workforce. The findings reveal that 46.67% of processing industries employ more than thirty people, followed by 26.67% of industries with a labour force of between twenty and thirty people and 13.33% of businesses with a labour force of between eleven and twenty people. As such, in comparison to previous methods, sago processing plants need a large number of personnel for the entirety of their processing operation.

Table 5 demonstrates the sources of funding and raw material procurement for the Salem district's micro food processing units.

Table 5

Table 5 Source of Raw Material Procurement and Finance of the Micro Food Processing Units in Salem District	
Particulars	**No. of units Responded**
Source of Procurement	
Farmers	21
	-28

Traders	54
	-72
Total	75
	-100
Financial Support from bank	
No	60
	-80
Yes	15
	-20
Total	75
	-100

Source Figures in Parentheses Indicate Percentage to Total

- **Source of procurement:** One of the elements influencing the location of processing facilities and the accessibility of raw materials is the source of procurement. According to the findings, 72% of sago processing facilities obtained their tapioca from traders in and around the Salem district, while 28% of the processing facilities obtained their raw materials directly from farmers. The procurement price of tapioca tubers fluctuated depending on their moisture and starch content.
- **Financial Support from Bank:** According to the statistics, eighty percent of the unit owners were operating their businesses on their own capital. The bank was only providing support to 20% of the units.

6. INFRASTRUCTURE SUPPORT FOR MICRO FOOD PROCESSING INDUSTRIES PRESENT IN THE SALEM DISTRICT

Micro food processing businesses in the Salem district depend on infrastructure support to expand and succeed. Due to their ability to generate employment and enhance the general growth of the area, these industries are vital to the local economy. In order to enable them to flourish and grow, it is crucial to give them the infrastructure support they require. By making investments in infrastructure, such as transportation, water supply, and electricity supply, we can guarantee that these sectors have the resources required to run smoothly and successfully. In order to foster economic growth and development in the Salem district, it is critical to acknowledge the significance of infrastructural assistance for small-scale food processing enterprises and to give these investments top priority.

- **Road:** Road plays a major role in sago processing either during procurement of raw materials or during marketing. The result shows that 80% of sago processing units were satisfied with the existing transport infrastructure followed by only 5% of the units were highly satisfied with the existing transport facilities and followed by 15% of the units were neutral level satisfaction with the existing transport facilities.
- **Water:** The result suggested that 80% of sago processing units were satisfied in their opinion on available water resources followed by 10% of the unit owners were highly satisfied with available water resources and 10% of unit owners were the neutral level of satisfaction with available water resources.

- **Electric Supply:** The result shows that 85% of sago processing units were satisfied with the available electricity facilities and 15% of the units were highly satisfied with available electricity facilities followed by five per cent of sago processing units were neutral level satisfaction. Moreover, sago processing units were required high electricity with respect to more machinery's usage.

7. FOOD PROCESSING INDUSTRIAL PROFILE OF SAGO STARCH PRESENT IN THE SALEM DISTRICT

Table 6 displays, details of the sago starch processing industries present in the Salem district. In Salem district, there are 8767 registered micro, small and medium-scale food processing industrial units with the state industries department. This provides employment to people for their sustainable income generation in which 18.47 % of the population is engaged in agriculture and allied agro-processing industries.

Table 6

Table 6 Details of the Food Processing & Sago Starch Industries as per the UAM Registration in Salem District

Type	No. of food processing industries	No. of Sago & Starch industries
Micro	**8100**	**91**
Small	646	77
Medium	21	4
Large	Nil	Nil

Source District Industrial Centre- Salem, 2022-23.

In Salem district, there are 8767 registered micro, small and medium-scale food processing industrial units with the state industries department. This provides employment to people for their sustainable income generation in which 18.47 % of the population is engaged in agriculture and allied agro-processing industries. There are more than 650 units engaged in tapioca processing of which 172 units are currently registered with UAM. In and around Salem the yield of tapioca is about 25-30 t/ha, the highest in the World. The national average is 19 t/ha and World average production stands at 10 t/ha. Hence, it is called the land of sago. Though there are many Self-Help Groups (SHG) and a few FPOs existing in the district, as such there are no specific SHGs or FPOs engaged in Tapioca Processing. Co 2, Co 3, CO (TP) 4, Mulluvadi 1, H 165, H 226, Sree Vishakam (H.1687), Sree Sahaya (H.2304), Sree Prakash (S. 856), Sree Vijaya, Sree Jaya, Sree Pekha, Sree Prabha, Co (Tp) 5, H - 97, H - 165, H - 226 and Sree Harsha are the popular varieties of Tapioca grown in Salem, Namakkal and Kallakurichi area of tapioca cluster.

8. MODERN MECHANIZATION FOR SAGO & STARCH PROCESSING UNITS IN SALEM DISTRICT

The majority of Salem's tapioca processing firms switched from using the traditional approach to using a mechanical one in order to produce sago and extract starch more effectively. The key unit operations in the tapioca processing process are the mechanical peeler, crushing machine, decanter and fiber separator, auto roaster, and hot air dryer. (Pandian & Meenambal, 2017). In the peeling segment, it was discovered that the starch loss with the peeling machine was approximately

5%, compared to over 10% with conventional methods. The peeling machine's effectiveness ranged from 95% to 98%. While starch separation in settling tanks takes 15 to 20 hours, in the starch separation section, starch is removed from starch milk in an hour using a decanter and fiber separator. The hot air dryer study unequivocally demonstrated that, up to 90 minutes for starch and 60 minutes for sago drying, the percentage moisture removal increases with drying time; after that, there is no discernible difference. According to an examination of tapioca processing methods, 15–18% of the starch in tapioca roots is recovered using a conventional approach and 22–25% using a mechanical method. It was also discovered that the mechanical approach uses less energy and labor than the traditional way. In and around the Salem district, the technology of sago manufacturing has significantly advanced from low-quality starch generated by sedimentation process to high-quality starch produced by fully automated and mechanized, dewatering centrifugal process.

Testing of Sago: The findings indicate that all sago processing units in Salem district utilize Sago-serve's testing laboratory for product testing. A total of 11 tests, including Chloride, Sulphate, Moisture, Total Ash, PH, Protein, Carbohydrates, Energy, Starch, Acid, Alcoholic, and Hydrocyanic acid, are conducted in accordance with the Food Safety and Standards Authority of India (FSSAI) regulations.

9. MARKETING CHANNELS FOR SAGO STARCH PROCESSING UNITS IN SALEM DISTRICT

At present, Tapioca products are sold through Sago-serve either directly retailing or by wholesale or through traders. In order to gain insight into the marketing practices and constraints associated with processing units, an analysis was conducted to identify the various market channels through which these units were marketed. The study revealed three main marketing channels utilized by processing unit owners.

Channel 1

Channel 2

Channel 3

The results showed that approximately 90% of processing unit owners opted to market their products through Farmer, Processor, Sago-serve, Trader, Wholesaler, and Retailer, known as channel III. Five percent of unit owners marketed through Trader, Processor, Sago-serve, Wholesaler, and Retailer, referred to as channel II, while other five percent marketed through Processor, Wholesaler, and Retailer, known as channel I. It was evident that the majority of processing unit owners chose to sell their products to the Sago-serve Cooperative Society Ltd in Salem. Sago-serve not only provides marketing services to processors but also to merchants. This cooperative society operates under the administrative control of the Director of Industries and Commerce, Government of Tamil Nadu. Salem is the

leading producer of sago in the state, specializing in the production of sago-based foods and starch. Sago-serve, the primary distributor, fulfills nearly 80% of the national demand for sago and starch.

10. FIRM LEVEL MARKETING ISSUES OF MICRO FOOD ENTERPRISES IN SALEM DISTRICT

A study on micro food processing found that they had to deal with a number of marketing-related issues. The results of applying Garrett's ranking technique to the top six marketing limits are shown in Table 7.

Table 7

Table 7 Firm Level Marketing Issues of Micro Food Enterprises in Salem District

S. No.	Constraints in Marketing	Mean Score	Rank
1	Lack of starch analyzer equipment	**60.15**	**I**
2	Labour Scarcity	**55**	**II**
3	Non-availability of Loan facility to machineries	**45.25**	**III**
4	Price Fluctuation	**25.23**	**IV**
5	Quality deterioration due to Bacterial growth in starch	**20.01**	**V**
6	Rainy days- Drying Problem	**18.65**	**VI**

Source Primary Data

Challenges faced in the sago starch manufacturing industry include a lack of starch analyzer equipment, labor scarcity, and the non-availability of loan facilities for machinery. Price fluctuations also pose a significant obstacle, as well as quality deterioration caused by bacterial growth in starch. Additionally, rainy days can lead to drying problems. These issues highlight the need for strategic solutions and innovative approaches to ensure the sustainability and success of starch production operations.

11. CONCLUSION

Implementation of specific strategies will greatly benefit for Salem district in the sago starch manufacturing industry. By establishing a robust sago cluster in Salem through the utilization of modern processing technology, and it is increased efficiency of mechanization, reduced post-harvest losses, lower production costs, and improved product quality for both domestic and international consumers. Providing credit facilities for working capital will enable farmers and processors to generate higher profits and offer high-quality products at competitive prices. Additionally, cultivating tapioca with modern varieties and irrigation techniques will result in environmentally friendly expansion.

By supporting farmers with custom hiring of machinery, subsidized loans, research guidance, and improvements to market infrastructure, we can promote efficiency in the agricultural sector. Overall, the implementation of these strategies will not only benefit the sago starch manufacturing industry in Salem but also contribute to the sustainable growth and development of the agricultural sector in the region.

CONFLICT OF INTERESTS

None.

ACKNOWLEDGMENTS

None.

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