ECONOMIC ANALYSIS OF RICE MILLING INDUSTRY IN CENTRAL KERALA

By

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(2016-11-091)

THESIS

Submitted in partial fulfillment of the

requirement for the degree of

Master of Science in Agriculture

Faculty of Agriculture

Kerala Agricultural University, Thrissur

DEPARTMENT OF AGRICULTURAL ECONOMICS

COLLEGE OF HORTICULTURE

VELLANIKKARA, THRISSUR – 680656

KERALA, INDIA

2018

DECLARATION

I, hereby declare that the thesis entitled **"Economic analysis of rice milling industry in central Kerala"** is a bonafide record of research done by me during the course of research and that it has not previously formed the basis for the award to me of any degree, diploma, fellowship or other similar title, of any other University or Society.

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ACKNOWLEDGEMENT

First and foremost, I bow my head before the **God Almighty** *for giving me the strength, knowledge, ability and opportunity to undertake this research study and to persevere and complete it successfully.*

With immense pleasure I avail this opportunity to express my deep sense of whole hearted gratitude and indebtedness to my major advisor **Dr. Chitra Parayil** *Asst.Professor (Agrl. Economics) and chairperson of my advisory committee for her expert advice, valuable guidance, practical suggestions, constant patience, inspiring encouragement, friendly approach, kind advice and timely help at various stages of my research work and thesis preparation and will be remembered forever.*

I would like to express my extreme indebtedness and obligation to **Dr. Jesy. K, Thomas,** *Professor and Head, Dept. of Agricultural Economics and member of my advisory committee for her meticulous help, expert advice, forbearance, critical evaluation, constant encouragement and support throughout my course of study.*

I sincerely thank **Dr. Anil Kuruvila,** *Asst. Professor, Department of Agricultural Economics, and member of my advisory committee for his unwavering encouragement, timely support and critical examination of the manuscript that has helped me a lot for the improvement and preparation of the thesis.*

I express my heartiest gratitude to **Dr. B. Shanmugasundaram** *Professor, Department Agricultural Extension and member of my advisory committee for her ever willing help, valuable guidance and creative suggestions throughout the period of my study.*

I owe my deepest gratitude to **Dr. P. Indira Devi,** *and* **Dr. Prema** *Professor, Department of Agricultural Economics for the heartfelt help, timely suggestions and back-up which gave me enough mental strength for the successful completion of my thesis work.*

I wish to extend my wholehearted gratitude to **Dr. Jiju P Alex, Dr. Jayashree Krishnan kutty,** *Professor,Department of Agricultural Extension for his generous support, immense help and most precious suggestions in times of need which helped me to overcome all the insurmountable obstacles.*

I am extremely thankful to all the respondent millers especially **Palakkad and Ernakulam rice millers** *or their co-operation and support during the survey. I sincerely acknowledge the kind concern and continuous support, which I have received from my family especially my parents Baburaj and Shaini and my grandparents Madhavan Nair, Radhamani and Meenakshi amma.*

True words of thanks to all my friends, more personally I would like to express my sincere gratitude to my dearest and intimate friends, **Sp, Nandu, Nithin, Athi, Swathy , Reshu, Sreethu, Aswini, Shanu, ansi, roshu, visku, Nagendra Jithin,** *all friends of jabolpians batch, all my Raichur friends , my beloved brothers* **unni, Kannan, cousins, all pampa hostel members including Nanu ettan and Leela chechi ,matran , beloved juniors Haritha, Sajay, Amal, Anees, Jaseel, Amal, and** *all western singing group for providing the much needed shoulders in times of need. I appreciate all my seniors,* **Lokesh annan, Anoopettan, Vivekettan, Amrutha chechi, Indu chechi, Sachu chechi, Seenatha, Radhika chechi, sachu chetan, Chandana chechi,** *juniors of Department of Agricultural Economics* **Swadima, Anirudh, Shana and Sindhuja** *, juniors of Department of Agricultural Extension, and my beloved juniors* **Anu ,Nandu,** *and* **Manu** *who helped me in one way or the other. I am extremely thankful to all the Research Associates,* **Rajeshettan, Sarada chechi** *and* **jayasree chechi** *and* **Vinod sir,** *Teaching Assistant of the Department of Agricultural Economics, and* **Sindhu chechi** *for their support during the conduct of research. I thankfully remember the services rendered by all the staff members of Student's computer club, especially* **Aravindettan,** *Bhavana Photostat, College Library, Office of COH and Central library, KAU. I am thankful to Kerala Agricultural University for the technical and financial assistance for persuasion of my study and research work.*

A word of apology to those I have not mentioned in person and a note of thanks to everyone who helped for the successful completion of this endeavor.

Athira B.

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Introduction

1. INTRODUCTION

India is a major stakeholder in rice production; accounts 21.24 per cent of global production and 26 per cent of the cultivated area, nearly 50 per cent of the area was irrigated which contributes 75 per cent of the production. It was projected that the global rice consumption will increase from 439 million tonnes (milled rice) in 2010 to 496 million tonnes in 2020 and further increase to 555 million tonnes in 2035. However, area under rice is expected to be reduced by about 40 million ha in the next 15-20 years owing to water shortage and urbanization in India (Arivelarasan *et al.*, 2011).

Rice milling is the oldest and the largest agro processing industry of the country. At present it has a turnover of more than Rs. 25,500/- crore per annum. It processes about 85 million tonnes of paddy per year and provides staple food grain and other valuable products required by over 60 percent of the population. Paddy grain is milled either in raw condition or after par-boiling, mostly by single hullers of which over 90,000 are registered in the country. Apart from it there are also a large number of unregistered single hulling units in the country (NABARD, 2015). Capacity utilization of rice mill industry in India is very low due to various constraints. This is mainly due to the compulsory levy on rice mills imposed in most of the states, which results in low profitability consequently limited ability to invest in up gradation. (GOI, 2015). Modern rice mills have a capacity of more than 500 Kg per hour with yield recovery of 70 % and grain breakage of 10% and mini rice mills have capacities ranging from 150-300 Kg per hour.

Almost the entire production (90 per cent) of paddy is converted into rice every year by paddy processing units of varying sizes and capacities spread across the country. The remaining 10 per cent grains produced in India is lost in processing due to old and out-dated methods of drying and milling activities. As demand for food grain increases with the growth of population, the need for efficient paddy processing units is felt in the country (Shwetha, 2011).

As per the Government of Kerala's Economic Review 2010 notes, food grains produced in the State account for only 15 per cent of its total consumption of food grains. Kerala imports food grains from Tamil Nadu, Andhra Pradesh, Madhya Pradesh, Bihar and Gujarat to fully meet its consumption needs (GoK, 2010). While Palakkad and Alappuzha are the two major paddy-growing regions of Kerala, most of the modern rice mills in the State are concentrated in Ernakulam district, mainly in the Kalady–Perumbavoor area. Large, private-sector rice mills in this area often act as a cartel, and are powerful enough to influence the price for paddy received by the farmer. As noted above, State government policies on prices and procurement have helped farmers receive steady prices. Similar interventions by the public or cooperative sectors in rice-processing can provide greater security to farmers' incomes.

Given the absence of effective procurement by the government or its agencies, paddy farmers were at the mercy of private dealers, mainly a small group of modern rice-mill owners in Ernakulum district. It was under these circumstances that the State government, in 2005, entrusted the Kerala State Civil Supplies Corporation Limited (popularly known as Supplyco) with the responsibility of procuring paddy from the farmers of Kerala, mainly in the major rice-producing region (RAS, 2011).

Research problem background

Main challenges encountered by the rice processors are to find appropriate solutions for quality rice processing and meeting the demand of current population growth rate. This work provides the basic information about the economics of rice mills in Kerala, factors affecting the milling efficiency and also will study the stakeholder responses (farmers, traders, and millers) on the rice milling industry. As it is very essential to assess and analyse the economic status of rice milling industry in central Kerala, the present thesis work is formulated with following objectives.

1. To analyse the capital investment in the rice milling industry,
2. To calculate the milling efficiency and factors affecting it.

3. To analyse the stakeholder response to milling industry in Kerala.

Limitation of the study

As most of the rice mills in Kerala are restricted to Ernakulam and Palakkad districts of Kerala, the study has been restricted to these districts. Hence these districts represent the economic analysis of rice milling industry in Central Kerala. The results of the study are based on primary data collected through pre tested interview schedules from the millers of Palakkad and Ernakulam districts who were not completely willing to give information about their milling activities. Because of the varying capacity of rice mills in Kerala, comparison is very difficult between heterogeneous groups.

Plan of thesis

The entire thesis contains five chapters. This chapter gives the introduction to research problem, covers the scope, objectives and states the limitations of the study. The second chapter deals with the review of literature relevant to the study. Review of literature includes the earlier work related to proposed research work. The third chapter details the study area, the methodological frame work, analytical tools and conceptual tools. Results and their detailed explanation are included in the fourth chapter. Summary and conclusion of the research work is included in chapter five followed by references, abstract and appendices.

Review of literature

2. REVIEW OF LITERATURE

Review of literature is very essential for the critical analysis of published sources or literature on a specific topic. It ensures to have a thorough understanding and detailed study of the topic. In this chapter the past studies which are relevant to the present studies are included and classified under the following headings which is further divided into the following sub headings.

2.1. Investment pattern in rice milling industry

2.1.1 Establishment cost of rice milling industry

2.1.2 Cost of processing in rice milling industry

2.1.3 Returns obtained from rice milling industry

2.2 Milling efficiency and factors affecting it

2.2.1 Demand for rice processing units

2.2.2 Capacity utilization in rice processing units

2.2.3 Factors affecting the milling efficiency

2.3. Stakeholders response to rice milling industry

2.3.1 Millers and farmers response to milling industry

2.3.2 Challenges faced and constraints in rice milling sector

2.3.3 Role of Government in the rice processing sector and its management

2.1. Investment pattern in rice milling industry

2.1.1 Establishment cost of rice milling industry

Gupta and George (1974) worked on the modernization in the rice milling industry in Punjab state. The study revealed that land, building and machinery

constituted 88 per cent of the total investment followed by transportation and equipment. The result also depicted the direct relation between fixed cost per rice mill and size of the mill.

Capital investment pattern of cashew nut in different processing units of Ratnagiri and Sindhudurg districts was Rs. 18, 54,710 of which 12.96 per cent was fixed capital (Ipte and Borude, 1982). Investment in fixed capital includes buildings and machinery and working capital includes raw nuts, wages and salaries.

In a study conducted by Nagesh (1990), on investment in production and marketing of cashew nut in Karnataka found that capital investment was highest on building followed by machinery-equipment and land with a pattern of 72.81, 75.42, and 11.77 per cent respectively.

Establishment cost of oil industries, dal mills, and cotton ginning industries was calculated by Kalse *et al.* (1996). Major fixed factor contributing was cost of machinery which accounts for 61.43 per cent and 59.12 per cent in dal mill and cotton ginning industries respectively.

Study of management appraisal of cashew processing units in Uttar Kannada region estimated the direct relation between total capital investment and size of unit with a total investment of Rs. 117.50 lakh for large scale unit and 36.32 lakh for small scale units. He also computed the fixed capital investment and was found that 80 per cent of the fixed capital investment was on building (Dev, 1998).

Joshi *et al.* (1999) analyzed the capital investment pattern in home, cottage, small and large scale mango pulp processing units in South Konkan region of Maharashtra and estimated the fixed and working capital. He found that working capital invested was more than fixed capital.

Krishnadas (2006) analyzed the causes and factors that led to the clustering of rice mills around Kalady. The long term Borrowings and capital are effectively invested in fixed assets and working capital in the rice mills under study. The real

cause for the deceleration of rice production in the state of Kerala is identified as negative change in the cropping pattern effect which also created a serious problem of raw material shortage. The other problem identified as cost of electricity, transport cost, high input cost, unhealthy competition, poor linkage with supporting industries etc.

2.1.2 Cost of processing in rice milling industry

Muralidharan (1981) computed the establishment cost of processing units of sugar, gur and khandsari units in Mandya districts of Karnataka with a value of Rs. 4,40,28,322.03 ,Rs. 46,329.83, and 9,16,722.38 lakh respectively.

Maurya *et al.* (1995) in their study on economics of production and processing of Aonla in Varanasi district of Uttar Pradesh worked out the cost of Aonla processing plant and its establishment. The total establishment cost (fixed cost) per quintal was Rs. 8.00. It was the highest for depreciation, (Rs. 3.40/q) followed by interest on fixed capital (Rs. 2.50/q), insurance (Rs. 1.00/q), maintenance cost (Rs. 0.60/q) and electricity and water charges (Rs.0.50/q).

2.1.3 Returns from the rice milling units.

Acharya and Agarwal (1989) in his study on agro-processing observed that the profit margin per quintal of rapeseed and mustard oil was Rs.l9, Rs.21 and Rs.22 in six bolt expellers, nine and nine bolt expellers and oil mills respectively. He also found that the profit margins of dal mill owners were Rs.22, Rs.l3 and Rs.27 per quintal of gram, moth and moong respectively

Economies of scale of groundnut processing units were studied by Singh (1974) in Punjab. Fixed cost in small, medium, and large groundnut units was found to be Rs. 0.58, Rs. 1.14, and Rs.0.50 respectively and per quintal total cost inn these mills were Rs. 118.85, Rs. 120.87 and Rs. 119.23 respectively.

. Srivastava (1989) observed that secondary and tertiary processing of raw materials and price of finished products are directly proportional. He also found

that agro processing unit's accounts for 39 per cent of all factories, 12 per cent of fixed capital and 13 per cent of working capital and 15 per cent of total capital employed in the industry. Fifteen per cent of this total capital generates around 25 per cent of the total employment, 26 per cent of total output and 21 per cent of net added value with a capital productivity around 0.35 and labour productivity less than 0.5.

Study on economics of marketing and processing of pulses in Bundelkhand region (Uttar Pradesh) was conducted by Singh *et al.* (1994). The result showed that of the total cost, land/building contributed to the highest share followed by machinery and equipment, electricity and other fixed capital in red gram processing unit.

Performance of co-operative structure infrastructure in Punjab market was studied by Rachhapal and Darshan (1996). A gross value of fixed assets of 152.77 lakhs, depreciation of 92.13 lakh and present value of fixed assets of 60.64 lakh was computed and analysed in the study.

Sakia and Talukdar (1996) calculated the economic feasibility of commercial processing units at farm level for major spices in Nagaon district in Assam and observed that investment in machinery and equipment was highest followed by opportunity cost of own land.

A study conducted by Kumar from Jawaharlal Nehru Kristi Vishwa Vidyalaya, Madhya Pradesh (2012) reported that modern rice mills are almost profitable and provide Rs. 18.29 quintal per net return to the mill owners

2.2. Milling efficiency and factors affecting it

2.2.1 Demand for agro processing sector

Dixit (1991) revealed that value addition and processing in agriculture is highly demanded and is the major reasons for the economic growth in the country. He also showed the large imbalance in the economy with 70 per cent of the population supported by a sector contributing only 40 per cent of the net domestic product.

Over a period of 40 years, India's annual requirement of food grains are estimated to have increased enormously from 61.90 million tonnes in 1951-56 to 145 million tonnes in 1980-85 and 180 million tonnes in 1992-93 (FAO, 1994).

Goswami (1994) in his study found that there is a rising trend of average expenditure for processed milk products in Karnataka with a rise in the income level. This points out the luxury status of processed milk products in the state.

In a study conducted by Venketesan (2003), demand for processed fruits and vegetables in Chennai metropolitan city were calculated. He revealed that in order to cope up with increased demand for fruits and vegetables, production level should be increased. The returns from the value addition could reduce the spoilage and hike in price level and is highly beneficial to the farmers. In addition to this processing also generates employment.

2.2.2 Capacity utilization in the rice milling units

Rai *et al.* (1996) conducted study on the capacity utilization and constraints of agro-processing units in Haryana and the study revealed that there is a great scope for improving the capacity utilization of process units and availability of raw materials, processing units and markets were not a serious problems. They also reported the future development of processing industry lies in wheat milling, rice milling, feed and concentrate industry, edible oil and cotton processing and sugarcane milling.

Dev (1998) for analyzing the business performance of cashew nut processing units in Uttar Kannada districts of Karnataka. He found that at an overall level, the large scale units were more efficient and had a good financial structure compared to medium and small scale units.

Ali *et al.* (2009) analysed and examined the efficiency and productivity change in 12 wide categories of food manufacturing industry from 1980-81 to 2001-02. They also used Data Envelopment Analysis (DEA) to calculate the total factor productivity (TFP) which is further divided into efficiency and technical change.

They noticed a positive change in TFP due to the technological process or shift in production frontier.

According to the annual report given by National Bank for Agriculture and Rural Development (NABARD) (2010-2011), the recovery ratio of whole grains in a traditional rice mill by using steel hullers for de-husking was found to be around 52-54 per cent in India.

Shweta (2011) discussed the efficiency factors in both conventional and modern rice mills. The result showed that capacity utilization of conventional unit was around 44 per cent only as compared to 69 per cent capacity utilization in modern rice mill.

Singha (2013) observed that larger quantities of food grain were reported to be lost due to in efficient milling process in the country. She found that conversion ratio from paddy to rice of modern and traditional mills in India, on an average was approximately 64 per cent per quintal of paddy processed for modern rice mill and 58.6 per cent for traditional mill. Variation of conversion ratio among the states was very negligible at the tune of 6.4 per cent only. This is due to technological advancement, infrastructural facilities and quality of raw paddy available for processing in the states.

Arivelarasan *et al.* (2016) used Data Envelopment Analysis (DEA) to measure technical efficiency of production units. The results revealed that there is substantial inefficiency in farming operations for the sample agricultural farm households.

2.2.3 Factors affecting the milling efficiency

Lele (1970) discussed the factor that determine the efficiency of rice milling industry and examined the performance of rice milling industry during a recent period of free trade. She found that a price policy which could stabilize off seasonal price movements and market supplies from year to year would considerably reduce uncertainty in trading operation.

Conway (1991) estimated the factors affecting milling efficiency and found that Head Rice Yield (HRY) and whiteness are the two major deciding factors. He also noted that transaction price is an estimating factor which is also dependent on size, shape and cleanliness of rice.

Brahmaprakash *et al.* (1997) estimated that market information, rapid and refrigerated transport system, storage facility, banking institutions, packing and post-harvest technologies are the major infrastructural requirement for improving the efficiency of agro-processing industry in rural India.

Githumbi *et al.* (2017) studied the effect of differentiation on performance of large rice milling industries. The study concluded that product and service differentiation were the two major factors that affects the rice milling industries in Kirinyaga country.

2. 3. Stakeholder response to rice milling industry

2.3.1 Challenges and constraints faced by the milling industry

Patil (1998) worked on the performance of fruits and vegetables processing unit in North Karnataka. The study revealed the scarcity of raw materials, uneven electricity supply and high taxation on commodities, and lack of advent of technology were the major constraints observed in fruits and processing units.

Management of agro processing units in Karnataka was studied by Chidri (1999) and indicated that high taxation, high procurement cost, irregular power supply inadequate finance, and irregular labour supply are the major constraints faced by an agro processing unit.

Manjunatha (2000) found that marketing, processing, Government policies and procurement are the major constraints in flour mills and included in his study on management of food processing units.

Saravanan (2002) studied the major problems faced by the cashew and processing units in Kanyakumari districts of Tamil Nadu. High wage rate, diminishing imports trend and inadequate availability resources from domestic market were the major problems identified. Apart from this irregular power supply during processing period and wide fluctuation in the price of cashew nut and high purchase tax also affected the efficient processing activities of cashew nuts.

Problems faced by agro-processing units of Bikaner were studied by Varghese *et al.* (2006). The study revealed that technological factor, raw materials based factors and policy based factors were the major problems faced by agro- processing units in the particular study area.

Even though India is one of the top producers in most of the crops, its processing level is very low (less than 10%). Approximately 2% of fruits and vegetables 8% marine, 35% milk, 6% poultry are processed. Scarcity of adequate variety is one of the major challenges faced by the processing industry. (Annual report 2015-16, MoFPI, GOI)

2.3.2 Role of Government in the agro processing sector and its management

Singh (1995) reported that lack of quality of resources, efficient technology and professional trained management personnel at each hierarchical level of organizational structure as the major constraints in the management of sugar factories in India. He also included Govt. pricing policies were included as firm's external problems.

Sabur *et al.* (2003) examined that the paddy were collected from farmers and rice from millers by the procurement centres. They also observed a large difference between procurement price and market price in Bogra and Naogaon districts of Bangladesh. The difference indicated that farmers were benefited in selling the paddy to procurement centres rather than the millers who sold rice to the centre.

The Economic Times (2011) reported that both Food Corporation of India (FCI) and state level agencies have procured around 11.95 million tonnes of paddy. FCI, as a central agency made its first attempt to make direct payment to Punjab and Haryana paddy farmers.

Indian Express (2017) pointed out that there was procurement wastage of 0 to 60 percent and caused the friction between farmers and supplyco - registered millers because the later has been forced to purchase the paddy which are damaged, discoloured and sprouted.

To full fill the cash requirement, most of the farmers sell paddy immediately after their harvest (Pavithra et al., 2018). They also revealed that main part of the rice value chain work takes place in rice mill only by converting paddy into rice.

2.3.3 Millers' and traders' preference in the agro processing sector

Singh *et al.* (1980) discussed about the milling and consumer acceptance of pigeon peas in India and reported that late maturity and kharif pigeon peas were preferred by farmers. They also revealed that dhal mill owners have preference in seed colour and white pigeon pea. Varietal, location and maturation differences were also observed to influence dhal yield in small scale processing.

Kumar *et al.* (2012) assessed the customer satisfaction at different levels of service quality in organized retailing in Bangalore city. They found out that tangibles, reliability, responsiveness, competence, credibility, accessibility, and customer knowledge have a direct relationship with the customer satisfaction.

In a study conducted by Jaim *et al.* (2012) on consumers' preference and cooking practices have explored various milling and cooking practices of rice as well as consumers preference for rice quality in Bangladesh. From the perception of millers about good quality of rice they gave importance to nutritional quality and consumers preferred mostly good quality rice, less or more polished rice, cooking practices etc.

Prema *et al.* (2012) in their study analyzed the varietal preference and criteria for rice among the consumers and the reasons in central Kerala (Palakkad, Thrissur, and Alappuzha).

A study on consumers' acceptance and preference on brown and under milled Indian rice varieties were done (Sudha *et al.*, 2013). Consumers reported colour, appearances, texture, taste and overall quality of the 4.4 per cent polished rice was strongly preferred in variety. If it is affordable, 93% consumers were willing to substitute brown or polished rice even though brown rice was less preferred over polished rice with o% to 4.4% polishing.

Sharma *et al* (2013) reported that farmers who hold large land holding directly supply their paddy to the rice mill which reduces their middleman cost and increase in the revenue.

The stakeholder analysis conducted by Indumathi *et al*, (2017), in Southern Tamil Nadu revealed the nature and degree of relationship between the identified stakeholders. The study also noted that most of the value addition takes place in a paddy processing unit where internal controls can be implemented and practiced in a sustainable manner.

Methodology

3. METHODOLOGY

This chapter includes a brief description of the study area, research design, sampling procedure, method of data collection and tools of analysis. This also enables to critically evaluate the problem and its solution and replicate the study if needed.

3.1 Area of the study

Rice mills from Palakkad and Ernakulam districts of Kerala were selected as the major area of the study. Economic analysis of rice mills including their investment pattern, milling efficiency and factors affecting it, capacity utilization and responses of the stakeholders who are related to the rice milling industry from these two districts were included in this study.

3.1.1. Palakkad district

Due to the Palakkad gap in the Western Ghats, the district is also known as the gateway to Kerala. The district covers an area of 4,480 Km^2 contributing 11.5 per cent of the total area of the state. 2011 census reported that the total population of Palakkad was 28, 10,892. The important crops cultivated are paddy, coconut, rubber, arecanut, tapioca, cotton and sugarcane.

3.1.1.1. Location

Palakkad district is surrounded by Malappuram on the North West, Thrissur on the south west, The Nilgiris on the north east and Coimbatore on the eastern side. Palakkad district is situated between 10046'21" North Latitude and 76039'5" East Longitude.

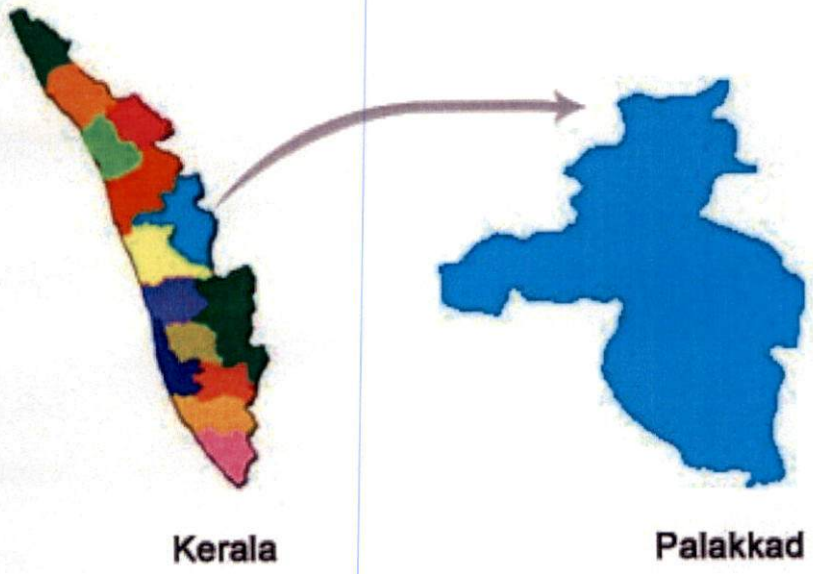


Fig: 3.1. Map of the study area- Palakkad

3.1.1.2 Topography and climate

Palakkad has generally tropical wet and dry climate. With the exception of March and April, the temperature remains moderate throughout the year. South west monsoon accounts for the major rainfall in Palakkad and a very high precipitation is received in the district. The hottest temperature was 37.3^0 C recorded in March and lowest temperature in the district was recorded in July (22.5^0 C). 1n 2016, average rainfall of the district was recorded as 2135 mm.

3.1.1.3 Demographic features

As per the 2011 census total population of the district is 28, 09,934 with 13, 59, 478 males and 14, 50,456 females. Sex ratio in the district is 1067 females for every 1000 males. Density of the population is 627 persons per Sq km.

3.1.2 Ernakulam district

Ernakulam is commonly called as the commercial capital of Kerala, spreads over an area of 3,068 Km^2. As per the 2011 census, total population of Palakkad was reported as 3,279,860 which covers around 12 per cent of the total population in Kerala. Being the third most populous city in the state, the district includes the largest metropolitan region of the state. With a contribution of 14 per cent GDP, Ernakulam is the largest revenue yielder of the state. Most important agricultural crops grown in the district are paddy, tapioca and banana.

3.1.2.1 Location

Ernakulam district is located between 9.98^0 North latitude 76.28°E East Longitude. District has an elevation of 4m (13ft). Ernakulum district is bordered by Arabian Sea in the west, Thrissur district in the north, Idukki on the East side and Kottayam and Alappuzha on the southern side.

Fig 3.2 Map of the study area – Ernakulam district

3.1.2.2 Topography and climate

Generally, Ernakulam has a tropical monsoon climate. As the district is situated on western coastal plains and situated quietly near to the sea, this affects the climate of Erankulam district in a large way. Summer season in Ernakulam district ranges from March to June with a maximum temperature of 37^0 C.

After the summer season comes the monsoon season and stays till September. Major share of the monsoon is obtained through South West monsoon. Lowest temperature in the district is reported in the month of December with a minimum temperature of 17^0 C. Total annual rainfall of the district was recorded as 3359.2 mm during 2015-16.

3.1.2.3 Demographic features

According to the 2011 census, total population of the district was reported as 3279860 where the male inhabitants are 1619557 and female inhabitants are 1662831. Density of the population was reported as 1072 people per sq. km with a sex ratio of 1027:1000. Average literacy of the district was found to be 95.68 per cent.

Table 3.1. Land utilization pattern of the study area

Sl no	Description	Palakkad	Ernakulam
Agricultural scenario			
1.	Total Geographical area	305826	447584
2.	Forest	70617	136257
	Land put to agricultural purpose	44330	50662
3.	Barren and uncultivable land	404	2003
4.	Permanent pastures and other grazing land	0	0
5.	Land under miscellaneous tree crops	160	724
6.	Cultivable waste	13455	23284
7.	Fallow other than current fallow	803	16155
8.	Current fallow	8899	13889
9.	Marshy land	0	0
10.	Still water	11171	15333
11.	Water logged area	290	0
12.	Social forestry	105	380
13.	Net area sown	148364	188897
14.	Area sown more than once	17721.64	89558.702
15.	Total cropped area	166085.614	278455.702

Source: Department of agriculture and statistics, 2016-17

Table 3.2. Industrial status of Palakkad and Ernakulam districts

Sl no	Industry	Palakkad	Ernakulam
1	Heavy industries	56	47
2	Micro manufacturing	13736	12619
3	Micro service	2716	2640
4	Small manufacturing	833	1630
5	Small service	165	370
6	No. of development plot per area	4	6
7	No. of mini industrial area	6	17
8	Handloom societies	42	21
9	Power loom societies	3	1
10	Coir societies	40	15
11	General industrial societies	161	271

Source: District Industries Centre, Government of Kerala- 2016-17

3.1.3 Selection of the study area

Total area under paddy cultivation in Kerala during the agricultural year 2015-16 according to the survey conducted by Department of Economics and statistics was reported as 1, 98,159 ha. Out of the total area under paddy, Palakkad and Alappuzha are the two major producing districts accounting for 41.84 percent and 17.37 percent respectively. The increase in output of paddy in these two districts caused the progressive growth in the establishment of rice mills in Ernakulam district. Although Palakkad and Alappuzha are the two major paddy growers in Kerala, most of the modern rice mills in Kerala are concentrated in Kalady and Perumbavoor region of Ernakulam district. Out of 120 modern rice mills in Kerala, 80 are located in Ernakulam and around 55 rice mills are located in and around Kalady

3.1.4 Selection of the rice mills

From the study area, rice mills belonging to both traditional and modern category are selected randomly. Mills which belong to different categories on the basis of volume, ownership, capacity utilization were selected randomly.

3.2 Sampling design

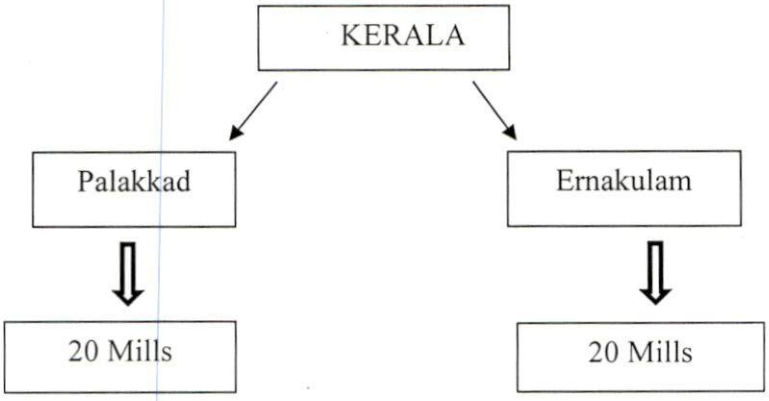
The present study is mainly based on primary data collected from 40 rice millers and 20 farmers. Kerala rice millers association provided the list of rice millers from which data was collected. The information was collected randomly from rice mills belonging to modern or traditional, registered or unregistered, and small/medium/large milling capacity categories and surveyed.

3.2.1 Collection of data

The primary data was collected selected randomly through personal interview method using a pre tested interview schedule from rice mills. The survey was conducted from February 2018 to June 2018. Data related to the investment pattern, capacity

utilization, employment generation, milling efficiency and factors affecting it, and responses of millers, farmers and traders regarding the paddy varieties, procurement source, and categories of rice buyers were collected. Secondary data were also collected from the various agricultural department, published and unpublished sources.

Distribution of sample rice mills in Kerala



3.3 Analysis of data

For the analysis of objectives of the study, three major techniques were used to treat the data collected and they are as follows

3.3.1. Percentage change analysis

3.3.2. Financial ratio analysis

3.3.3. Data envelopment analysis

3.3.4. Garret rank technique

3.3.1. Percentage change analysis

Percentage change analysis is a simple mathematical concept that represents the degree of change over time. The percentage change analysis is a way to express a

change in a variable. It represents the relative change between the old value and the new one. The percentage change is calculated by the formula:

$$\text{Percentage change} = \frac{V_2 - V_1}{V_1} \times 100$$

Where,

V_1= previous value

V_2= current value

3.3.2. Financial ratio analysis

Financial ratios are used to evaluate the business performance of the rice mills. These include liquidity, profitability ratio and solvency ratio. In this study, profitability ratio is the major ratio used for analysis.

3.3.1.1. Test of profitability

It is a method to find out the financial status of a firm and overall efficiency. This compare the returns over the amount of sunk into the business by a firm. This measures company's net income to the total assets base.

a) B: C ratio analysis = Ratio of the benefits of a project or proposal, expressed in monetary terms, relative to its costs.

BCR = Gross income / Total Costs

Rice mills with B: C ratio value greater than one is always selected. Higher B: C ratio indicates the greater profitability of rice mills.

b) Gross profit ratio

It is calculated by dividing gross profit by net sales revenue. This is a popular tool to measure the operational performance of the business. When gross profit ratio is expressed in percentage, it is known as gross profit margin or gross profit percentage.

$$\text{Gross profit ratio} = \frac{\text{Gross profit}}{\text{Net sales}}$$

c) Operating ratio

This ratio measures what it costs to operate a piece of property compared to the income that property brings in. This establishes a relationship total expense for selling a good and sales on the other hand. It is generally expressed as percentage.

$$\text{Operating ratio} = \frac{\text{Operating cost}}{\text{Net sales}}$$

d) Break even output analysis = Breakeven output is a production level that achieves zero economic profit. The total revenue received by a firm at the breakeven output just matches the total cost incurred. However, because total cost includes a normal profit, only economic profit is zero.

Fixed Costs ÷ (Price - Variable Costs) = Breakeven Point in Units. In other words, the breakeven point is equal to the total fixed costs divided by the difference between the unit price and variable costs.

3.3.3. Data envelopment analysis

Data envelopment analysis is a nonparametric method in operational research and economics for the estimation of productive efficiency of decision making units. Data envelopment analysis is used in multiple inputs and outputs cases which makes comparison difficult and where the relative performances of organizational units are to be measured. Based on the comparative efficiency, individualized regulatory rates

for each firm can be designed. Efficiency in DEA is defined as the weighted sum of outputs to a weighted sum of inputs where weights structure is calculated by means of mathematical programming and constant rate of returns.

The performance of rice millers was assessed using an output and three inputs using DEA model. The quantity of paddy processed in tonnes was taken as the output variable and electricity consumption in terms of electrical units (Rs.), man days and actual capacity of the mill (tonnes) were considered as the three inputs. The result of the analysis was depicted in following tables and figures. In order to identify and estimate the relative efficiencies of decision making units DEA as a multi-factor productivity analysis was used. Basically, efficiency was the ratio of weighted sum of outputs to weighted sum of inputs

$$\text{Efficiency} = \frac{\text{Weighted sum of outputs}}{\text{Weighted sum of inputs}}$$

Higher the ratio, the more efficient the unit was. In a group, the units getting value 1were called the efficient units while the others were termed as inefficient. Effectively, this efficient configuration becomes a focus for benchmarking activities.

3.3.4 Garrett's Ranking Technique

In this study, Garrett's ranking technique was used to analyze the constraints of rice processing units. The respondents were asked to rank (in the order of severity) the constraints in business performance of rice mills and these ranks were converted into scores by referring to Garrett's table.

The order of the merit given by the respondents was changed into ranks by using the formula.

$$\text{Percent position} = \frac{100\,(Rij - 0.50)}{Nj}$$

Where,

R_{ij} = Rank given for i th item by j^{th} individual

Nj = Number of items ranked by j^{th} individual

These percentages were converted into scores by referring to Garret's table given by Garrett and Woodworth (1969). 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 attribute with the highest mean value was considered as the most important one and the others followed in that order.

Results and discussion

4. RESULTS AND DISCUSSION

This chapter deals with the analysis of primary data collected from the rice millers in both the districts. Results obtained from the analysis are categorized into following sub headings.

1. Rice processing scenario
2. Socio economic profile of farmers
3. Capital investment pattern in rice mills
4. Preferences of the rice millers in processing industry
5. Efficiency analysis and factors affecting efficiency
6. Constraints in rice milling industry

4.1. Rice processing scenario

4.1.1. Rice processing scenario in India

Rice milling industry is considered as one of the oldest food processing industries in India occupying about 37% of the total cropped area with an annual turnover of 3.65 billion rupees per year. Rice milling industry in India process about 85 million tonnes of paddy every year contributing food grains about 65% of population. In 2016-17, under the Ministry of Agricultural co-operation and farmers welfare, an additional 86 rice processing mills for export of rice to USA and 30 for China has been started. 3.9-6.0 percent of cumulative wastage is reported in cereals. Process of modernization of rice mills was initiated in 1970 in order to obtain higher yield of rice and better quality of byproducts such as bran husk, suitable for edible oil/ industrial oil extraction and as source of fuel respectively.

4.1.2. Growth of modern rice mills in India

From the figure 4.1.it is clear that there is an increasing trend in the growth of number of mills from 1992 to 2005. There are about 36000 modern rice mills in

India, which accounts for 25% of the total number of rice mills. Capacity utilization of rice mill industry in India is very low as in the case of wheat. This is mainly due to the compulsory levy on rice mills imposed in most of the states, which results in low profitability consequently limited ability to invest in up gradation. Modern rice mills have a capacity of 2-4 tonnes per hour with yield recovery of 70 % and grain breakage of 10% and mini rice mills have capacities ranging from 150-550 Kg per hour. The slow rate of modernization of hullers is attributed to the compulsory levy on rice mills imposed in most states which results in low profitability and consequently limited ability and consequently limited ability to invest in up gradation.

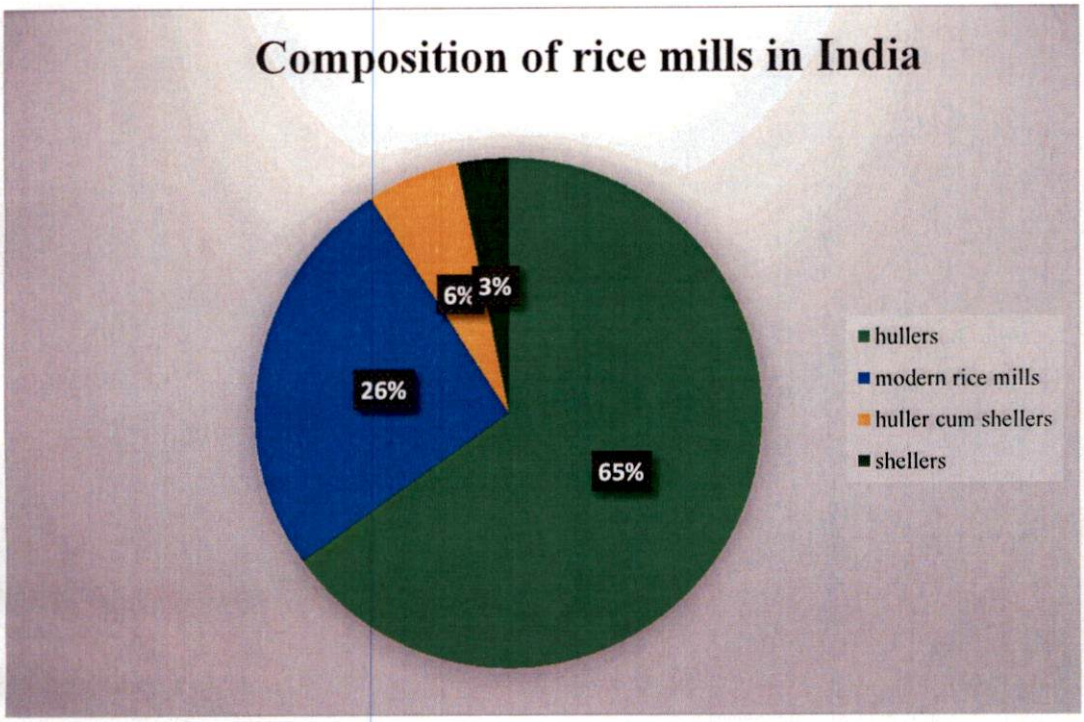


Fig:4.1. Composition of rice mills in India

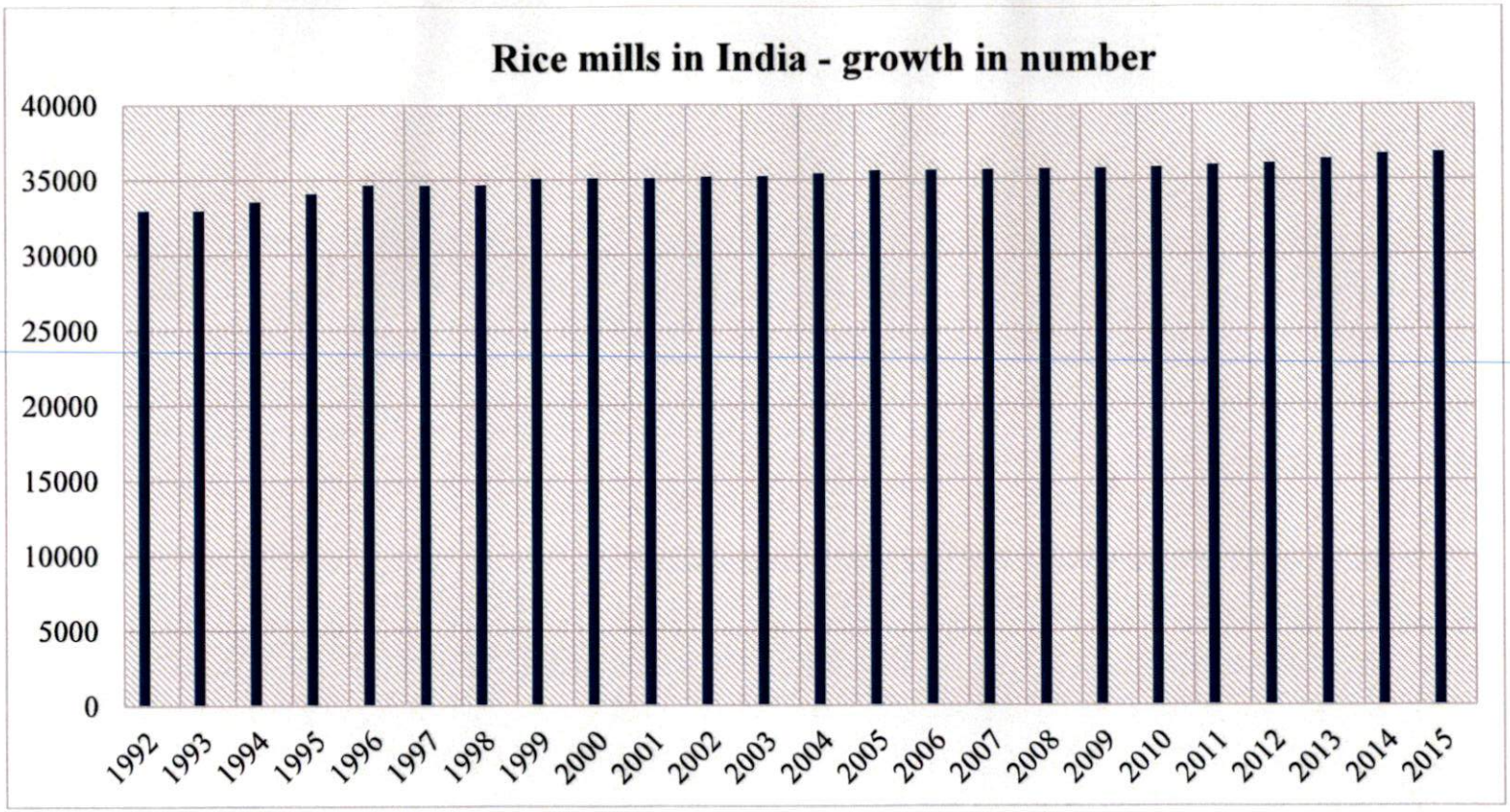


Fig:4.2. Number of rice mills in India from 1992 to 2015

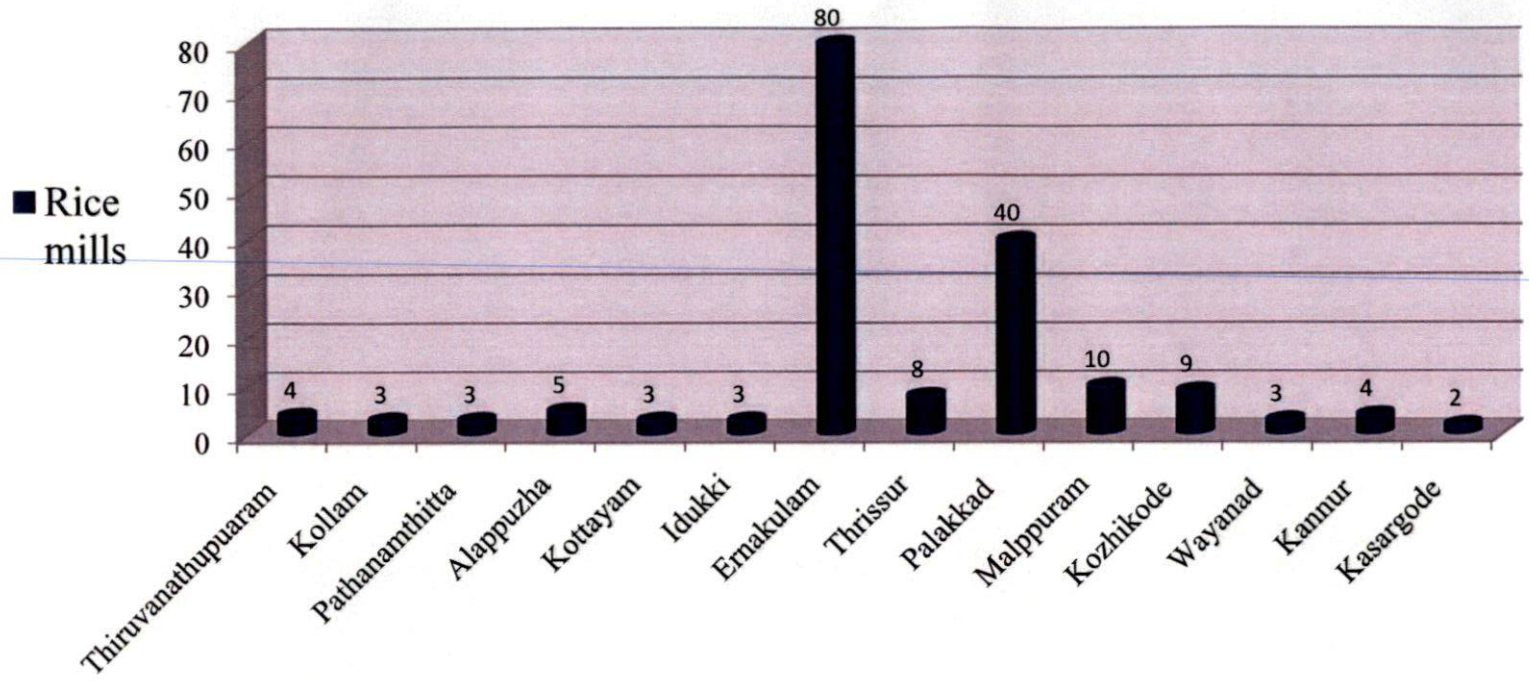


Fig:4.3. Number of rice mills in Kerala

4.2. Socio economic characteristics of rice millers

4.2.1. Age of the respondents

One of the important factors that determine the milling pattern was the age of the rice millers. Distribution of rice processors according to their age was presented in Table 4.1. In the current study, the age of respondents has been classified into 4 categories as less than 40, 40-50, 50-60 and greater than 60 years. The Table 4.1 shows that maximum respondents belong to the age group of 50-60 in Palakkad district and 40-50 years in Ernakulam district. No millers in Ernakulam district were less than 40 years of age.

Table 4.1. Age wise distribution of rice millers

Age	Palakkad	Ernakulam
<40	2 (10)	0 (0)
40-50	6 (30)	9 (45)
50-60	10 (50)	8 (40)
>60	2 (10)	3 (15)
Total	20 (100)	20 (100)

Note: Figures in parentheses represent the per cent to the total

The Study showed that participation and involvement of elderly group in rice milling was much higher than other age groups in both the districts.

4.2.2 Educational status

Farmers and millers were aware about an improved technology which further enabled the adoption of a technology by them (Foltz, 2003). Educational status of the sample respondents was shown in Table 4.2. It was evident that literacy level among rice millers was high in Ernakulm district. The result pointed out that all rice millers were educated and none were illiterate in both the districts. Most of the rice millers have completed SSLC in both the districts. Millers in both districts were educated and

20 per cent and 15 percent of millers Ernakulam and Palakkad districts were graduates respectively.

Table 4.2.Educational status of sample respondents

Education level	Ernakulam	Palakkad
Illiterate	0 (0)	0 (0)
Up to 9th standard	2 (10)	3 (15)
SSLC	10 (50)	9 (45)
Plus two	4 (20)	5 (25)
Graduate level	4 (20)	3 (15)
Total	20(100)	20 (100)

Note: Figures in parentheses represent the per cent to the total

4.2.3 Experience in rice milling

Experience in rice millers in years for both districts was studied. Based on the experience in rice milling, the rice millers were categorized into 3 different categories. Millers from both districts were categorized into groups such as less than 10 years, 10-25 years and more than 25 years of experience (Table 4.3). The results showed that in both districts, most of the millers have been practicing rice milling for a period of 10-25 years. There were only very few millers who had an experience of less than 10 years in both districts. In Palakkad, there were more established conventional rice mills compared to Ernakulam.

Table 4.3. Experience of sample respondents in rice milling

Experience (years)	Palakkad	Ernakulam
<10	1 (5)	2 (10)
10-25	10 (50)	12 (60)
>25	9 (45)	6 (30)
Total	20 (100)	20 (100)

Note: Figures in parentheses represent the per cent to the total

4.3.4 Land holdings

Table 4.4 shows the details of the size of land holdings held by the sample respondents. In both districts, there were no respondent with the land holding of less than 1 ha. Majority of the respondents had a land holding with a size more than two ha. This clearly proves that stability and economic condition of rice millers in central Kerala was far better than the farmers in the same area. The average land holding size at the aggregate level was found to be 2.3 ha for millers in Palakkad and 2.1 ha in Ernakulam.

Table 4.4. Distribution of sample respondents according to the size of holdings

Land ownership (ha)	Palakkad	Ernakulam
< 1	0 (0)	0 (0)
1-2	8 (40)	9 (45)
>2	12(60)	11 (55)
Total	20 (100)	20 (100)

Note: Figures in parentheses represent the per cent to the total

4.3.5 Gender

Table 4.5 depicts the gender wise classification of the workers in the mills. It was clearly evident that in both the districts the number of male employees was much higher than the female employees. It was found that more than 90 percent of workers in a rice mill were males. In either of the districts there were no female workers who were involved in the loading or unloading section. All the female staff members work in the office and take care of the financial accounting. Participation of female employees in rice milling activities was found to be little higher in Ernakulam than Palakkad. In some of the small rice mill units, there were some female employees who took part in manual drying of paddy.

Table 4.5. Gender wise distribution of workers in sample rice mill (%)

	Gender		
	Male	Female	Total
Palakkad	98	2	20
Ernakulam	94	6	20

4.3.6. Family size

The size of the family was a major factor influencing family labour availability. In most of the rice mills, family members of 3-6 take part in milling activities. Table 4.6 shows the classification of sample respondents according to the size of the family. From the table, it was clear that size of the family of majority of the respondents were between 3 and 6 members. This resulted in the better availability and utilization of family labour as a substitute for hired labour. There were very few respondents whose family size was either less than 2 or more than 6. Higher the number of family members, lesser the value of marketable surplus

Table 4.6. Distribution of sample respondent's family size.

Districts	Family size (Number of members)			Total
	1-3	3-6	6 and above	
Palakkad	3 (15)	13 (75)	4 (20)	20 (100)
Ernakulam	5 (25)	9 (45)	6 (30)	20 (100)

Note: Figures in parentheses represent the per cent to the total

4.3.7 Working Hours

The length of the working day in all the rice mills was eight hours. The number of hours worked over and above 8 hours was considered as overtime and paid accordingly. In the exceptional case of a rice mill operating for 24 hours, there was shift in jobs. Usually such shifts in duty was found to vary according to the nature of

operation involved and arrangements were made in consultation with the labour union. Due to the labour shortage in some of the mills labourers working in shifts were very common.

4.3.8 Wage structure

Workers in a rice mill can be categorized into two groups, white collar and blue collar. The white collar workers were those who were paid on a monthly basis. These include the office staff as well as those operating machines. The machine operator, manager and accounts keeper, cook, security guard etc.were considered to come under the category of white collar job as they received their salary on a monthly basis.

The salaries of the manager and accountant vary from 18,000 to 25,000 per month. Workers belonging to loading and unloading section receives wage on a daily basis which varies from Rs. 450 to Rs. 600 depending on the size of mill. Large mills provided wage with an average rate of Rs. 600 per day and were higher than the wages paid by small and medium mills as an average rate of Rs. 450 per day.

Wage rate of male workers was comparatively higher than the female workers which could be may be mainly due to the comparatively higher physical efficiency of male workers. There was no opportunity or infrastructure to train women and unskilled workers in every mill.

4.3.9. Nature of ownership of the land holding of modern rice mill unit

The data collected based on the ownership of the rice mills compound showed that out of 40 sample respondents from both the districts, only one was rented (Table 4.7). The rented rice mill had a small capacity and was situated in Palakkad district.

Table 4.7. Form of business ownership of the rice mill unit

Nature of ownership	Palakkad		Ernakulam	
	Number	Percentage	Number	Percentage
Own premises	19	95	20	100
Rented	1	5	0	0

Table 4.7 showed that 95 per cent of the mills in Palakkad were owned by the millers and all mills in Ernakulam, were owned by the same. This situation is slightly different from other mills in the country where the rent of buildings and premises was a major component of the cost of processing. This further proved that the rice millers in Kerala had a strong financial background.

4.5 Classification of mills according to their forms of business ownership

Table 4.8. Distribution of sample rice mills according to their ownership

	Sole proprietorship	Partnership	Total
Palakkad	9(45)	11(55)	20(100)
Ernakulam	6(30)	14(70)	20(100)

Note: Figures in parentheses represent per cent to the total

Business ownership of respondents in Ernakulam and Palakkad district can be categorized into sole proprietorship and partnership. About 45 percent and 30 percent of rice mills were owned and run by one person in Palakkad and Ernakulam districts

respectively. Among the 40 sample respondents there were no mills under corporate ownership. The most common type of ownership of sample rice mills were partnership contributing around 55 per cent in Palakkad and 70 per cent in Ernakulam district. Participation of family members was the backbone of the business in rice mills. Most of this rice mills have been working for more than 20 years. The profit was shared among the members according to the contribution in their investment on rice mill.

Three mills which were not involved in local trading were those mills which procured paddy only from supply co (Kerala State Civil Supplies Corporation Limited) and which provided rice to the consumers through Public Distribution System (PDS). The rice mills had a direct tie up with the supplyco and retailers were not found to play any role in this chain.

4.3 Preferences of the stakeholders to the milling industry

4.3.1 Processing activities in a rice mill

From the conversion of paddy to rice, many processing activities are focused in a rice mills there involves a lot of activities in a rice mill. Some of the major activities are milling, polishing, and supply to the exporters, local trading through retailers, and byproduct trading. Rice husk and bran were the two major by-products of rice milling activity. Table 4.9 showed that every mill did milling and by-product trading. Two small mills in Palakkad were not involved in the activity of polishing. Only three mills were involved in exporting as there were so many constraints for rest of the mills to enter into the export business. All the processing activities which were shown in table 4.9 were important in terms of trade.

Table 4.9. Processing activities of rice mills in Palakkad and Ernakulam

	Milling	Polishing	Supply to the exporters	Local trading	By product trading
Palakkad	20	18	1	19	20
Ernakulam	20	20	2	18	20
Total	40	38	3	37	40

Note: Figures in parentheses represent the per cent to the total

Three mills which were not involved in local trading were those mills which procured paddy only from supply co (Kerala State Civil Supplies Corporation Limited) and which provided rice to the consumers through Public Distribution System (PDS). The rice mills had a direct tie up with the supplyco and retailers were not found to play any role in this chain.

4.3.2 Varietal preference of paddy by rice millers

Rice millers in Palakkad and Ernakulam district have different preferences in the selection of paddy varieties. This was mainly dependent on the procurement cost, consumer preference for the variety in that area, and quality of paddy varieties fixed by the rice millers. The quality of paddy varieties was assessed by shape, colour and odour. In some rice mills the millers even purchased the paddy only after by checking its cooking qualities. Rice millers purchase different varieties of paddy from different states like Karnataka, Tamil Nadu and Andhra Pradesh. The millers who purchased from the farmers of Palakkad and Alappuzha region of Kerala mainly preferred varieties like Jyothi, Ponni and Uma varieties. Uma and TK 9 were the two major rice varieties purchased from Karnataka and Tamil Nadu respectively. Table 4.10 showed the percentage of varietal preference of the major varieties in the two districts.

Table 4.10: Varietal preference of paddy in Ernakulam and Palakkad rice mills

Districts	Varieties				Total
	Uma	Jaya	Jyothi	TK9	
Palakkad	12	2	3	3	20
Ernakulam	11	1	3	4	20

Table 4.11. Distribution and frequency of purchase of paddy by the millers

4.3.3 Frequency of purchase of paddy by the rice millers

From the table 4.11, it was clear that millers purchased the paddy from the farmers on a seasonal basis rather than monthly or irregular basis. Due to the seasonality of paddy, 35 percent and 40 percent millers purchase paddy from farmers of Ernakulam and Palakkad districts respectively on a seasonal basis. About 20 percent of millers from Ernakulam and 15 percent of millers from Palakkad purchase on an irregular basis.

	Weekly	Monthly	Seasonally	Irregularly	Total
Ernakulam	2(10)	6(30)	7(35)	5(20)	20
Palakkad	3(15)	6(30)	8(40)	3(15)	20

Note: Figures in parentheses represent the per cent to the total

This may be mainly due to the cost constraints, labour shortage and also frictional relationship between and millers and farmers. Millers procure paddy on a monthly or weekly basis from domestic farmers as there were only few farmers of the state from whom millers purchased paddy.

4.3.4 Categories of rice buyers from millers

Rice millers had a mutual understanding with four categories of buyers' *viz.*, traders or direct market operations, directly to the consumers, public agencies and restaurants in (Table 4.12).

Table 4.12. Categories of rice buyers from millers

Districts	Trader	Consumer	Public agencies	Restaurant
Palakkad	16	7	4	1
Ernakulam	17	8	3	2
Total	33	15	7	3

Out of the 40 mills in both districts, 33 mills had a direct contact with nearby markets and sold the main product (rice). Only a few mills sold rice directly to the consumers. Theses consumers resided in the nearby area of the rice mill and had good relation with the owners of the rice mill. There were also some public agencies which procured rice from the millers. Public Distribution System was the major channel which fell under this category. Rice millers had procured paddy from Supplyco, processed it and through Public Distribution System (PDS) rice reached the consumers. These types of procurement were mainly based on contract basis and had a direct deal with the agency. Frequency of purchase of paddy was mainly on a monthly basis. A few millers had tie up with large restaurants in the area. They purchased rice from millers on a weekly basis.

4.3.5. Preferences of traders and farmers in processing industry

Results obtained from the analysis of preferences of traders and farmers in processing industry showed that opinion of traders and millers were almost same. In

Kalady area, the millers often acted as a cartel and there was misunderstanding between these two. Price and varietal preferences were same and Uma was the most demanded variety. But in the case of farmers in Palakkad, they were not satisfied for preferring the same variety from other states. This was mainly due to the high price offered by domestic farmers compared to the other state farmers. Farmers were of the opinion that there should be Government control for milling industry. But this proposal was completely rejected by the private millers.

4.5 Efficiency analysis of rice mills

In general, "efficiency implies performing or functioning in the best possible manner with the least waste of time and effort. It was also defined as maximizing a desired outcome with given resources" (Yao *et al.*, 2010). In absolute terms, the efficiency of a producer generally involves "a comparison of observed output to maximum potential output obtainable from the input, or comparing observed input to minimum potential input required to produce the output, or some combination of the two" (Fried et al., 2008). Analysis of rice mills was done using 3 statistical tools such as Per cent analysis, financial ratios and Data Envelopment Analysis (DEA).

4.5.1 Per cent analysis

4.5.1.1. Capacity utilization of rice mills

Capacity utilization of rice mills was calculated using Per cent analysis. Capacity utilization is the ratio of actual capacity to the potential capacity to produce. From the Table 4.13, it is clear that capacity utilization of medium and large mills in Palakkad district was higher than in Ernakulam district. As there were no small capacity mills in Ernakulam from the sample respondents, their percent of utilization cannot be assessed.

Table 4.13. Capacity utilization of rice mills in Palakkad and Ernakulm districts

District	Capacity utilization (%)		
	Small	Medium	Large
Palakkad	73	79	86
Ernakulam	0	76	85

Within the districts, it was evident that capacity utilization of large mills were more than that of small and medium sized mill. This was mainly due to high technological intervention, usage of advanced machinery and also efficiency in the labour management.

4.5.1.2. Cost and returns from rice mills of different capacities

From the Table 4.14 it was evident that total fixed cost and total variable cost of processing increased with increase in the capacity of rice mills. Total fixed cost in a medium capacity rice mill was almost eight times greater than small capacity mill and large capacity rice mill was twice than that of medium capacity rice mill. In the case of total variable cost, medium capacity had ten times greater spending than small mills and large capacity mills was almost twice greater than that of medium capacity rice mill. Total cost and gross return from these mills were directly related to their capacity ie., greater the capacity of a rice mill, greater will be its gross returns.

Table 4.14. Cost and returns from rice mills of different capacities (Rs. Lakh)

Components	Small	Medium	Large
Total fixed cost	25	208.13	436
Total variable cost	94.22	908.21	2141.15
Total cost	119.22	1116.20	2577.15
Gross return	147	1400	3500

It was also evident from the table that total fixed cost was always greater than total variable cost. Fig: 4.4 showed the share of fixed and variable cost in total cost of different capacities of rice mill. Around 83 per cent of total cost is variable cost for large capacity rice mills and highest contribution to the fixed cost is from small capacity rice mills (21%).

4.5.1.3. Break even output analysis

Break-even output (units) = Fixed costs (Rs.) / Contribution per unit (Rs.)

Table 4.15. Break even output of different capacities of rice mill

Sl. no	Capacity	Break even output(per unit)
1	Small	6
2	Medium	12
3	Large	72

Table 4.15 showed the break even output (units) of small, medium, and large capacities of rice mill. From the table it was clear that break even outputs of each

capacities of rice mills were less than the actual output processed per unit. This proved the economic feasibility of rice mills functioning

4.5.1.4. Capital investment pattern of rice mills over 25 years

Capital investment pattern of rice mills in Palakkad and Ernakulam districts over 25 years were calculated and analysed. The results showed that from 1980 to 2017 investment on rice mills had increased from ₹30 lakh to ₹300 lakh. Capital-labour ratio of 40 rice mills were also calculated and showed an inverse relation between the ratio and capacity of rice mills (Fig: 4.4). Ratio is also inversely proportional to the establishment year *ie*., more the age of rice mills, lower was the capital-labour ratio obtained.

The analysis indicated that there was a direct relationship between the total capital investment and size/capacity of the processing units. The total capital investment was higher in larger units than in the smaller or medium capacity units. The requirement of capital investment increased with the increase in size of the units because of the increased requirement of building, machinery and equipment, infrastructure and other fixtures and also increased requirement of working capital.

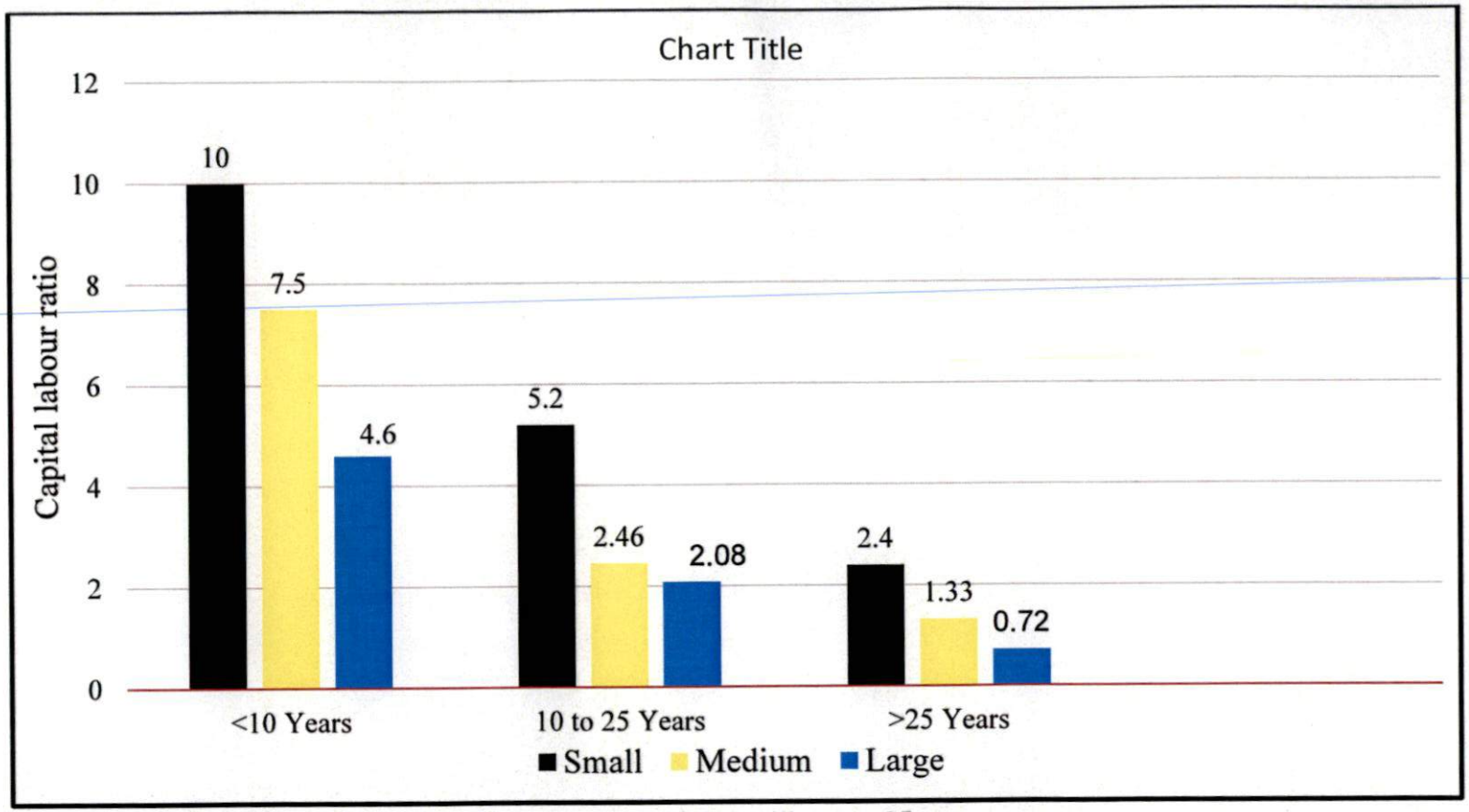


Fig:4.4. Capital- labour ratio of different capacities of rice mills over 25 years

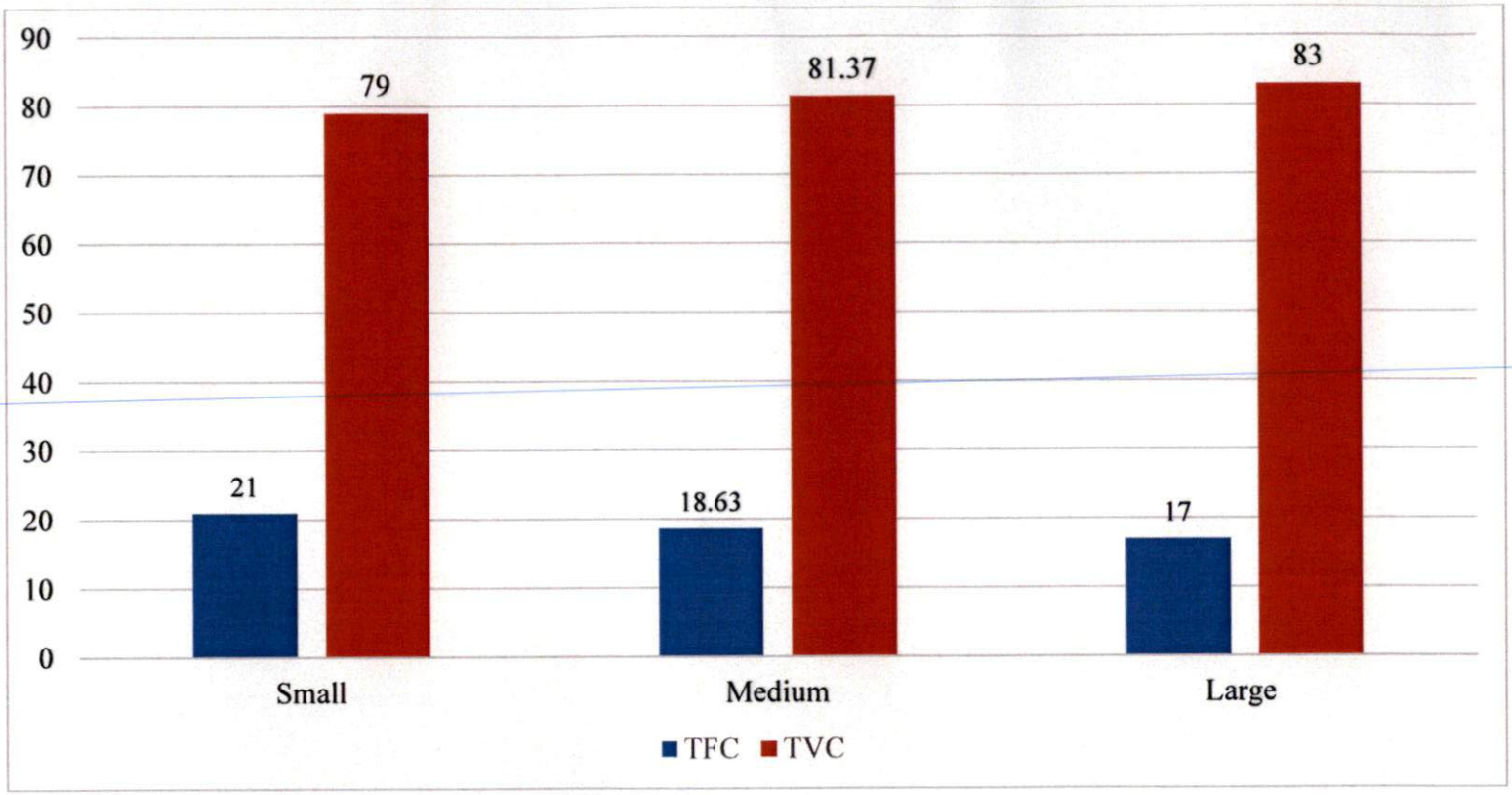


Fig :4.5. Share of fixed and variable cost in different capacities of rice mill

4.5.2 Financial ratios

4.5.2.1 Benefit cost ratio of rice mills in Palakkad and Ernakulam districts

Benefit cost ratios of rice mills in Palakkad and Ernakulam are shown in Table 4.16. It is evident from the table that net returns from the processing increases with capacity and size of the mill. Here, the ratio of gross returns to the total cost of processing was calculated. Higher value of B: C ratio of large mills (1.35) denoted that they had better investment.

Table 4.16. B: C ratio of rice mills in Palakkad and Ernakulam district

Sl.no	Category	B:C ratio
1	Small	1.23
2	Medium	1.25
3	Large	1.35

4.5.2.2 Operating expense ratio

The operating expense ratio (OER) was equal to a mill's operating expenses divided by its revenues. Table 4.17 showed the operating expense ratio in per cent values. The OER measures what it costs to conduct processing activity in a rice mill compared to the income that the same brings in. Normally operating expense ratio ranges between 60 to 80 per cent, and the lower it was, the better. Operating expense ratio was least for large sized rice mills which showed a better investment.

Compared to the operating expense ratio of medium and small sized mills, the value was least for small sized mills indicating a better condition of small mills than medium capacity mills.

Table 4.17. Operating cost percentage of small, medium and large capacity rice mills

Sl.No	Category	Operating cost percentage
1	Small	64.09
2	Medium	64.87
3	Large	61.17

4.5.2.3. Gross margin of rice mills

Gross margin is a company's total sales revenue minus its cost of goods sold (COGS), divided by total sales revenue, expressed as a percentage. The gross margin represents the per cent of total sales revenue that the company retains after incurring the direct costs associated with producing the goods and services it sells. The higher the percentage, the more the company retains on each rupees of sales, to service its other cost and debt obligation. Figure 4.6 showed the gross margin of rice mills in Kerala. It was evident from the figure that with the increase in the size of the mill, gross margin also increases. Large, medium, and small capacity rice mills had a gross margin per cent of 26.46, 20.21, and 26.36 respectively.

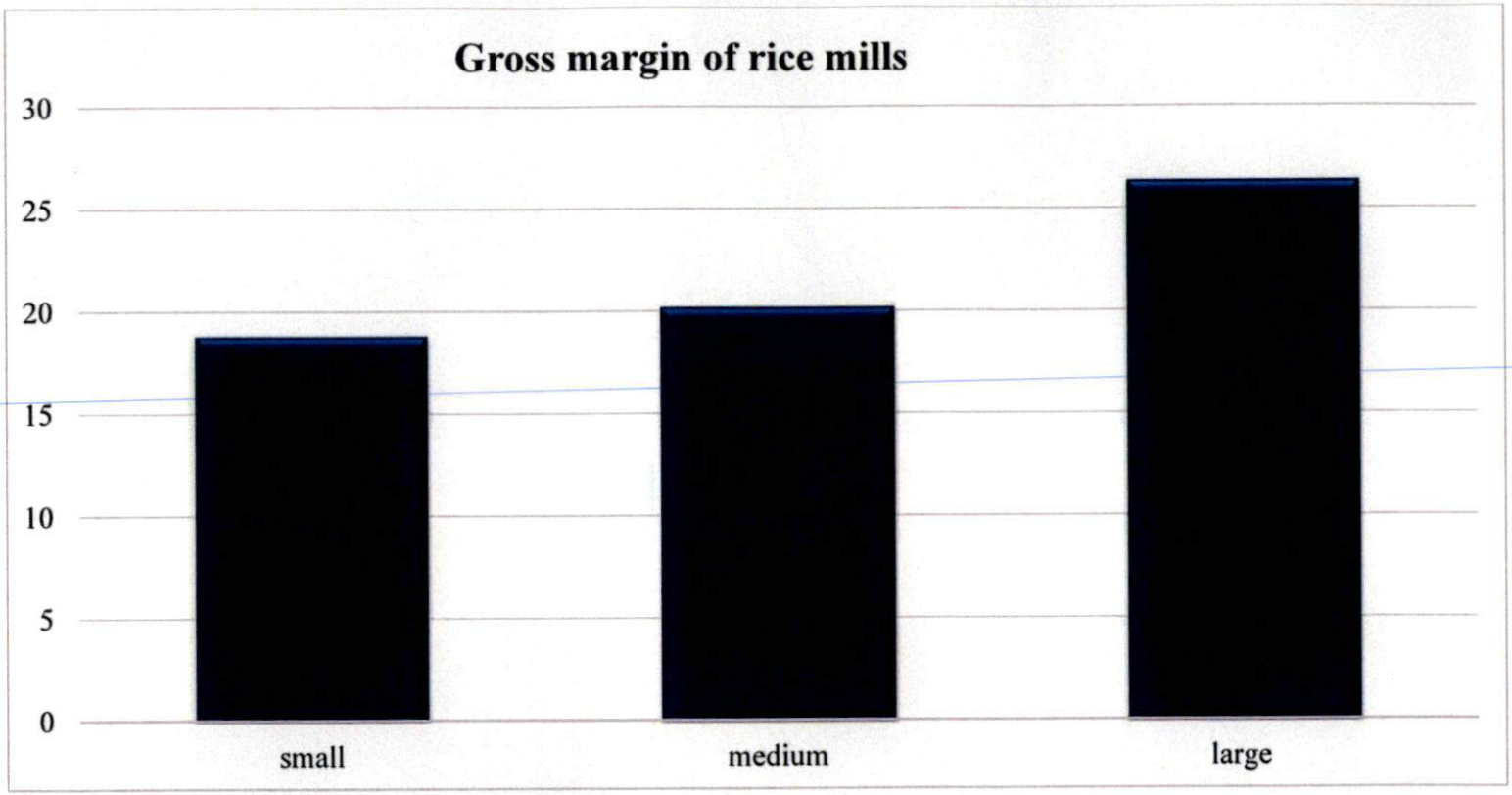


Fig:4.6. Gross margin of rice mills with different capacities

4.5.3 Data Envelopment Analysis

It is a non-parametric technique used in the estimation of production functions and has been used extensively to estimate measures of technical efficiency in a range of industries (Cooper, Seiford and Tone, 2000). Input oriented analysis was done to calculate the efficiency of rice mills in Palakkad and Ernakulam districts. With input-oriented DEA, the linear programming model is configured so as to determine how much the input use of a rice mill could contract if used efficiently in order to achieve the same output level. The quantity of paddy processed in tonnes was taken as the output variable and electricity consumption in terms of electrical units (number), man days and actual capacity of the mill (tonnes) were considered as the three inputs. The result of the analysis has been depicted in following tables and figures. In order to identify and estimate the relative efficiencies of decision making units DEA as a multi-factor productivity analysis was used. Basically, efficiency was the ratio of weighted sum of outputs to the weighted sum of inputs

$$\text{Efficiency} = \frac{\text{Weighted sum of outputs}}{\text{Weighted sum of inputs}}$$

The higher the ratio, the more efficient the unit was. In a group, the units getting value one were called the efficient units while the others were termed as inefficient. Effectively, this efficient configuration becomes a focus for benchmarking activities.

4.5.3.1 Technical efficiency

A rice mill was said to be technically efficient when it is possible for a firm, with the given know how, to produce a larger output from the same inputs, or the same output with less of one or more inputs without increasing the amount of other inputs. (Koopmans, 1951). From Fig: 4.7 it was clear that all mills in Palakkad had technical efficiency more than 0.800. Five out of 20 rice mills have a technical efficiency value of 1 which means that they have attained technical efficiency and

these firms need not to minimize its input usage. Mean technical efficiency value of 20 rice mills in Palakkad was 0.951 and there were 14 mills which had their technical efficiency value more than the mean value. Due to variation in both input and output for given price values, the inefficient mills will have to minimize their values for higher outputs at minimal inputs (Coelli, 2008). . Firm number 13 was having the minimum technical efficiency of 0.814 which implies that the rice mill conducts all its activity with only 81.40 per cent of the resources and can reach its full efficiency level by still utilizing 18.60 per cent of the resources. Technical efficiency of rice mills in Ernakulam district was shown in Fig: 4.8. It was evident from the figure that 12 out of 20 rice mills in Ernakulam had attained efficiency and these 12 mills need not to minimize their input usage further. Mean efficiency of rice mills in Ernakulam was 0.969 an there were 14 mills which had their efficiency level more than the mean value. The least technical efficiency among the 20 rice mills from Ernakulam was shown by the second firm with a value of 0.818 which means in order to achieve a full efficiency level, mill should utilize 18.20 per cent of the resources or 18.20 per cent of resources were left unutilized in the case of second firm .Comparing the technical efficiency value of Palakkad Ernakulam was having a mean higher technical efficiency value.

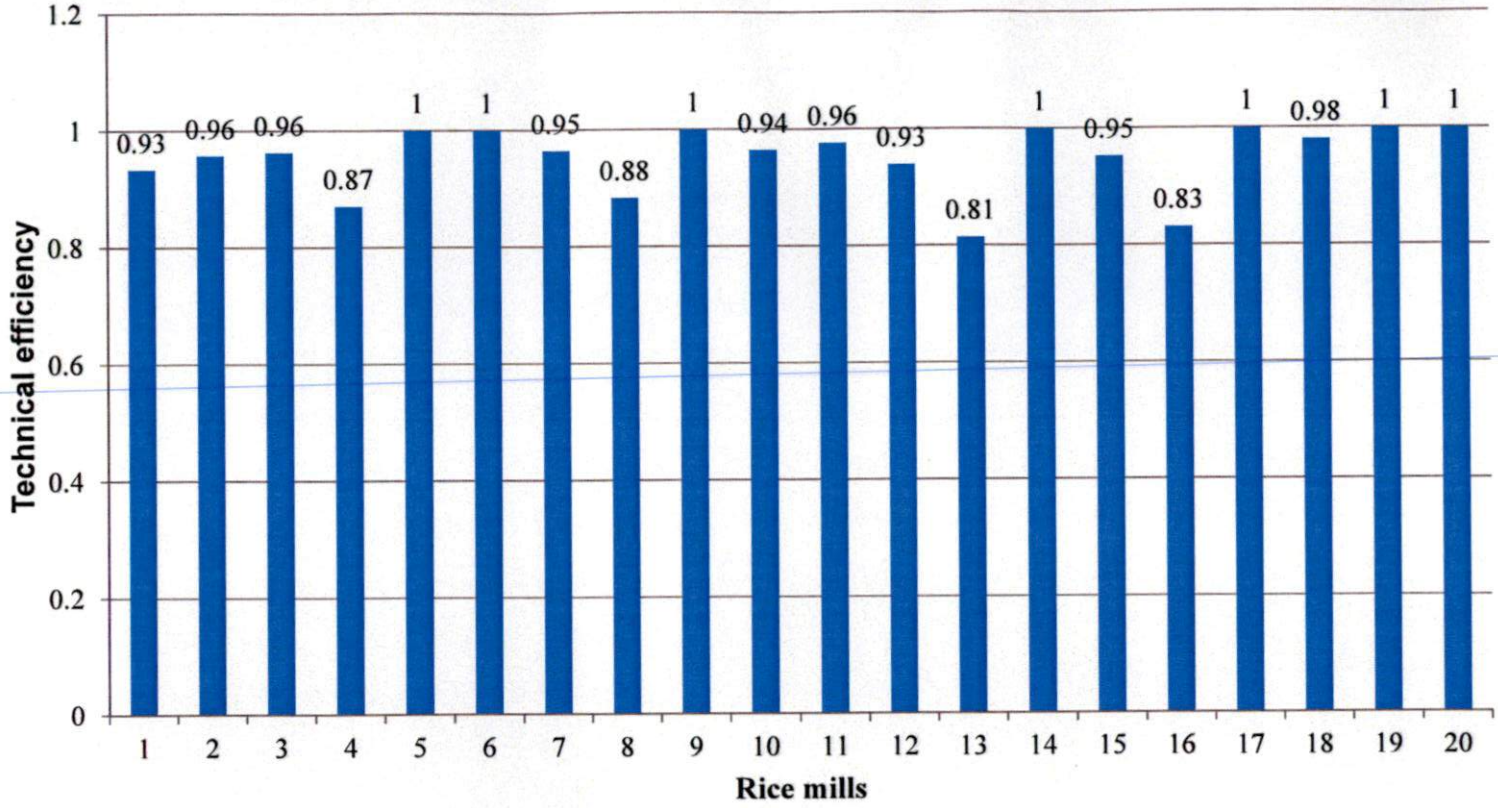


Fig: 4.7. Technical efficiency of rice mills in Palakkad

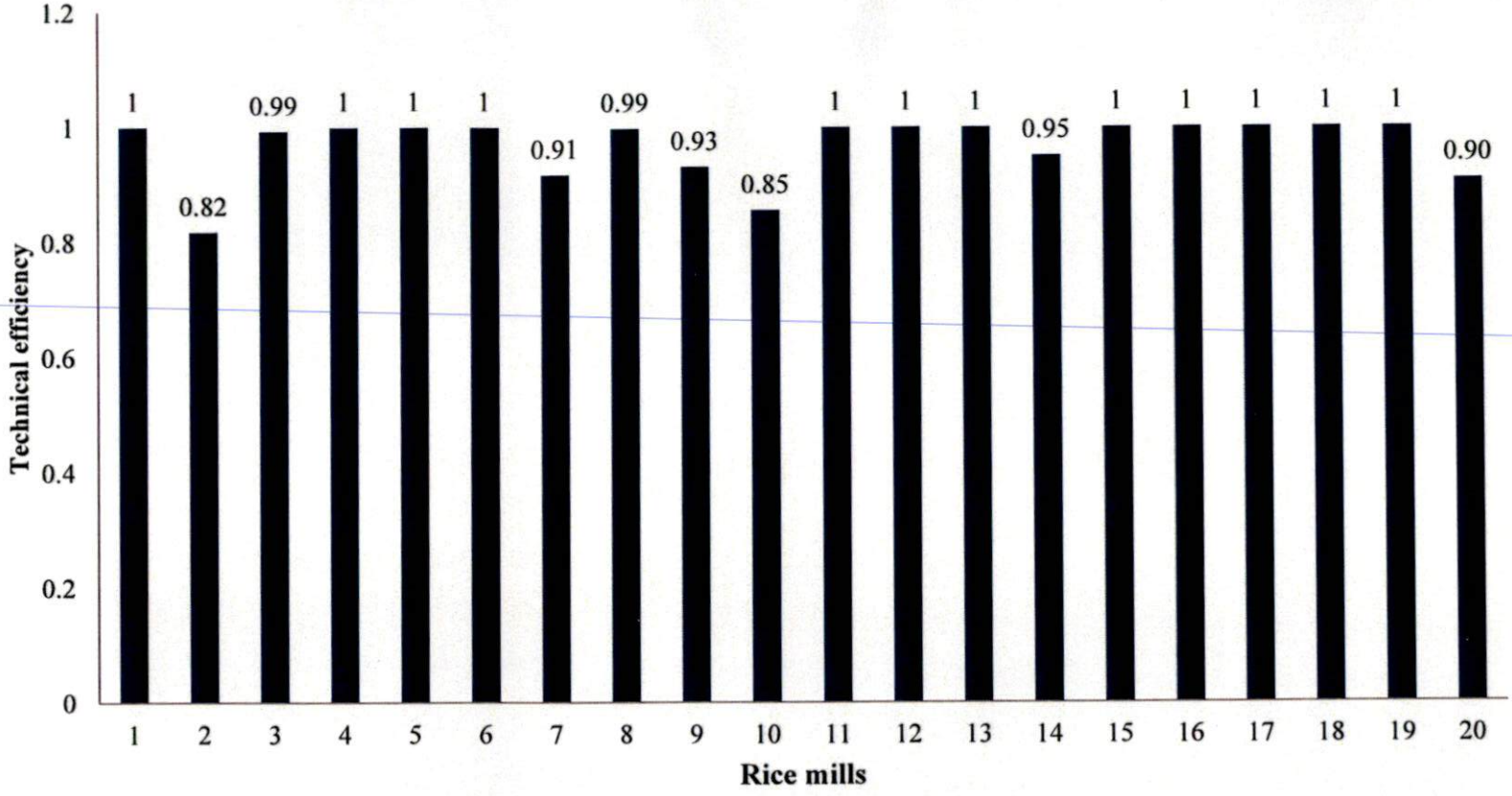


Fig: 4.8. Technical efficiency of rice mills in Ernakualm

Efficiency of Palakkad and Ernakulam rice mills in the usage of electrical units were given in Fig: 4.9. The figure clearly depicted the efficiency with which each rice mills had been using electrical units *ie.*, 100 per cent efficiency showed that the firm used all its available electrical units in an efficient manner. Rice mill with efficiency of 90 per cent showed that still 10 per cent of the available input is left unused. Distribution of rice mills according to the efficiency of electrical unit usage in Palakkad and Ernakulam was shown in Fig: 4.10. Rice mills were categorised into mainly four groups according to the efficiency with which they used *viz.*, 70-79 per cent, 80-89 per cent, 90-99 per cent and 100 per cent. Figure clearly showed that there were no rice mills in Ernakulam that used the electrical units below 80 per cent. Four rice mills each in Palakkad and Ernakulam had a per cent efficiency of 80-89. Seven mills from both the districts had used electrical units with an efficiency ranging from 90-99 per cent. Out of 40 mills, 12 mills in Ernakulam and 11 rice mills in Palakkad were completely efficient in electrical unit usage.

Efficiency of Palakkad and Ernakulam rice mills in actual capacity units (lakh tonnes) were given in Fig: 4.11. From the figure it was clearly evident that the efficiency with which each rice mills had been utilizing their capacity was different. Distribution of rice mills according to efficiency of actual capacity usage in Palakkad and Ernakulam (%) was shown in Fig: 4.12. Two rice mills from Palakkad and three rice mills from Ernakulam had an efficiency of 70-80 per cent. Five out of 40 mills used capacity with an efficiency range of 80-90 per cent. Compared to Ernakulam, Palakkad had more number of rice mills which fell under 90-99 per cent. Thirteen rice mills in Ernakulam and nine mills in Palakkad had completely attained efficiency level of 100 per cent.

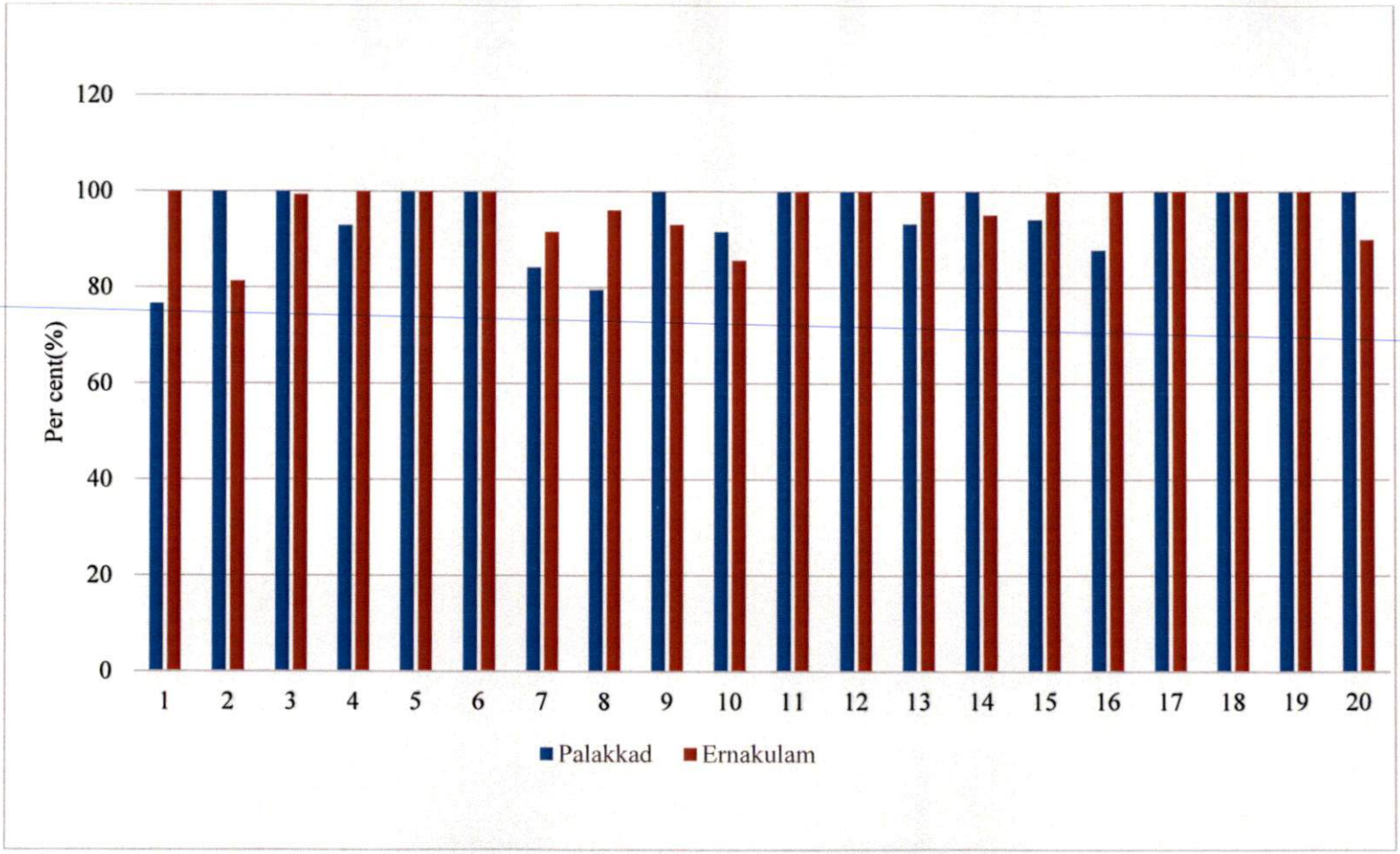


Fig: 4.9. Efficiency in the usage of electrical units in Palakkad and Ernakulam districts

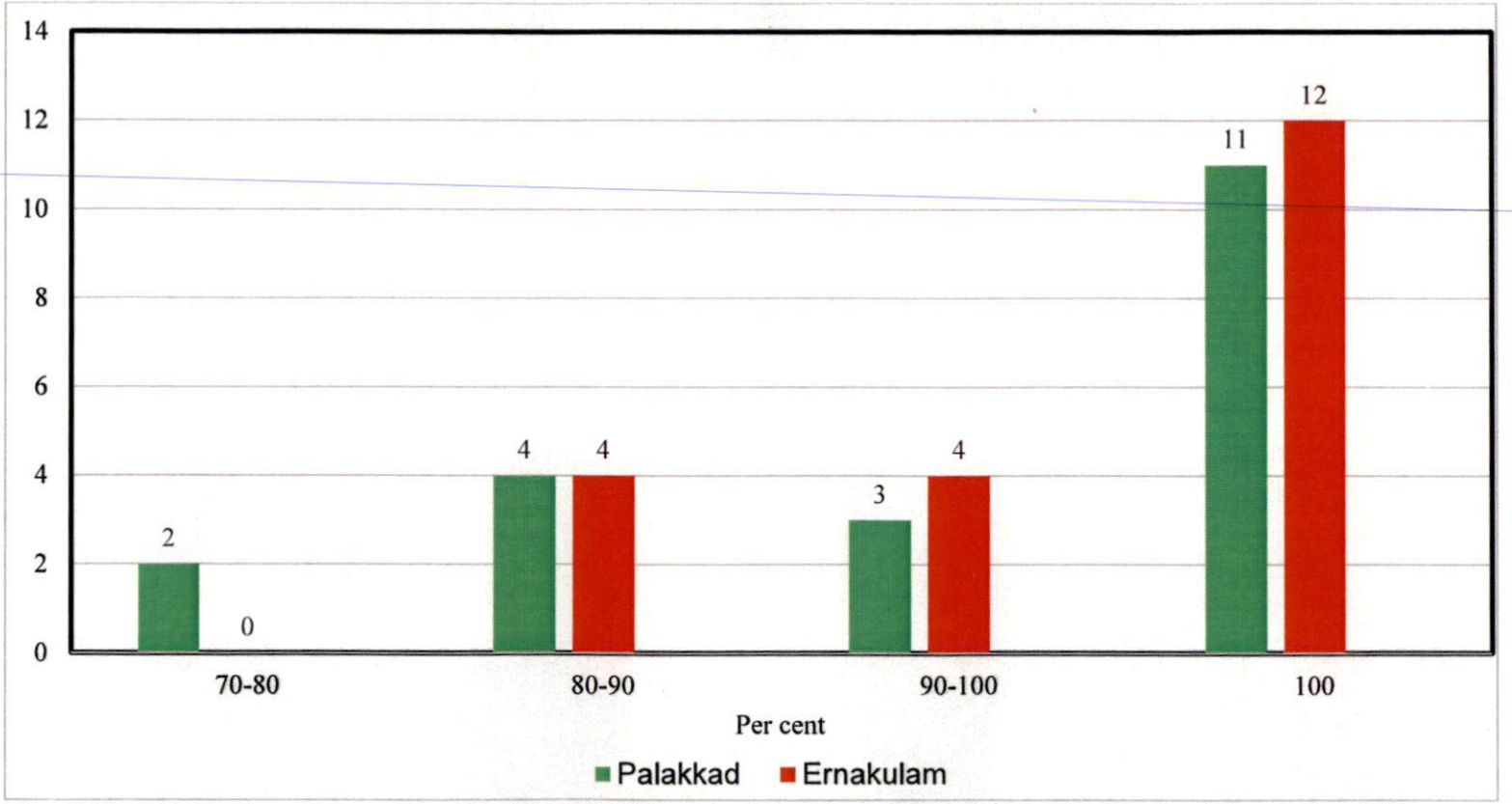


Fig : 4.10. Distribution of rice mills according to efficiency of electrical units usage in Palakkad and Ernakulam (%)

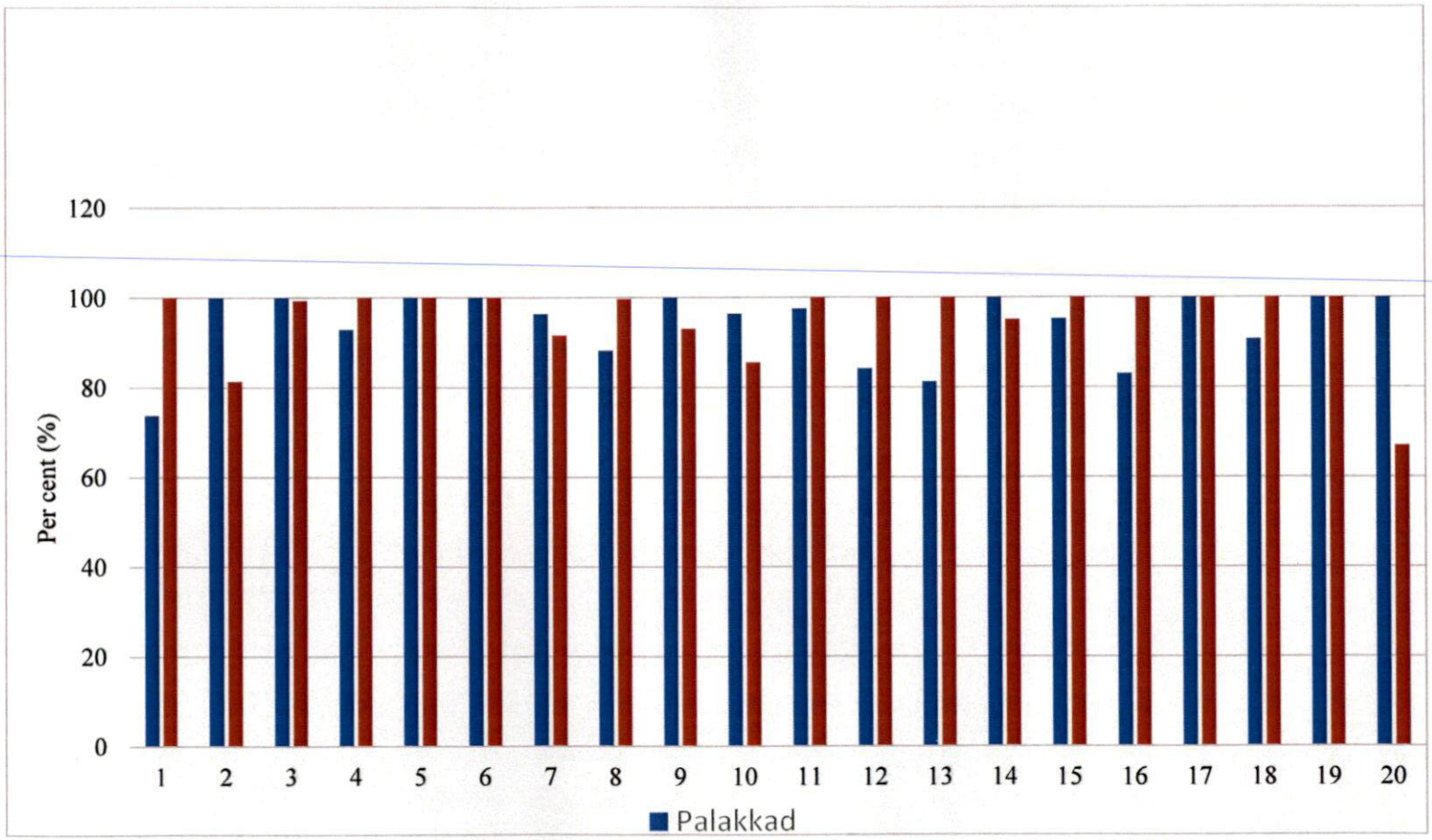


Fig: 4.11. Efficiency in the actual capacity in Palakkad and Ernakulam districts

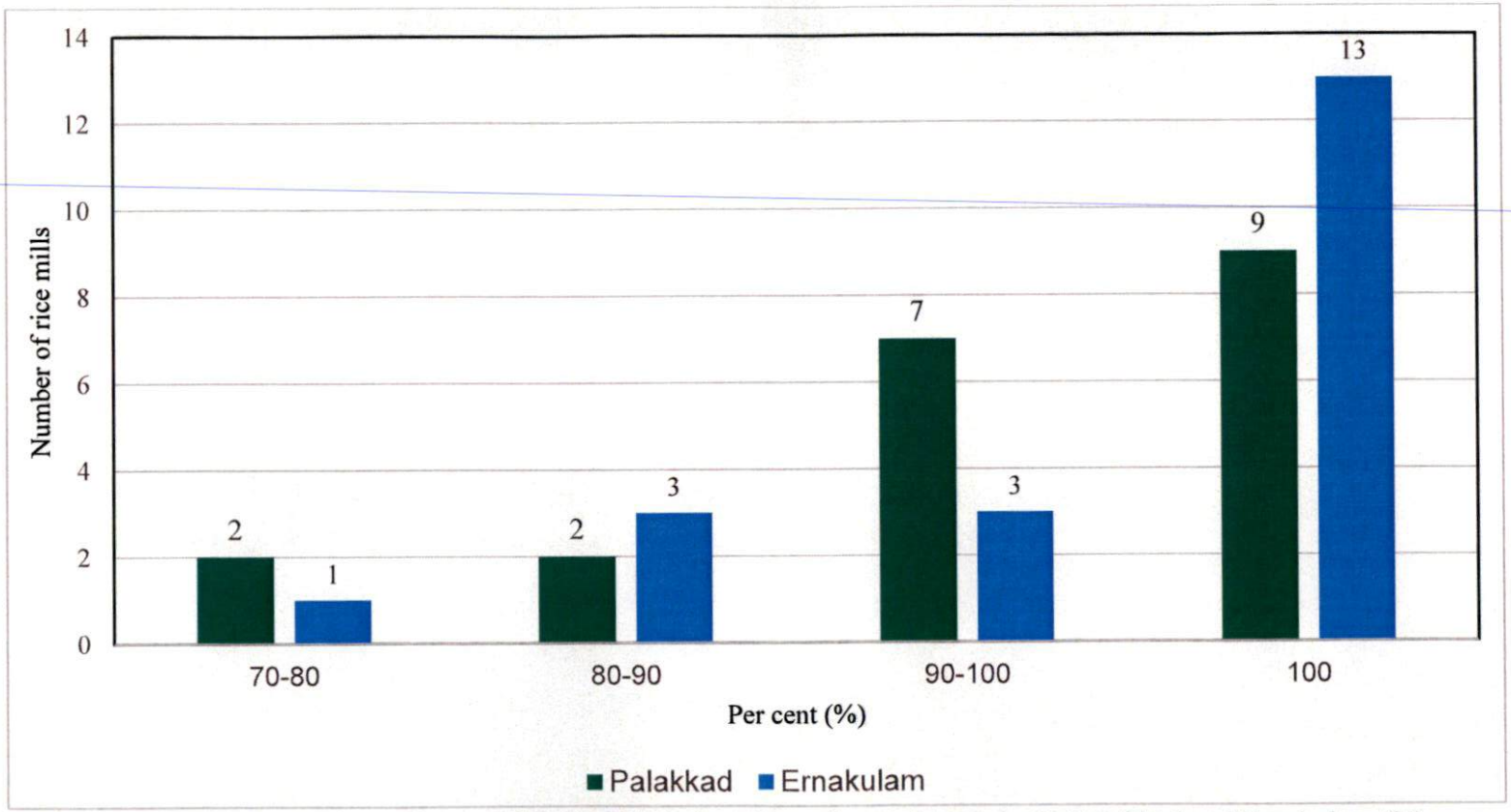


Fig: 4.12. Distribution of rice mills according to efficiency of actual capacity usage in Palakkad and Ernakulam (%)

Efficiency in the number of man days usage in Palakkad and Ernakulam districts was shown in Fig:4.13. Efficiency of man days unit in Palakkad and Ernakulam districts were different. Distribution of rice mills according to efficiency of man days usage in Palakkad and Ernakulam (%) were calculated. Here there are five categories in which mills belong to. No mills in Ernakulam had efficiency level less than 80 per cent. Three mills in Palakkad had efficiency in man days unit ranging from 60-80 per cent. Just like the efficiency usage of electrical unit usage and actual capacity of rice mills in both the districts, 22 mills had attained complete efficiency in the input usage.

Compared to the efficiency usage in both the districts, Ernakulam had more number of mills which are 100 per cent efficient in the usage of all three inputs. Man days unit usage in Palakkad district also showed efficiency level less than 80 per cent.

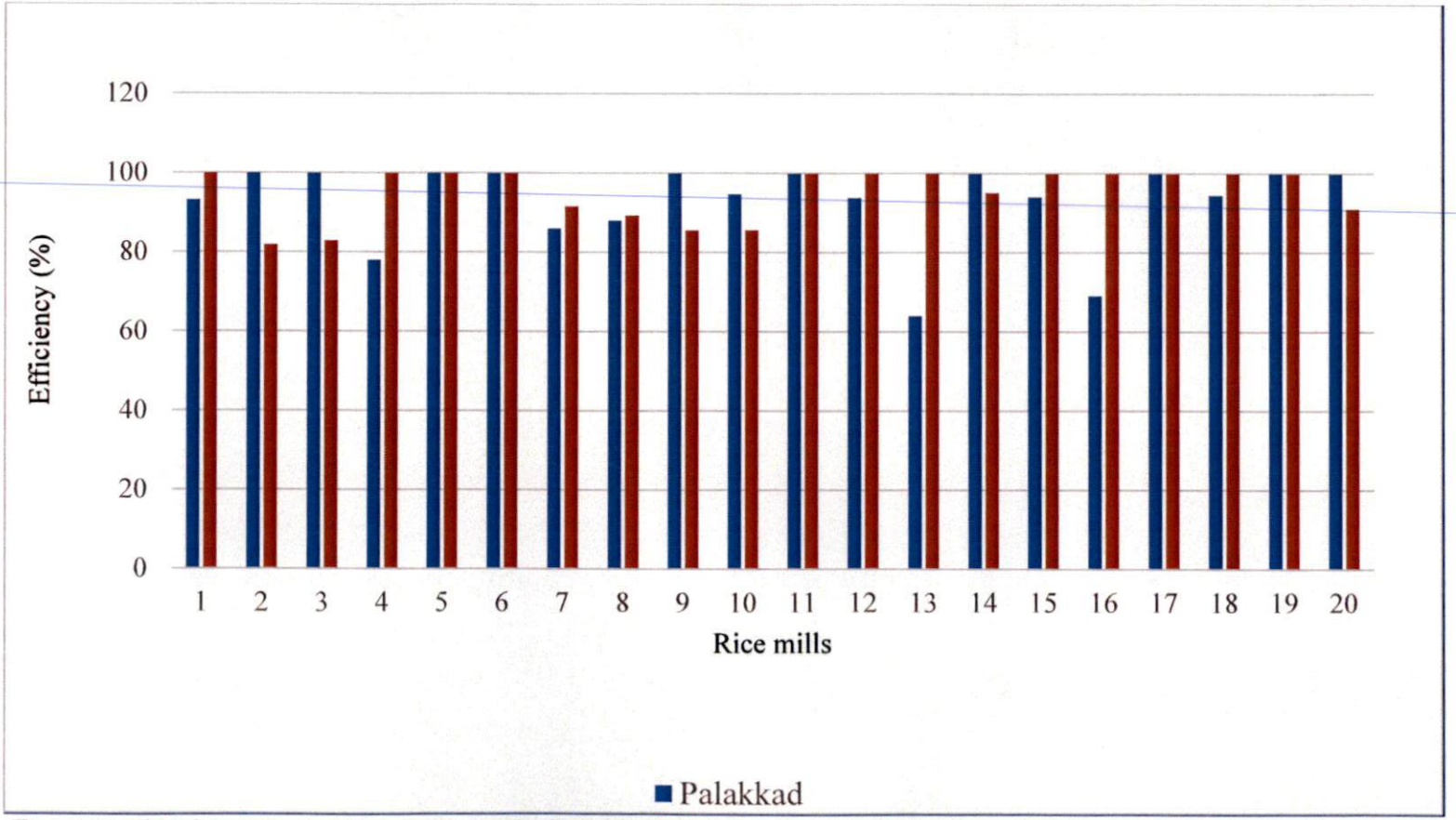


Fig: 4.13. Efficiency in the man day unit in Palakkad and Ernakulam districts

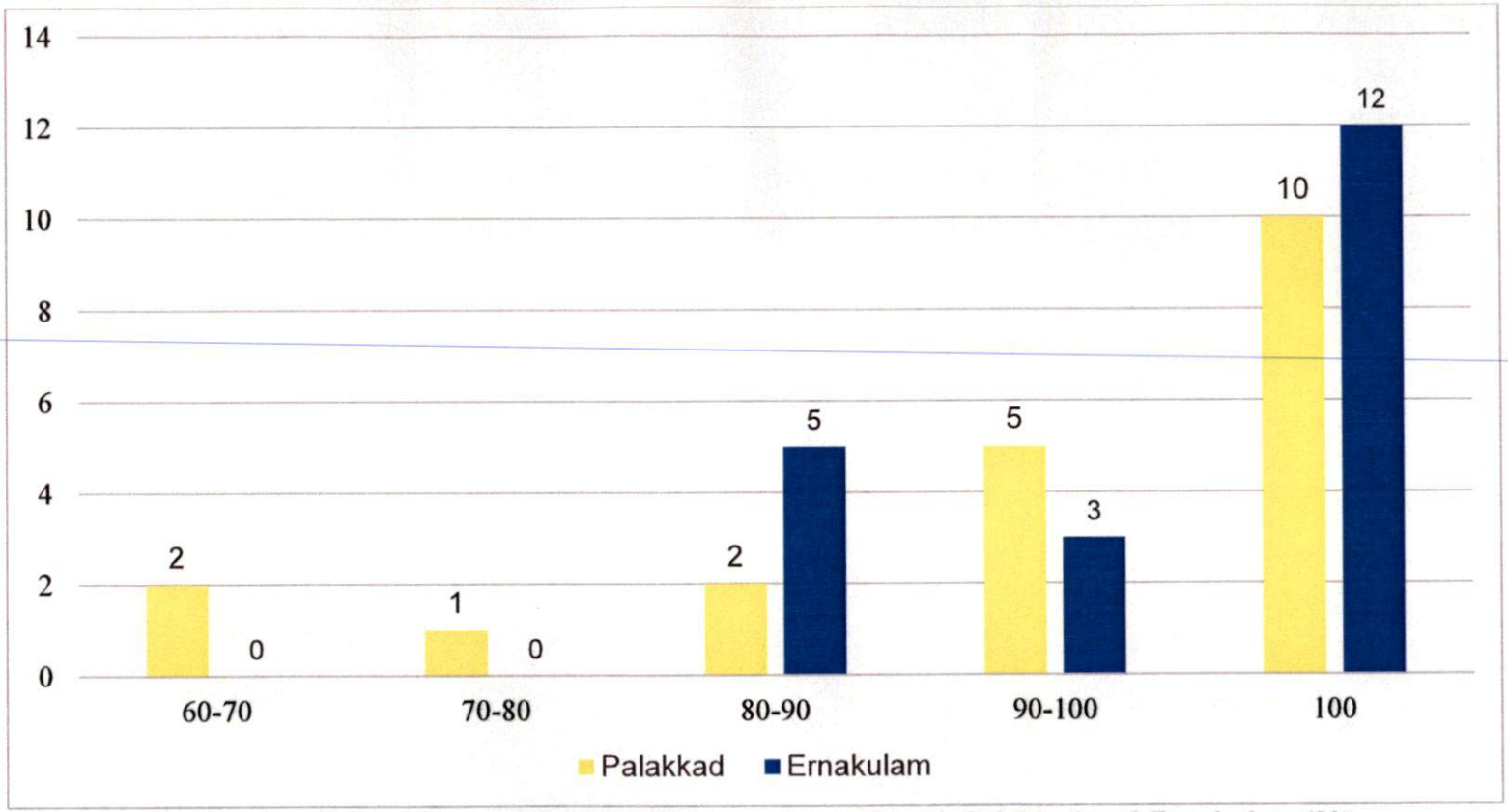


Fig: 4.14. Distribution of rice mills according to efficiency of man days in Palakkad and Ernakulam (%)

4.13.2. Number of peers and peer count for each rice mill

The value and the reference of the organizations (rice mills) that were to be adopted were presented by the summary of peers in Fig: 4.15 and Fig: 4.16. Interpretation indicated that firm number 1, 12 and 13 could follow the input pattern of either 19th or 9th rice mill firm. Similarly, firm number 5, 6, 14, 19, and 20 can follow their own proportional input-output variables. These firms do not need to refer any mills as they were efficiently using the resources. Peer count of a firm indicates the number of times by which each firm was referred by another firm and became the ideal or model firm because of their input output usage. From the Fig: 4.13, it was clearly evident that it was the firm 19 which has been referred most (13 times), followed by 6th firm (9 times), 9th firm (4 times) and 14th firm (1 time).

Fig: 4.15 showed the model rice mills of each sample respondents in Ernakulam district. All rice mills except 2, 3, 7, 9, 10, 14, and 20 did not have any peer implying the efficiency of these mills. Maximum peer count for rice mills in Ernakulam was for mill number 15 and 17 ie., 7 times. This showed the better efficiency of mills in Ernakulam compared to the mills in Palakkad but compared to the peer count summary of Palakkad, Ernakulam had a less maximum value.

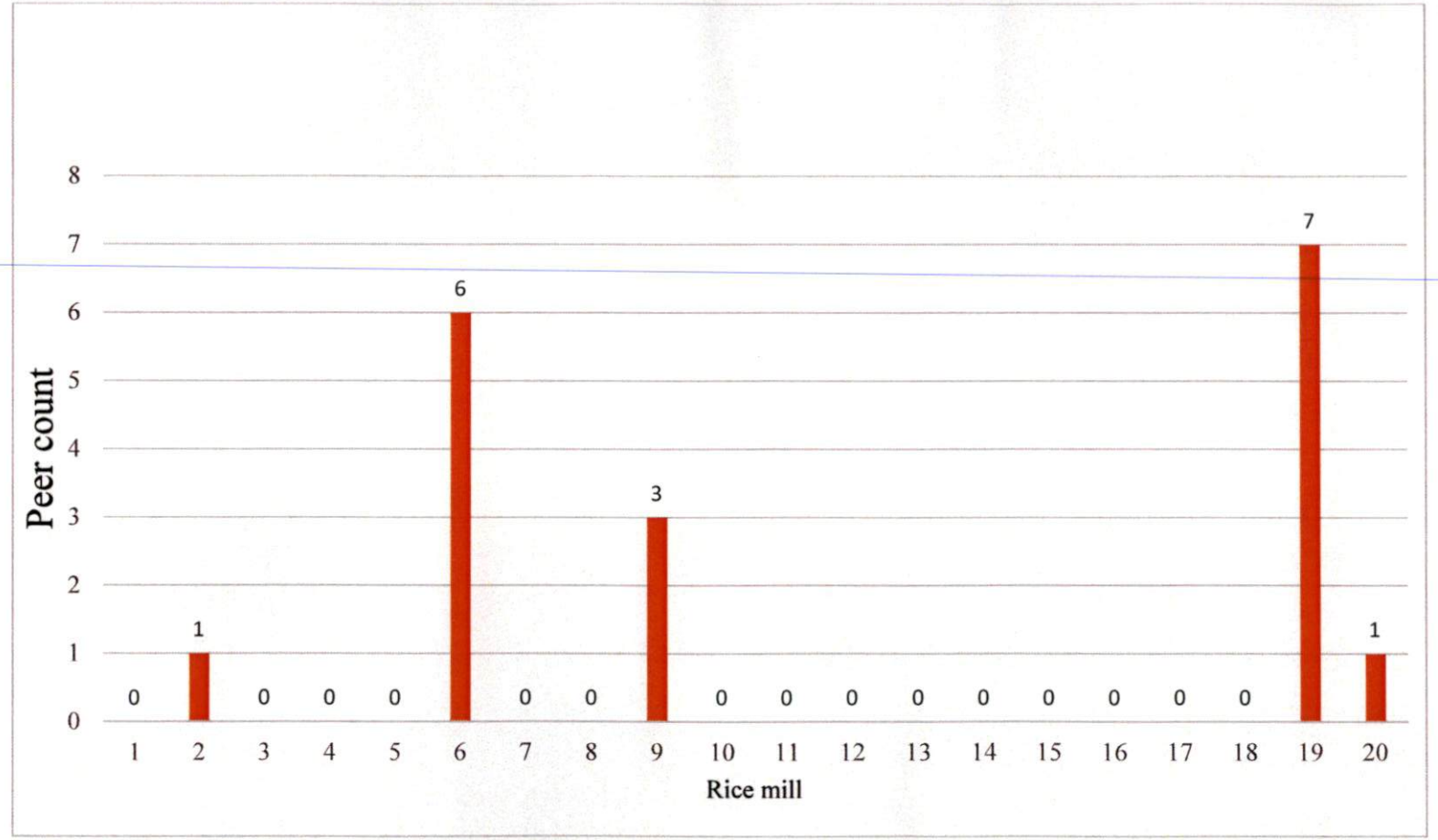


Fig: 4.14. Peer count of rice mills in Palakkad

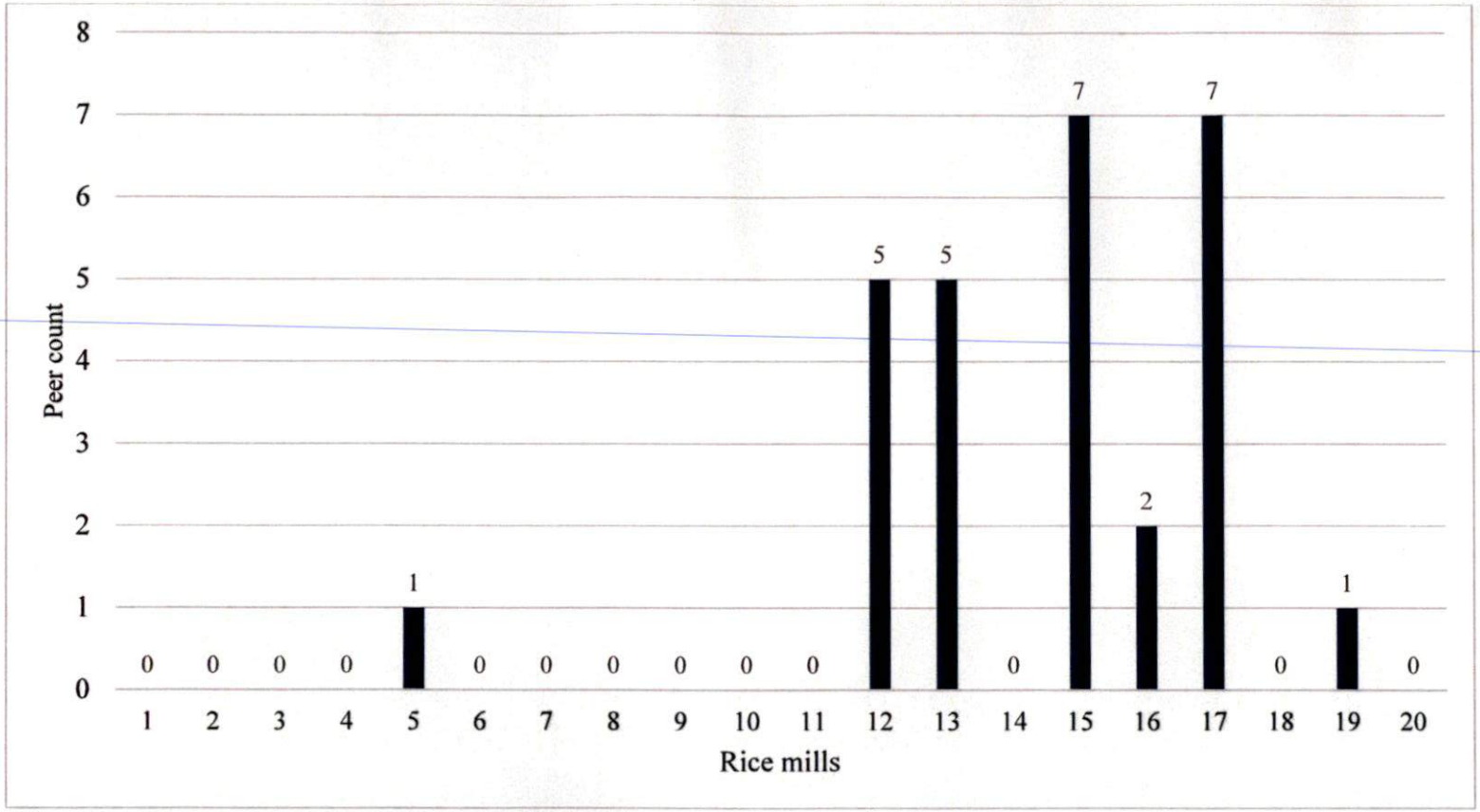


Fig: 4.15. Peer count of rice mills in Ernakulam

4.6. Constraints in rice milling

The rice millers of Palakkad and Ernakulam districts of Kerala faced several constraints in processing activities. The most important constraints as pointed out by the millers were listed and then ranked based on the responses of sample respondents. Ranks were converted into mean score using the Garrett ranking technique for identifying the real constraints existing in the rice mills of Palakkad and Ernakulam districts.

4.15.1. Constraints faced by the rice millers in procurement and processing of paddy

According to Lele (1970), the efficiency of the rice mills can be gauged in three factors technology, degree of competition and capacity utilisation. In the study findings of Wilfred (2006) in Uganda mentioned that the electricity was the main factor that obstructs smooth running of the milling units. It was followed by the technical performance of rice mills, access to repair facilities and services of the machines. Alsothe study by Lançon, *et al.*, (2003) explored the second constraint mentioned above (technology efficiency) as a major problem for the paddy processing industry in Nigeria.

The major constraints faced by the Palakkad and Ernakulam rice millers in procurement and processing of paddy were identified and were listed in Table 4.18. Maintenance cost or depreciation charge was the major constraints confronted by the millers. Wear and tear loss existed in all 40 mills with varying intensity. Millers were spending a large amount of their budget for fixing the machineries. Labour problem was the second major difficult factors for modern rice mills, which made the mills under-run or could not run the mills to the extent of installed capacity. This particular factor alone accounted for percent of the total factor responsible for under-utilization of the modern mills. It was followed by shortage of raw paddy and irregularity in their supply with 52.75 per cent of the total. This can be explained by the fact that paddy is a seasonal crop, and thus it does not have a smooth supply throughout the

year even in the district with highest production. Similarly, electricity problem was not an exception, and this factor accounted for 51.40 of total per cent. At last but not the least, high rate of taxation, unhealthy competition exist among the clustered rice mills especially in Kalady were found to be responsible for under- utilization of the modern rice mills with a Garrett score of 43.82 and 38.62 percent during the study period.

Table 4.18. Constraints faced by Palakkad and Ernakulam rice millers in procurement and processing of paddy varieties

Sl.No	Constraints	Garret score	Rank
1.	Depreciation charge/maintenance cost	70.3	1
2.	Labour shortage	63.37	2
3.	Irregularity in paddy supply	52.75	3
4.	Electricity charge and supply	51.40	4
5.	Taxation	43.82	5
6.	Unhealthy competition	38.62	6
7.	Problems in storage facilities	30.72	7

Summary

5. SUMMARY AND CONCLUSION

The present study entitled "Economic analysis of rice milling industry in central Kerala" was conducted in Palakkad and Ernakulam districts of Kerala. The objectives of the study are to find out the capital investment pattern in rice mills, stakeholders response to the milling industry and milling efficiency factors affecting milling efficiency.

The districts Palakkad and Ernakulam was purposively selected for the study as majority of the rice mills in Kerala are concentrated in these two districts. The present study is mainly based on primary data collected from a sample of 40 rice millers in Palakkad and Ernakulam districts of Kerala. From the study area, rice mills belonging to both traditional and modern category are selected randomly. Mills which belong to different categories on the basis of volume, ownership, capacity utilization were selected randomly.

The primary data was collected selected randomly through personal interview method using a pre tested interview schedule from rice mills. The survey was conducted from February 2018 to June 2018. Data related to the investment pattern, capacity utilization, employment generation, milling efficiency and factors affecting it, and responses of millers, farmers and traders regarding the paddy varieties, procurement source, and categories of rice buyers were collected. Secondary data was collected from District Industries Centre, Indiastat, and NABARD.

The analysis of the primary data referring to the socio- economic characteristics of the rice millers include age, educational status, experience in rice milling, land ownership, ownership of the mill and the premises, form of business ownership, gender wise distribution of workers, family size, working hours, wage structure. In the current study, the age of respondents has been classified into 4 categories as less than 40, 40-50, 50-60 and greater than 60 years.

Result showed that maximum respondents belong to the age group of 50-60 in Palakkad district and 40-50 years in Ernakulam district. No millers in Ernakulam district were of less than 40 years of age. From the educational status of the sample respondents, it was evident that literacy level among rice millers was high in Ernakulm district. The result pointed out that all rice millers were educated and none were illiterate in both the districts. Most of the rice millers have completed SSLC in both the districts. Millers in both districts were educated and 20 per cent and 15 percent of millers Ernakulam and Palakkad districts were graduates respectively.

Experience of rice millers in years for both districts was studied. Based on the experience in rice milling, the rice millers were categorized into 3 different categories. Millers from both districts were categorized into groups such as less than 10 years, 10-25 years and more than 25 years of experience. The results showed that in both districts, most of the millers have been practicing rice milling for a period of 10-25 years. There were only very few millers who had an experience of less than 10 years in both districts. Details of the size of land holdings held by the sample respondents showed that in both districts, there were no respondent with the land holding of less than 1 ha. Majority of the respondents had a land holding with a size more than two ha.

Gender distribution of the study showed that in both the districts, the number of male employees was much higher than the female employees. It was found that more than 90 percent of workers in a rice mill were males and in either of the districts there were no female workers who were involved in the loading or unloading section. The size of the family was a major factor influencing family labour availability. In most of the rice mills, family members of 3-6 take part in milling activities. The size of the family was a major factor influencing family labour availability. In most of the rice mills, family members of 3-6 take part in milling activities.

Workers in a rice mill were categorized into two groups, white collar and blue collar. The white collar workers were those who were paid on a monthly basis. These include the office staff as well as those operating machines. Wage rate of male workers was comparatively higher than the female workers which could be may be mainly due to the comparatively higher physical efficiency of male workers. The data collected based on the ownership of the rice mills compound showed that out of 40 sample respondents from both the districts, only one was rented. Business ownership of respondents in Ernakulam and Palakkad district can be categorized into sole proprietorship and partnership.

According to milling capacity mills are categorized into three group *viz.,* small, medium and large mills. This classification was mainly based on per hour production of rice from the paddy varieties. Small mill processes and produces less than 300 Kg. of rice in an hour. Medium and large sized mills produced 300 Kg-500 Kg and more than 500 Kg of rice respectively. Analysis of the number of rice mills belonging to these three categories showed that an equal per cent of mills in Palakkad district belongs to medium and large capacity mills respectively. Only 10 per cent of rice mills in Palakkad came under small capacity mills. Investment on different particulars of small, medium and large capacity rice mills in Palakkad and Ernakulam districts. Capital investment of small, medium, and a large capacity mills with an annual average installed capacity of 350 tonnes, 4000 tonnes and 43200 tonnes respectively was presented in Table 4. A large portion of their investment is spent on machinery and equipment with a distribution of 50, 58.33, and 54.34 per cent in small, medium, and large capacity rice mills. There is a total investment of Rs. 180 lakh, Rs. 300 lakh and Rs. 460 lakh in small, medium and large capacity rice mills.

Capital-labour ratio of 40 rice mills were also calculated and showed an inverse relation between the ratio and capacity of rice mills. Ratio is also inversely proportional to the establishment year *ie.*, more the age of rice mills, lower was the capital-labour ratio. Low capital- labour ratio indicated a higher output and employment generation in rice mills which are evident from the net returns of rice

mills in small, medium and large capacity rice mills. Break even output analysis was done for the rice mills in Ernakulam and Palakkad of small, medium and large capacities. Analysis showed a break even output of 6, 12 and 72 lakh tonnes for small, medium and large capacity rice mills. This proved all the rice mills run on a profitable basis because they had already crossed the processing output which caused the economies of scale.

Capacity utilization of medium and large mills in Palakkad district was higher than in Ernakulam district. As there were no small capacity mills in Ernakulam from the sample respondents, their percent of utilization cannot be assessed. Net returns from the processing increased with capacity and size of the mill. Higher value of B: C ratio of large mills (1.36) denoted that they had better activity. Operating expense ratio was least for large sized rice mills which showed a better investment. Compared to the operating expense ratio of medium and small sized mills, the value was least for small sized mills indicating a better condition of small mills than medium capacity mills. Gross margin of rice mills in Kerala showed that with the increase in the size of the mill, gross margin also increases. Large, medium, and small capacity rice mills had a gross margin percent of 26.46, 20.21, and 26.36 respectively.

All mills in Palakkad had technical efficiency more than 0.80. Five out of 20 rice mills have a technical efficiency value of 1. Mean technical efficiency value of 20 rice mills in Palakkad was 0.95 and there were 14 mills which had their technical efficiency value more than the mean value. Due to variation in both input and output for given price values, the inefficient mills had to minimize their values for higher outputs at minimal inputs. Study showed that 12 out of 20 rice mills in Ernakulam had attained efficiency and these 12 mills need not to minimize their input usage further. Mean efficiency of rice mills in Ernakulam was 0.97 an there was 14 mills which had their efficiency level more than the mean value. Comparing the technical efficiency value of Palakkad Ernakulam was having a higher technical efficiency value. Constraints related to the efficiency of rice mills showed that maintenance cost or depreciation charge was the major

constraints confronted by the millers. Wear and tear loss existed in all 40 mills with varying intensity. Millers spent a large amount of their budget for fixing the machineries. Labour problem was the second major difficult factors for modern rice mills, which made the mills under-run or could not run the mills to the extent of installed capacity. Apart from these constraints irregularity in electricity supply, taxation, problems during the shortage contribute to the major constraints.

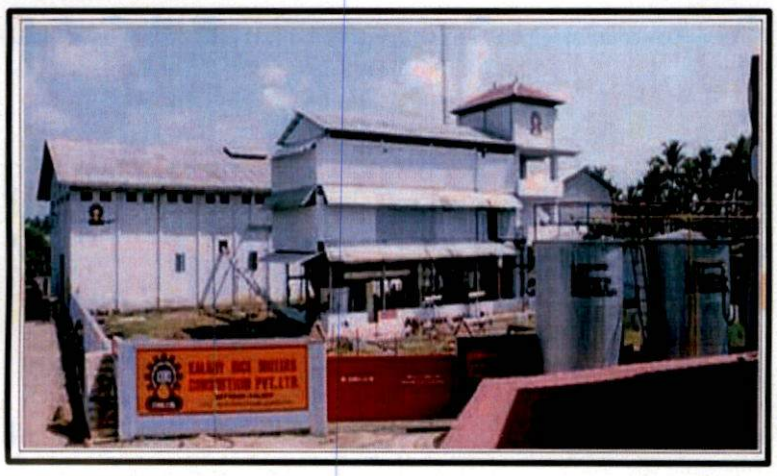


Plate 1: Survey of the study area: rice mills in Ernakulam and Palakkad districts

References

REFERENCES

Acharya, S.S. and Agarwal, N.L., 1989. Economics of marketing and processing of rape seed in Haryana. *Agricultural Situation in India*, *44*(7).42-47.

Ali, J., Singh, S.P. and Ekanem, E. 2009. Efficiency and productivity changes in the Indian food processing industry: Determinants and policy implications. *Int. Food and Agribusiness Management Review 12*(1):43-66p.

Arivelarasan, P., and Chinnadurai, M. 2016. Analysis of farm efficiency in rice production application of data envelopment anlaysis. *J. Life Sci. Leafl.* 17: 101-109.

Autrey, H.S., Grigorieff, W.W., Altschul, A.M., and Hogan, J.T. 1955. Rice milling, effects of milling conditions on breakage of rice grains. *J. Agric, Food Chem*. 3(7): 593-599p.

Balamuniswamy, D. and Erraiah, G. 2014. Role of Regional Rural Banks Finance to Weaker Sections of the Rural Society in India. *Indian j. Res*. *3*(1):42-43p.

Chidri, M.V. 1999. A study on management of agro-processing industries in Karnataka-a case study of tur dal industry. *M. Sc.(Agri.) Thesis*.

Coelli, T.J., Hajargasht, G. and Lovell, C.K., 2008. Econometric estimation of an input distance function in a system of equations. *No. WP01/2008. Centre for Efficiency and Productivity Analysis. St Lucia, Queensland, Australia*

Conway, J.A., Hodges, R.J., Sidik, M., Halid, H. and Conway, J.A. 1992. Cost efficiency of respraying store surfaces with insecticide to protect bagged milled rice from insect attack. *Int. J. Pest Manag. 38*(4): 391-397.

Dixit, A.K., Abel, A.B., Eberly, J.C. and Pindyck, R.S. 1991. Options, the value of capital, and investment. *Q. J. Econ.* 111(3):753-777.

Dev, J.P., 1998. Management appraisal of cashew processing industry in Uttar Kannada District (Karnataka). *M. Sc. (Agri.) Thesis, University of Agricultural Sciences, Dharwad.*

FAO [Food and Agricultural Organization]. 1994. [on- line]. Available. www.fao.org/countryprofiles /index/en/? iso3=IND [16 March 2018]

Githumbi, S., Majiwa, E., Lee, B.L., Wilson, C., Fujii, H. and Managi, S. 2018. A network data envelopment analysis (NDEA) model of post-harvest handling: the case of Kenya's rice processing industry. *Food Security*, *10*(3), pp.631-648.

Gupta, V.K. and George, P.S., 2009. Modernization in the rice milling industry in Punjab. *Indian J. Agric Econ. 29*: 215-217.

GOI [Government of India]. 2015. Ministry of Agriculture and Farmers Welfare [on-line]. Available: http://www.indiastat.com/Searchresult.aspx.http://agmarknet.nic.in / preface-rice-paddy.html [25 March 2018]

GOI [Government of India]. 2016. Ministry of Food Processing Industries [on-line]. Available: mofpi.nic.in/documents/reports/annual-report [25 March 2018]

GOK [Government of Kerala]. 2010. Ministry of Food Processing Industries [on-line]. Available: www.kaavpublications.or /journals/journal-1/article/article-1509.pd [25 March 2018]

Goswami, S.N., 1994. Differences in the consumption pattern of milk and milk products among different income groups. *Indian J. Dairy Sci. 47*:62.

Gupta, V.K., George, P.S. 1974. Aspects of Entrepreneurship in Primary Food-processing Industries in Punjab. *The J. Entrepreneurship. 6*(2): 223-231.

Indumathi, V. 2015. Lean management practices and potential value upgrading options in conventional and modern paddy processing chain of southern tamil nadu (doctoral dissertation, Tamil nadu agricultural university Coimbatore).

Ipte, P.G. and Borude, S.G., 1982. An economics of marketing and processing of cashew in Ratanagiri/Sindurag district of Maharashtra. *Cashew Causerie*. 4:.22-27.

Jaim, W.M.H. and Hossain, M. 2012. Rice milling processes, consumers' preferences and cooking practices in Bangladesh: Implications for nutritional value. Adoption and Diffusion of Modern Rice Varieties in Bangladesh and Eastern India, 77-92.

Joshi, M.G., Wadkar, S.S., Veerkar, P.D. and Powar, A.G., 1999. Comparative economics of scale of processing Alphonso Mango into pulp in south Konkan region. *The Bihar Journal of Agricultural Marketing*, 7(2), pp.190-194.

Kalse, P.V., Kalyankar, S.P. and Patil, H.N., 1996. Agro-processing industries: Existing potential and capacity utilization in Maharashtra. *India Journal of Agricultural Marketing*.

Koopman, T.C. 1951. Activity analysis of production and allocation. *New York*.

Krishnadas, K., 2006. Agro-processing in Kerala: a case study of rice mills in Kalady.

Kumar, R. and Barani, G., 2012. Appraisal relationship between service quality and customer satisfaction in organized retailing at Bangalore City, India. Industrial Engineering Letters. 2(2): 61-70.

Kumar, V., Koutu, G.K., Mishra, D.K. and Singh, S.K. 2013. Principal component analysis of inter sub-specific RILs of rice for the important traits responsible for yield and quality. *JNKVV Res. J.* 47(2):185-190.

Lele, U.J., 1970. Modernisation of the Rice Milling Industry: Lessons from Past Performance. Economic and Political Weekly 1081-1090.

Manjunatha, M.B., 2000. Management of food processing units–A case study of Roller flour mills in Bijapur District (Karnataka), MBA (agribusiness) Thesis. *Dharwad (India)*.

Marskole, M.K., 2012. *Economics of Organic Paddy Production in Balaghat District of Madhya Pradesh* (Doctoral dissertation, JNKVV).

Maurya, O.P., Singh, G.S. and Kashwaha, R.K.S., 1995. Economics of production and processing of Anola district Varanasi, Uttar Pradesh–A case study. *Bihar J. Agric. Mktg. 3:*45-151.

Muralidharan, M.A., Bhide, S., Chowdhury, A., Heady, E.O. and 1981. Structural Changes in an Agricultural Assembling Market: A Case Study of Arecanut (Betel-nut) Market in Mangalore, Karnataka State. *Indian j. of agric.economics*, *36*(2): 25p.

NABARD [National Bank for Agricultural and Rural Development]. 2011. Agricultural Credit in India: Trends, Regional Spreads and Data Base Issues. [on- line]. Available: https://www.nabard.org/english/ricemill.asp [24 Dec. 2015].

Nagesh, A. R. 1990. Investment in production and marketing of cashew in Karnataka–An economic analysis. *M. Sc.(Agri.) Thesis*.

Nayak, P. 1996. Problems and Prospects of Rice Mill Modernization: A Case Study. *J. Assam Uni*, 1(1): 22-28.

Singh, U. and Jambunathan, R., 1980, December. A survey of the methods of milling and consumer acceptance of pigeonpeas in India. In International Workshop on Pigeonpeas (p. 419).

Patil, L.S., 1998. Performance evaluation of fruits and vegetable processing units in North Karnataka. *M. Sc.(Agri.) Thesis*.

Pavithra, A.S., Singh, K.M., Ahmad, N., Sinha, D.K. and Mishra, R.R., 2018. Economic Analysis of Rice Value Chain in Bihar and Karnataka States of India. Int. J. Curr. Microbiol. App. Sci, 7(3), pp.2738-2747.

Prakash, B. and Srivastava, S., 2005. IMPACT OF NEW ECONOMIC POLICY ON EXPORT OF AGRICULTURAL COMMODITIES IN INDIA. *Encyclopaedia Of Agricultural Marketing*, *11*, p.75

Prema, A., and Francies, R.M. 2012. Consumer preference for rice varieties: a case study in central Kerala [abstract]. In: Abstracts, *International Symposium on 100 Years of Rice Science and Looking Beyond*; 9-12 Jan. 2012, Tamil Nadu Agricultural University, Coimbatore, p.324.

Rachhapal, S. and Darshan, S. 1996. Performance of cooperative sector infrastructure in agro-processing – A case Of Punjab market canneries. *Indian Journal of Agricultural Marketing*, **10** (1): 145-161.

RAS [Review of Paddy cultivation in Kerala. [online]. Available: http://ras.org.in /paddy_cultivation_in_kerala. [12 July, 2011].

Ramandev, J.P., 1998. Management appraisal of cashew processing industry in Uttar Kannada (Karnataka). *M. Sc.(Agri.) Thesis*.

Sabur, S.A., Jahan, H. and Reza, M.S., 2003. An evaluation of government rice procurement programme in selected areas of Bangladesh. Bangladesh Journal of Agricultural Economics, 26(1), pp.111-126.

Sakia, A. and Talukdar, K.C., 1996. Economic potentialities of commercial processing firms at farm level for major spices in Nagaon district of Assam. *Indian Journal of Agricultural Marketing*, *10*(2), p.57.

Saravanan, M.P., Pannarasi, T. and Chandrakumar, M., 2002. Study on the efficiency of cashewnut processing units in Tamil Nadu. *The Cashew*, *16*(4), pp.19-24.

Sharma, V., Giri, S. and Rai, S.S., 2013. Supply Chain Management of Rice in India: A Rice Processing Company's Perspective. International Journal of Managing Value and Supply Chains, 4(1), p.25.

Shwetha, M. K. 2011. Economics of Paddy Processing: A Comparative Analysis of Conventional and Modern Rice Mills, Karnataka. *J. Agri. Sci.* 24(3): 331-335.

Singha, K. 2010. Economics of paddy processing in India: a case of Karnataka. *Sci. J.Agric* 1(4): 8p.

Singh, B. and Sidhu, D.S., 1974. Economics of scale in groundnut processing industry in Punjab. *Agricultural Marketing*, *17*(2), pp.18-26.

Singh, U. and Jambunathan, R., 1980, December. A survey of the methods of milling and consumer acceptance of pigeonpeas in India. In *International Workshop on Pigeonpeas*(p. 419).

Singh, G.N., Singh, S.N. and Singh, H., 1994. Economics of marketing and processing of pulses in District Banda of Bundelkhand Region (UP)-A case study. *Indian Journal of Agricultural Marketing*, *8*(2), pp.239-245.

Singh, M., 1995. Reduction in the cost of production of sugar cost effective management of sugar factories. Indian Sugar, 45(1), pp.9-15.

Singha, K. 2010. Economics of paddy processing in India: a case of Karnataka. *Sci. J. Agric* 1(4): 8.

Singha, K., 2013. Paddy processing mills in India: An analysis. *Rice Research: Open Access*.

Sori, S. K., Gauraha, A. K., Sushila, K., and Chandra Sen. 2013. An economic analysis of paddy processing in Mahasamund district of Chhattisgarh. *J. of Interacademicia.* 17 (3):583-587.

Sudha, V., Spiegelman, D., Hong, B., Malik, V., Jones, C., Wedick, N.M., Hu, F.B., Willett, W., Bai, M.R., Ponnalagu, M.M. and Arumugam, K., 2013. Consumer Acceptance and Preference Study (CAPS) on brown and undermilled Indian rice varieties in Chennai, India. Journal of the American College of Nutrition, 32(1), pp.50-57.

Srivastava, U.K., 1989. Agro processing industries: potential, constraints and task ahead.

Varghese, K.A. and Singh, I., 2006. Prospects and Problems of Agro-Processing Industries in Bikaner District of Rajasthan. *Indian Journal of Agricultural Marketing*, *20*(1), p.124.

Veerkar, P. D. and Borude, S.G. 1990. Comparative economics of scale of processing Alphonso mango into pulp in Ratnagiri district, Maharashtra. *Indian Journal of Agricultural Marketing* 4(1): 60-65.

Venkatesan, M., 2003. *Demand for Processed Fruit and Vegetables Products in Chennai Metropolitan City _ An Economic Analysis* (Doctoral dissertation, University of Agricultural Sciences, GKVK).

Appendices

APPENDIX I

Survey questionnaire for farmers

KERALA AGRICULTURAL UNIVERSITY

COLLEGE OF HORTICULTURE, VELLANIKARA, THRISSUR

Department of Agricultural economics

Economic analysis of rice milling industry in central Kerala

Interview schedule

1. Name of the rice mill :
2. Name of the owner :
3. Address of the mill :
4. District
5. How many permanent employees does your mill employ in total? _____
6. How many seasonal employees does your mill employ at peak season?
7. Out of the total number of employees number of women employees –
8. How many of your total employees are members of your family (apart from yourself)?
9. Is your business profitable during the whole year? Yes / No
10.

1	Milling	Y	N	5	Local rice trading	Y	N
2	Polishing	Y	N	6	Rice exporting	Y	N

3	Paddy processing	Y	N	7	By-product trading	Y	N
4	Rice supplying to rice exporters	Y	N	8	Other	Y	N
Note: Y = Important (in terms of sales); N = Not important (in terms of sales).							

2. Economics of processing

11. Cost of processing

Value of sales (revenues)	Milling fee	
	Rice sale	
	Rent	
	Licenses, fees	
	Energy (electricity , gases)	
	Plant and machinery (indigenous)	
	Plant and machinery (	

Cost	imported)	
	Procurement cost	
	Maintenance cost	
	Labor cost (salary)	
	Total cost	
Value of profits		

12. Category to which mill belongs to (according to milling capacity)

    A. SMALL (below 150 Kg. of rice per hour) of rice per hour) -

    B. MEDIUM (150- 300 kg of rice per hour)

    C. BIG –(300 and 500 kg of rice per hour)

    D. LARGE- (500 and 5000 kg of rice per hour).

13. Modern mill/ traditional mill(according to the inventories used)-

14. Annual capacity of the rice mill

15. Total volume of rice produced (ton)-

16. Capacity utilization (%)-

17. No of women employees over 6 years-

2012-

2013

2014

2015

2016

2017

18. Distribution of rice buyers from millers-

A. Trader

B. Consumer

C. Public agencies

D. Restaurant

19. Share of total volume rice sales per type of buyer

A. Trader

B. Consumer

C. Public agencies

D. Restaurant

20. Criteria for paddy type identification and grading and grading method (% of respondent)

A. Identification-

Shape

Color

Odor

B. Grading –

Appearance

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Brightness

Cleanliness

Color

Hardness

Moisture

Shape

20. Other by- products from the processing industry-

21. Frequency of purchase of rice by the suppliers –

    A. Weekly

    B. Monthly

    C. Seasonally

    D. Irregularly

22. Are there any non-processing activities?(if yes what)

23. What may be the reasons for the gap between potential and actual milling capacity?

24. Distribution of Pre and post milling activities-

    A. Winnowing of paddy

    B. Drying of paddy

    C. Parboiling of paddy

    D. Packing rice

ECONOMIC ANALYSIS OF RICE MILLING INDUSTRY IN CENTRAL KERALA

By

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(2016-11-091)

THESIS

Submitted in partial fulfillment of the

requirement for the degree of

Master of Science in Agriculture

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2018

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ABSTRACT

Rice milling is the oldest and the largest agro processing industry of the country. At present it has a turnover of more than Rs. 25,500/- crore per annum. It processes about 85 million tonnes of paddy per year and provides staple food grain and other valuable products required by over 60 per cent of the population. As demand for food grain increases with the growth of population, the need for efficient paddy processing units is felt in the country. Main challenges encountered by the rice processors are to find appropriate solutions for quality rice processing and meeting the demand of current population growth rate. This work provides the basic information about the economics of rice mills in Kerala, factors affecting the milling efficiency and also will study the stakeholder responses (farmers, traders, and millers) on the rice milling industry.

The study was based on both Primary and secondary data. The primary was collected from stakeholders in milling industry in Palakkad and Ernakulam districts of Kerala. This includes millers, farmers and traders of Palakkad and Ernakulum districts. Data was collected from 40 mills (20 from each district), farmers and traders. The year 2016-17 is considered as the year of reference.

Capital investment pattern of rice mills in Palakkad and Ernakulam districts were calculated and analysed. The results showed that from 1980 to 2017 investment on rice mills had increased from Rs. 30 lakh to 300 lakh. Capital-labour ratio of 40 rice mills were also calculated and showed an inverse relation between the ratio and capacity of rice mills. Low capital- labour ratio indicated a higher profitability and employment generation in rice mills.

Response of the rice millers to the processing industry was analyzed. Millers purchase paddy from farmers in weekly, monthly seasonally and irregular time intervals. Major varieties preferred by the rice millers were Uma, Jaya, Jyothi and TK-9. They mainly procure the paddy varieties from Tamil Nadu and Karnataka farmers compared to the farmers in Palakkad and Alappuzha districts due to the low price. Milling, polishing, supply to the exporters, local trading and

by product trading are the major processing activities in rice mills. Major buyers of rice from the rice mills were Traders, consumers, restaurants and public agencies with varying number.

Efficiency analysis of rice mills was done using three tools such as percentage analysis, financial ratio and Data Envelopment Technique. Capacity utilization of rice mills were calculated using percentage analysis and found to be higher for large capacity rice mills followed by medium and small capacity rice mills. Financial ratios used were B:C ratio, Gross margin and Operating expense ratio and proved that all the rice mills in Palakkad and Ernakulam were running on a profitable basis. Data envelopment analysis showed the efficiency of rice mills with a mean technical efficiency of 0.95 in Palakkad and 0.96 in Ernakulam. Mean scale efficiency value of 0.91 and 0.93 was obtained from Palakkad and Ernakulam districts respectively. Peer count and input targets of both districts were also obtained from DEA analysis.

Major constraints in the rice milling industry were identified using Garret ranking technique. Maintenance cost, labour shortage and irregularity in paddy supply were the main three hindrances to the smooth functioning of rice mills. With the increase in demand for processed rice in India and Kerala there is great need to improve the quality of rice and installed capacity of processing