MECHANISATION AND COIR INDUSTRY IN KERALA:

IMPACT, DETERMINANTS AND THE ROLE OF GOVERNMENT

Thesis submitted to the University of Calicut
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By

RASEENA K. K.

Under the supervision of

Prof. (Rtd) Dr. K X JOSEPH

Department of Economics

University of Calicut

DEPARTMENT OF ECONOMICS

UNIVERSITY OF CALICUT

Dr JOHN MATTHAI CENTRE

ARANATTUAKARA, THRISSUR

SEPTEMBER, 2020

Department of Economics
University of Calicut
Dr.John Matthai Centre
Aranattukara, Thrissur

Dr. K X JOSEPH
Professor (Rtd),
Department of Economics
Dr. John Matthai Centre
Aranattukara, Thrissur

CERTIFICATE

This is to certify that the revisions are made in the thesis as per the suggestions made by the adjudicators of the thesis.

Place: Thrissur
Date: September 2020

Dr. K X JOSEPH
Professor (Rtd) & Supervising Teacher

CERTIFICATE

This is to certify that this thesis entitled, **"MECHANISATION AND COIR INDUSTRY IN KERALA: IMPACT, DETERMINANTS AND THE ROLE OF GOVERNMENT''** being submitted by **RASEENA K.K**. for the award of the degree of **Doctor of Philosophy,** to the University of Calicut is a record of bona fide research work carried out by her under my guidance and supervision.The contents of this thesis, in full or in part, had not been submitted to any other institute or University for the award of any degree, diploma, fellowship or other similar title or recognition before. Plagiarism is checked and found within the permitted limits.

Dr. K X JOSEPH
Professor (Rtd), Supervising Teacher
Department of Economics
Dr. John Matthai Centre
Aranattukara, Thrissur

Dr. SHYJAN D
Associate Professor (HoD), Co-Guide
Department of Economics
Dr. John Matthai Centre
Aranattukara, Thrissur.

Place: Thrissur
Date:

DECLARATION

I, **RASEENA K.K**, affirm that this thesis titled **"MECHANISATION AND COIR INDUSTRY IN KERALA: IMPACT, DETERMINANTS AND THE ROLE OF GOVERNMENT"** submitted to the University of Calicut for the award of the degree of **Doctor of Philosophy** in Economics is a bona fide record of research done by me under the guidance of Dr. K. X. JOSEPH, Retired Professor of Economics, University of Calicut and Dr. SHYJAN D., Associate Professor and Head, Department of Economics, University of Calicut. I declare that this thesis had not been submitted by me earlier for the award of any degree, diploma, fellowship or any other similar title or rcognition of any University/Institution.

Place: Thrissur **RASEENA K.K.**

Date:

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LIST OF ABBREVIATIONS

Abbreviations	Description
AAS	Actual Adoption Score
AMT	Advanced Manufacturing Techniques
ANOVA	Analysis of Variance
APK	Average Productivity of Capital
APL	Average Productivity of Labour
APM	Average Productivity of Materials
ATC	Agreement on Textiles and Clothing
CAGR	Compound Annual Growth Rate
CCRI	Central Coir Research Institute
CICT	Central Institute of Coir Technology
COIRFED	Kerala State Coir Co-operative Coir Marketing Federation Ltd
CUY	Coir Udyami Yojana
CV	Coefficient of Variation
DMP	Domestic Market Promotion Scheme
EM	Extent of Mechanisation
EMDA	External Market Development Assistance
EMPS	Export Market Promotion Scheme
FDI	Foreign Direct Investment
FOMIL	Foam Mattings (India) Limited
GATT	General Agreement on Tariff and Trade
GPTs	General Purpose Technologies
GSDP	Gross State Domestic Product
ICDP	Integrated Coir Development Project
ICTE	International Coir Tech Expo
IITF	India International Trade Fair
IIUS	Industrial Infrastructure Up-gradation Scheme
KCWWFB	Kerala Coir Workers Welfare Fund Board
KMD	Kerala Model of Development
KNN	Knowledge News Network
KSCMMC	Kerala State Coir Machinery Manufacturing Company

LDCs	Less Developed Countries
Ln	Natural Logarithm
MAU	Marathwada Agricultural University
MCY	Mahila Coir Yojana
MFA	Multi Fibre Agreement
MI	Mechanisation Index
MPKV	Mahatma Phule Krishi Vidyapeeth
MRTS	Marginal Rate of Technical Substitution
MSME	Micro, Small and Medium Enterprises
MSMED	Micro, Small and Medium Enterprises Development
NCRMI	National Coir Research and Management Institute
OCC	Organic Composition of Capital
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Square
PMI	Production and Marketing Incentive
PMSBY	Pradhan Mantri Suraksha Bima Yojana
PVC	Poly Vinyl Chloride
R&D	Research and Development
RAS	Recommended Adoption Score
REMOT	Rejuvenation, Modernisation and Technology Up-gradation
SD	Standard Deviation
SE	Standard Error
SFURTI	Scheme of Fund for Regeneration of Traditional Industries
TAM	Technology Acceptance Model
TFP	Total Factor Productivity
TMB	Textiles Monitory Body
VIF	Variance Inflation Factor
WB	World Bank
WDR	World Development Report
WTO	World Trade Organization

ABSTRACT

The present research is an attempt to measure the degree of mechanisation in coir industry of Kerala with a view to evaluate its impacts and to identify the determinants. The analysis is expected to yield wider policy implications regarding the channels of interventions in coir industry for its betterment. The study uses primary data collected from 115 coir manufacturers of Alappuzha District by using simple random sampling. It starts with measuring the degree of mechanisation of the selected coir firms in Kerala using two indices, Extent of Mechanisation (EM) and Mechanisation Index (MI). The coir industry of Kerala are categorised in to 4 levels of mechanisation, namely, traditional firms, low mechanised firms, medium mechanised firms and high mechanised firms using MI. It is found that, majority of the coir producing firms of Kerala belongs to traditional and low mechanised levels.

The awareness level of the manufacturers about the machines available for manufacturing coir products is examined and found that education of the manufacturer has positive influence on awareness. The firm specific determinants of the mechanisation are identified using regression analysis and the results reveal that, firm size, participation in promotional programmes and the average education of the labour positively influences the mechanisation index whereas, the presence of labour union inversely affects it.

The impact of mechanisation on the performance of coir industry is evaluated using the variables, production, efficiency, factor productivities, number of diversified products and the extent of market. It is evident that MI positively influences the daily production, per capita production, APL/hour, TFP (efficiency) and extent of market of the firms. It is found that, the share of capital in total output increases as mechanisation increases whereas the share of labour decreases as increase in mechanisation. It is clear from the analysis that, product diversification is limited in coir industry even with high levels of mechanisation. Thus it can be concluded that, the mechanisation boosts the performance of coir industry of Kerala in general and production, productivity, efficiency and extent of market of the selected firms in particular. In contrast to this, the study found that, decreasing returns operates in coir industry of Kerala in all levels of mechanisation.

The study highlights that, at higher levels of mechanisation, the firms cannot utilise their full capacity mainly due to market inefficiencies. Both the raw material and the product markets are inefficient to tap the full capacity of the firms. The existence of X-inefficiency may be one of the reasons for low level of mechanisation in the industry. This analysis necessitated

the market interventions by the government for better performance of this industry. At the same time, the lower mechanised firms can perform better only if the production techniques updates.

The analysis of the support and benefits received by the private sector coir manufacturers reveal that, the financial support by the government aims to develop the infrastructure of the firm. But the non-financial assistances like government procurement and participation in government sponsored trade fairs positively influence the mechanisation index whereas, the provision of subsidized raw materials has a negative influence on MI. In this respect, the 'Coir Kerala' is a good initiative by the government to mechanise and thus to improve the coir industry of Kerala. The study concluded that, proper market interventions are required for efficient utilisation of production capacity of the firms and thus to improve the performance of traditional coir industry of Kerala. This in turn, will boost the mechanisation and thus the performance again. This chain of actions and reactions will help the industry to overcome all its vulnerabilities and will lead it to prosperity.

CHAPTER 1

INTRODUCTION

- ***Introduction***
- ***Need and Significance of the Study***
- ***Statement of the problem***
- ***Objectives of the study***
- ***Data Source and Methods***
- ***Scheme of the Study***

CHAPTER 1

INTRODUCTION

1.1 Introduction

Coir industry is one of the most important agro based and traditional industry in Kerala. There are many favourable ecological settings such as, backwaters for natural retting, abundant supply of coconut and availability of cheap and skilled labour force that contribute unique textures and features of durability and flexibility that is suitable to produce varieties of coir products. The international market for coir has attained the logo "Kerala Coir- the Golden Yarn of the God's own Country". But the existence of traditional production techniques, below subsistence wage rates and continuous labour struggles haunted the industry for a long time (Prakash 1977; Coir Board 2008; Amutha 2013; Mohanasundaram 2015 and Ashik 2018).

As a solution to the low productivity due to the use of outdated methods of production, mechanisation of the industry is recommended (Isaac et al., 1992; Rammohan 1999; Sabarinath 2000; Menon 2005; and Isaac & Mathai 2017). In the midst of already existing problems in the industry, this new initiative generated another fear among the coir workers regarding mass labour displacement [Kannan (1976) and Isaac (1983)]. As a result, they protested against the machines. Besides, the power loom products cannot compete with the handloom products both in national and international markets. The de-fibering machines were also not successful in Kerala because of the homestead cultivation of coconut. Because of the delay in collection of coconut husk, it becomes dry and not suitable for mechanical fibre extraction. So the practice of natural retting and de-fibering continued in Kerala.

But the mechanical fibre extraction is intensively practiced by the neighbouring States, Tamil Nadu and Karnataka where coconut is a plantation crop and green husk is available in plenty at harvesting points itself. Thus the fibre separated from the green raw husk using machines were plenty and cheaply available from the neighbouring states. The mechanically extracted and scientifically treated fibre can be useful for spinning coir yarn and manufacturing various coir products. The retted fibre cannot be distinguished easily from scientifically treated mechanical fibre and so the plenty and cheap availability of machine fibre captured the

market and as a result, the de-fibering and spinning activities are disappeared from Kerala gradually. Mean while some efforts are made to encourage the de-fibering and spinning activities in Kerala by introducing mobile de-fibering units and mechanical spinning. But none of these can fully achieve the goal.

The coir industry in Kerala faces dilemma of the traditional methods employed in production centres in contrast to the intensive use of advanced technologies in major coir producing country in Asia such as Sri Lanka (Rajan & Kumar, 2004). So, Issac & Mathai (2017) argued that modernisation and diversification are the key link in the transformation of the coir industry. So Kerala initiated the second face of the modernisation of the industry through mechanisation during 1990's with the New Economic Policy.

Thus the penetration and spread of the modernisation efforts demand special enquiry. What is the present level of mechanisation of this traditional industry? Whether the different coir products vary in its degree of mechanisation? Whether the degree of mechanisation varies between the firms of the industry? If the degree of mechanisation varies between the firms, what are the factors that enables or preventing the mechanisation? Whether this variation in mechanisation levels reflects in firm's performance? Whether the State intervention plays any role in mechanising the industry? If so which are the channels of State intervention? These questions are to be addressed in any discussions regarding mechanisation and coir industry. So the present study focused to examine the degree of mechanisation of the selected coir industries of Kerala with a view to evaluate its performance, to identify the enabling or preventing factors and to enquire the role of the State in this venture of modernising a traditional industry.

1.2 Need and Significance of the Study

One of the major criticisms of the Kerala Model of Development is its backwardness in the productive sectors, primary and secondary. Many reasons were traced out for this backwardness, and of them, the geographical and demographic reasons predominates. In Kerala the share of primary sector to State income continuously decreasing where as that of the industrial sector is of a stagnant one. The share of manufacturing to Kerala's GSDP is 7.5% (Economic Review, 2018). This shows that, the share of one of the most important productive sectors of the economy to the State income is negligible. Within the adverse atmosphere of industrial development in Kerala, the small scale and traditional industries

play a key role. The major small scale and traditional industries of Kerala are coir, cashew, hand loom, bamboo, pottery and handicrafts.

Most of these traditional and small scale industries are in the phase of decay or almost stagnant. Among these industries, coir has a major role with State dominance from its origin and development. This agro-based rural industry provides sustenance to around 2 lakh families in the coastal belt of Kerala (Economic Review, 2017). But actually what happened was that, due to mechanisation, the de-fibering activity shifted firstly to the neighbouring States with the use of de-fibering machines. This not only eliminates the major environmental and health problems related to the de-fibering process traditionally practiced in Kerala but also produced a value added bye product, coir pith, which earns a value equal to its major product, fibre and occupies prime position in the export basket of coir and coir products (Coir Board, 2019). Due to the easy availability of fibre in the neighbouring states they started spinning. These changes destroyed both defibering and spinning activities of Kerala. Later, the fibre and yarn became a monopoly of the neighbouring states, especially of Tamil Nadu. So the prices of both fire and yarn are increased. The provision for direct export of fibre due to liberalised trade regimes, fibre occupies next to coir pith in the export basket of coir and coir products (Coir Board, 2019) worsened this situation. This created much uncertainty to Kerala's product manufacturing sector.

Isaac (1983) opined that, the efforts to mechanise coir industry is failed in Kerala due to the resistance of labour force fearing huge levels of labour displacement it follows. Presently Kerala not only given up the resistance to technological up gradation, but also take initiatives actively for promoting rapid mechanisation of the coir industry. This will be beneficial to Kerala firstly on the environment friendly processing of fibre and secondly by increasing productivity and thus wages, especially to women.

In this scenario, both the entrepreneurs and State Government, great efforts were taken to rejuvenate the industry mainly through mechanisation during 1990's as its second phase. But the result is not much as expected. Not only this, it varies in its degree and thus the determinants of mechanisation need a special enquiry (Burton et al., 1999; Varukolu 2007; Lin & Zhang 2009; Gosh 2010; Kuriakose et al., 2011; Okello et al., 2014; Narayanamoorthy et al., 2014 and Oladeji et al., 2015). Before going with intense mechanisation in a traditional industrial setup, it is essential to enquire the present status of usage of mechanised production techniques in this industry, the determinants of mechanisation and to evaluate its impact on

performance. After that, it was crucial to identify the proper space for government intervention for supporting this. These are the subject matters of the present study.

1.3 Statement of the Problem

As coir industry of Kerala is concerned, the major areas of discussions are the various problems it faces in this modern era, its labour and wage pattern and the production techniques and productivity. Intense mechanisation is advocated for the betterment of productivity and wage levels. But mechanisation has both positive and negative impacts. The impacts that mechanisation brought in the industry has viewed in a macro perspective. But a micro economic exercise is needed in the enquiry of the degree of mechanisation. This study is set in the perspective of having micro founded expositions rather than a macro view. Each firm in the industry demand special attention in the case of the production techniques it employed and resulted reflections in its performance. To explore the extent by which a traditional industry can modernise, firm specific intensity of mechanisation need to be measured and evaluated in terms of performance.

The degree of mechanisation may vary among the firms of this industry. It demands the enquiry of firm specific factors that promotes or prevents mechanisation. This also helps in identifying the existence of differences in the degree of mechanisation and its root causes. Policies for improving the production techniques gain special focus and dimensions in this respect. The role of the State for the improvement of the industry, especially in its production techniques, demands special attention to identify the channels of State interventions for better performance. Therefore the present study takes a micro analysis of the degree of mechanisation of the coir industry of Kerala with a view to evaluate its performance and to identify the enabling and preventing factors.

1.4 Objectives of the Study

The major research questions, on which the study is trying to find the solutions, are illustrated in the form of objectives. These are;

- **To measure the degree of mechanisation in coir industry of Kerala**

This involves measuring the extent of usage of various machines available in coir manufacturing. Based on this, the coir industry is categorised in to four levels of mechanisation namely, traditional units, low mechanised units, medium mechanised units and

high mechanised units. This kind of categorisation of the sample coir units gives a picture of the extent of usage of various machines available in coir manufacturing. This also exhibits the extent by which a traditional industry can modernise.

- **To identify the firm specific factors determining the mechanisation of coir industry**

It examines the firm specific factors determining the use of various machines for production of coir and coir products and thus to explore the necessary pre requisites of mechanisation for accelerating its speed and the degree.

- **To analyse the impact of the mechanisation on the performance of coir industry**

It examines the factor productivities and process efficiency as the major proxies of performance. It relates performance with other variables like production, number of product varieties and the extent of market access. This analysis may help the coir manufacturer to find out the appropriate level of mechanisation.

- **To examine the role of the government in modernising the coir industry.**

It involves an analysis of the government support in modernising the industry both in terms of financial and non financial assistances. The variables used for this purpose includes, amount of grants and subsidised loans received, the facility of government sponsored trainings availed and the market assistance received in the form of subsidised raw materials and government procurement and assistance for the exposure to government sponsored trade fairs. It aims at identifying the channels of government intervention in the coir industry of Kerala for modernisation.

1.5 Data Source and Methods

1.5.1 Data Source

The present study uses both primary and secondary sources of information for analysing the major objectives. The details of these sources are explained under this head. For illustrating the story of the most prominent traditional industry of the State, its past glory and present scenario the researcher used the description and facts given by various institutions, individuals, government bodies, reports of various study groups regarding coir industry.

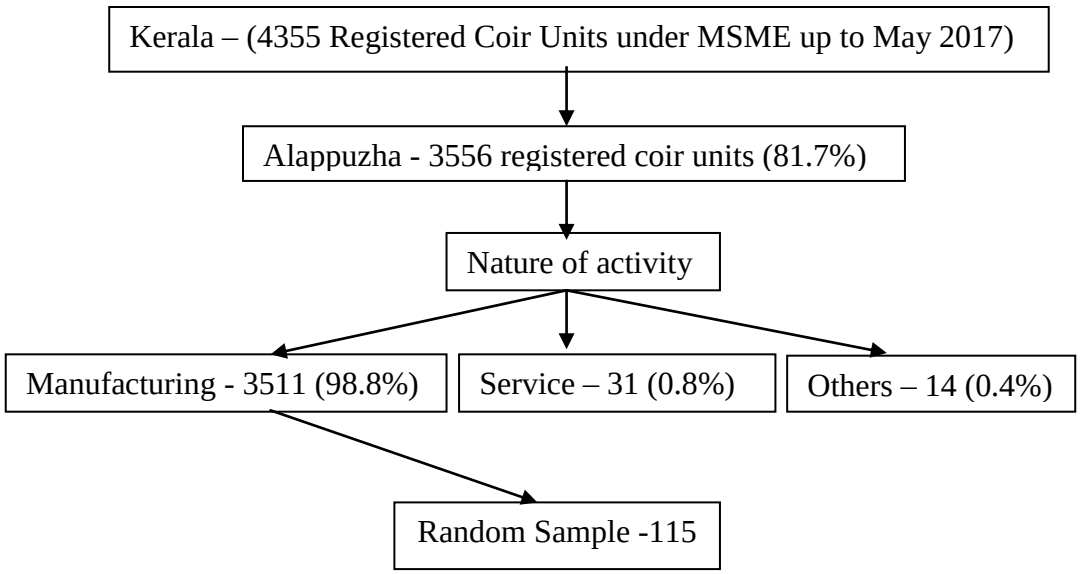
These constitute the major sources of the secondary data. It includes the institutions like Coir Board (1974-2019), Ministry of Industry and Trade (1980-2019), Ministry of Small and Medium enterprises (MSME- 2017) and Coir Directorate (2017). An unstructured interview is also carried with the officials of Coir-fed, Central Coir Research Institute, National Coir Research and Management Institute and The Kerala State Coir Machinery Manufacturing Unit, for acquiring the information relating to the State interventions in coir industry. Various govt reports on coir industry, study reports of various institutions, published works such as articles and books, websites of the institutions dealing in coir and ministry of industry and trade are also used to collect background information for the study. The coir export data published by the Coir Board from 1974-75 to 2018-19 are used for analysing the trends in exports during different trade regimes. The data on total exports of the nation is used to compare the trends in growth rates with those of the coir exports. The data on India's total exports are collected from the Website of Ministry of Industry and Trade (1980-2019). The data of the registered coir units of Kerala is collected from the Ministry of Small and Medium enterprises (2017) to determine the size of the population of the present study.

The present study mostly depends on the first hand information collected by the researcher from 115 selected coir manufacturing firms of Alappuzha District by conducting direct interview with them from January to May 2018. The population of the study constitutes 3511 Coir manufacturing firms of the district registered under Coir Board (MSME) up to May 2017 and a sample of 115 coir manufacturers are chosen using simple random sampling method. The detailed picture of the sample frame used in the study is given in the following section.

1.5.2. Sampling Frame

The methods used for selecting the sample, the sample size determination, and the modes of collecting the information from the primary sources are described in detail under this head. No accurate data is available regarding the total number of coir manufacturers in Kerala. Various studies and reports provide varied numbers regarding the coir manufacturers of Kerala. So the present study considers the number of coir producing firms registered in the Ministry of Small and Medium Enterprises (MSME) under the frame work of Coir Board rules and regulations till May 2017 as total population and it is 4355. From this, a sample of 115 firms is selected using simple random sampling for the present study. The procedure of sample selection is depicted in Figure 1.1.

Figure 1.1: The Sampling Frame



Source: Authors Compilation

Figure 1.1 shows that, out of the total 4355 registered coir manufacturers, 81.7% coir manufacturers belongs to Alappuzha District. The rest 18.3% is scattered in the remaining districts of Kerala, mainly in 7 districts, like Thiruvanathapuram, Kollam, Ernakulam, Thrissur, Malappuram, Kozhikkode and Kannur. Considering the concentration of the coir manufacturers and the intensity of the coir production activities, Alappuzha is selected purposefully as the sample district. The registered coir manufacturers are categorised in to three, based on the nature of work as manufacturing, service and others.

Manufacturing sector constitutes the lion share (98.8%) of the total registered coir firms in Alappuzha. Since the study is related to production techniques, only manufacturers are selected as the focus group of the study. Hence, the population constitutes 3511 coir manufacturers of Alappuzha district who registered under the Coir Board till May 2017. Form this population, a sample of 115 are drawn randomly. But one of the major difficulties faced by the researcher during primary data collection is that some of the selected sample coir manufacturing firms are not working. So such units were dropped and new sample are drawn again from the population randomly.

Sample size calculator is used to decide the optimum sample size of the study. The formula used for this purpose is described in the equation 1.1.

Optimum Sample Size $= \frac{Z^2 \mathrm{P}(1-\mathrm{P})/e^2}{1+(Z^2 \mathrm{P}(1-\mathrm{P})/e^2 \mathrm{N}}$ ..... (1.1)

Where,

N= Population

e= Margin of error

z= z score

347 is the optimum sample size using equation 1.1. As a doctoral thesis is concerned, this is a large sample since the respondents are coir manufacturers who are scattered in different parts of the district. Considering the time and resources, one third of the optimum sample is taken as the sample size for the present study and it is 115. Hence the study considers 115 coir manufacturers as the sample for collecting the relevant information stated in objectives through primary survey.

For gathering the primary data, a direct interview is conducted among the sample coir manufacturers during January to May 2018. For this purpose, an interview schedule was prepared and tested by conducting a pilot survey during December 2017. After the pilot survey some difficulties are found with the schedule to gather the needy information. Necessary modifications and changes are incorporated after the pilot study. This modified interview schedule (see Appendix I) is executed finally in January 2018 and the process of primary data collection is continued till May 2018.

1.5.3 Research Methods

The study employs some statistical tools for the scientific analysis of the stated objectives. The compound annual growth rates are used for analysing the trend of exports of coir and that of total exports from India during 1974-75 to 2018-19. Frequency tables, charts and diagrams (such as pie charts, line charts and bar charts) are used for presenting the primary data. The summary statistics like percentages, averages and measures of dispersion are used to know the distribution, dispersion and the spread of data. Apart from this, the average score of mechanisation index is computed for comparing mechanisation among the various features of the firm and for understanding the impact of mechanisation on the product varieties and on the market accessibility. The summary statistics are also used for having a picture about the

Mechanisation Index (MI) among those who availed and not availed the governmental assistances, both financial and non-financial.

As a prerequisite of measuring the degree of mechanisation of the coir industry, the awareness level of the coir manufacturers about the available machines for manufacturing coir is examined. Chi-square test of association is performed to examine the association of various factors with the awareness level. A binary Logit regression model is employed to elicit the determinants of the awareness level. The Collinearity of the explanatory variables included in binary Logit regression model is checked using Variance Inflation Factor.

For measuring the degree of mechanisation of coir industry, two indices of mechanisation are prepared and used. These are the Extent of Mechanisation (EM) score and the Mechanisation Index (MI) score. EM score is calculated to examine the extent of the use of machines in various stages of production of each coir products. From this, MI is computed, which is a weighted average of EM scores, where relative share of each product in total output of the firm is taken as the weights. This MI is used for measuring the degree of mechanisation in coir industry of Kerala. The details of the formulation of these indices are explained in the Chapter 4, where the degree of mechanisation of the selected coir firms is measured.

The impact of mechanisation on the performance of the coir firms is evaluated on the basis of total factor productivities (TFP) and average factor productivities. Other variables such as, production, factor shares, number of products produced and the extent of market are also used to evaluate the performance. For evaluating the impact of mechanisation on factor productivities, the average factor productivities of the traditional inputs, labour, capital and raw materials, were calculated. The marginal productivities of the labour and capital are computed using the production function approach. The details of the measurement of the average and marginal factor productivities are presented in Chapter 5. For measuring TFP and factor shares, the production function approach is used by employing the framework of Cobb- Douglas production function. The OLS method is used for estimating the production function. For employing the OLS, the production function is transformed in to linear model using the natural logarithm. Thus, a log-linear regression model is fitted for estimating the production function and the detailed derivation of this is presented in Chapter 5, where the impact of mechanisation is evaluated in terms of TFP and factor shares.

For exploring the firm specific factors determining the mechanisation and the role of government support in the mechanisation of the coir industry, the Tobit regression models are used. For analysing the role of firm specific factors on mechanisation, the MI is treated as the dependant variable and the various features of the coir producing firms are considered as the explanatory variables of the regression model. In the case of analysing the role of government support in mechanisation, the independent variables are the governmental interventions in coir industry in the form of both financial and non financial assistances. The details of the regression models are presented in Chapter 4 and 6 respectively. The Chi-square test of normality is used to check the basic assumption of normality of the Tobit regression model. The Collinearity of the explanatory variables included in the Tobit regression model is checked using Variance Inflation Factor. A multi-nominal Logit regression model is used for identifying the firm specific determinants of mechanisation levels. This is used for the sensitivity analysis of the determinants of MI using Tobit regression model.

The non parametric ANOVA (Kruskal-Wallis test) is used in the present study to check the mean differences of different variables since the assumption of normality is violated. To run ANOVA, the normality of the variables is checked using Kolmogorov- Smirnov test. The non parametric ANOVA test, Kruskal-Wallis test, is used,

- to test the mean difference of the EM scores of different products
- to test the mean difference of the per capita production among the mechanisation levels and
- to test the mean difference of the AP_L/hour among the mechanisation levels

In order to check the statistical difference of the average MI of those who availed the governmental financial assistance and those who not availed, the statistical test for comparing means, Mann- Whitney U test, is used since the distribution of the MI is not normal. For checking the association between the mechanisation index and daily production, the Karl Pearson's coefficient of correlation is computed. The detailed explanation of the research methods is presented in respective chapters and sub-sections.

1.6 Scheme of the Study

The study is organised in seven chapters including the introductory chapter. Chapter 2 illustrates the developments in the literature related to the topic of research. This includes a review of theoretical as well as empirical literature in the areas of coir industry and its modernisation, diffusion and adoption of new production techniques, impacts of new

production techniques on performance, determinants of technology adoption and the government role in industrialisation. The potentials of the present study are identified from the literature surveyed and is illustrated in the title research gap. A brief history of Kerala's coir industry, its origin and developments, is the content of the Chapter 3. The impact of trade reforms on coir export and the innovative practices prevailed in the coir industry are also presented in this chapter.

The detailed analysis of the stated objectives of the study using primary data on coir manufacturing is presented in Chapters 4, 5 and 6. The Chapter 4 deals with the measurement of the degree of mechanisation in selected coir producing firms of Kerala and analysing the firm specific determinants of it. This chapter also covers the categorisation of the sample coir firms in to various levels of mechanisation based on the value of Mechanisation Index as traditional firms, low mechanised firms, medium mechanised firms and high mechanised firms. After this, the Mechanisation Index is analysed among various features of the coir producing firms. An analysis of the firm specific factors determining the mechanisation of coir industry is also comes under the purview of this chapter. The evaluation of the impact of mechanisation on the performance of the coir industry is the content of the Chapter 5. The performance is analysed using five major variables, namely, production, productivity, efficiency, number of product varieties and the extent of market access. Out of these, the factor productivities and the total factor productivity (TFP) are taken as key indicators of performance. The Chapter 6 includes a description of various government institutions working in the coir industry, different government schemes for the coir industry in general, and the role of government in mechanisation of the industry of Kerala in particular. Summary of findings and policy implications are presented in Chapter 7.

CHAPTER 2

DEVELOPMENTS IN THE LITERATURE:

Theory and Empirics

- ***Introduction***
- ***Theoretical Background***
- ***Empirical Literature***
- ***Research gap***

CHAPTER 2

DEVELOPMENTS IN LITERATURE: Theory and Empirics

2.1 Introduction

The coir industry of Kerala passes through many ups and downs due to various reasons from its origin. As it is one of the export-oriented industry of the State, changes that took place globally affects it in many ways. Most importantly, the global advancements in technology became transferred to all countries, especially through the channels of trade and it affects the production techniques prevail even in the traditional small scale sectors. Thus coir industry also confronts such a situation and related changes happened in its relations of production and performance. For analysing the current level of mechanisation, its determinants and impacts, it is essential to form a strong theoretical base for the study. Many empirical studies were also carried out in various aspects of coir industry. These works tries to examine its present status, various problems it faces and to provide a decision in choosing the suitable manufacturing technique since a shift in the experienced techniques of production changes the relations of production. In this scenario, the present study attempts to measure the extent of technical advancements in terms of mechanisation taken place in the coir industry of Kerala, its determinants, impacts on the performance and the government role in the technical advancements. For that, an overview of the existing literature on various issues is necessary. This chapter presents the results derived from the survey of both the theoretical and empirical literature related to the topic of research.

2.2 Theoretical Background

Since the mechanisation of coir industry is concerned, the questions relating to its contribution to firms performance and growth, possible levels by which the machines can be adopted, the direct and indirect impacts it contributes, the measurement of the impact of the production techniques, the determinants of its levels and the important agents and ways of interventions for it are the issues to be addressed. For all these issues the existing literature provides some explanations. The summary of the survey of the theories regarding these above discussed concepts are presented here, namely the theories explaining technology and growth, the decisions of choice of technology, and the theories regarding the diffusion and

adoption of new techniques of production. This theoretical basis helped to develop the analytical framework of the study.

2.2.1 Technology and Growth

The determinants of the extent and speed of growth and development of a nation undergo serious discussions from the beginning of the discipline, economics. The 'Father of Economics', Adam Smith, through his work "An enquiry in to the nature and causes of wealth of Nations" (1776) sought to account for the differences between countries in productive capability. He observed that a country's supply of 'the necessaries and convenience of life' depended on two things, the proportion of people productively employed and, more important, the productivity of those so employed. Superior productivity of labour, according to Smith, could explained by the way the workers were organised in production, the skill they possessed, and the effectiveness of the tools and equipments with which they worked. Taking a long view, Smith envisaged economic growth as a process continuing over time with increasing division of labour, technological progress, and accumulation of capital over time. He viewed technological progress as a rise in productivity of workers as a result of increase in division of labour and specialisation.

The role of machinery in the production process, the growth of mechanisation and the factors that are helping in the application of science of production are analysed by Karl Marx (1867). The essential message emerged was clear that, economic growth was the result of continuous improvements in the 'productive powers of labour' (progressively increasing productivity), obtained through technological progress. Marx considered technological change rather than profits as the primer driver of economic growth in capitalist economies. According to him, technological change in each stage of a country's economic development determines not only the economic situation but also the production relations in a society. Marx believed that capital accumulation along with technological progress increases labour productivity and brings about economic growth. He also has the view that, with further economic development, there was a tendency for capital per worker (OCC) to rise. Wages remaining sticky at subsistence level, the more surplus value created by workers is reinvested in new capital goods (increasing OCC). Thus, the labourers were not paid according to their productivity and thus the exploitation of labour force continues.

As a result, the competition among the capitalists, seeking to increase the surplus value forces them to accumulate capital, to make investment. As technical progress and capital

accumulation proceed apace and capitalist economic system develops, the surplus value extracted from workers or rate of their exploitation will increase as a result of the competitive struggle among the capitalists. According to this law (Marxian concept of immiserisation of the proletariat), technical progress and capital accumulation in a capitalist society and consequently the growth in the national income must lead to the fall in the relative share of wages in the national income and rise in the relative share of profits (Marxian theory of distribution). Economic growth is the result of continuous improvements in the 'productive powers of labour' (progressively increasing productivity), obtained through technological progress (Marx, 1867). Marx classified the factors of production into variable capital (labour) and constant capital (machines). Thus mechanisation in coir industry can be treated as the increased use of constant capital and the resulted increment in Organic Composition of Capital (OCC). Thus as per the Marxian analysis, the increased OCC worsened the condition of labour force, despite of the increase in productivity, by decreasing the share of Variable Capital (VC) in total output (share of wages) and the consequent increment in the share of Constant Capital(CC). So, the present study utilised the theoretical framework developed by Marx to evaluate the impact of mechanisation in labour productivity and factor shares.

Schumpeter (1934) through his innovation theory laid great stress on the role of technical innovations in bringing about economic growth. According to him, the innovation does not mean invention; rather it refers to the commercial application of new technology, new materials, new methods and new sources of energy. It is the entrepreneur who carries out the innovations and organizes the production structure more efficiently. According to him, innovations occur in spurts rather than in a smooth flow and hence economic progress is not a smooth and uninterrupted process. The pace of economic progress is punctuated by the pace of innovation. His theory of development assigns paramount role to the entrepreneur and the innovations introduced by him in the process of economic development. He opined that, the rate of growth of output depends upon the rate of growth of productive factors, the rate of growth of technology and the rate of growth of investment friendly socio-cultural environment. Schumpeter held that the alterations in the supply of productive factors can only bring about gradual, continuous and slow evolution of the economic system. On the other hand, the impact of technological and social change calls for spontaneous, discontinuous change in the channels of output flow.

In the long run, economies converge to their steady state equilibrium and that permanent growth is achievable only through technological progress (Solow, 1957). Neo classical

models of growth developed in late 1950's and 1960's mostly by the American economist Robert Solow and the British Economist J E Meade considered two factor production functions with capital and labour as determinant of output. Besides, it added exogenously determined factor, technology, to production function. The Solow model uses the production function of the form, Y=A f(K,L). Where, Y= GDP, K= stock of capital, L= amount of unskilled labour and A= exogenously determined level of technology. Considering this way, A represents the Total Factor Productivity (TFP). When we empirically estimate production function specified in this way, then the contribution of A to the growth in total output is called 'Solow Residual', which means that the TFP really measures the increase in output which is not accounted for by changes in factors, labour and capital. If there is no technical progress, then output per capita will ultimately converge to steady state level. The standard Solow model predicts that, in the long run, economies converge to their steady state equilibrium and that permanent growth is achievable only through technological progress. The 'Solow residual' measures the exogenous increase in total factor productivity (TFP) during a particular time period. The increase in TFP is often attributed entirely to technological progress, but it also includes any permanent improvement in the efficiency with which factors of production are combined over time. J E Meade (1972) stated the three principal means where by an economy can grow. They are capital accumulation, growth of working population and technical progress. He tries to explain the system develops through time as the stock of machines increases, as the working population grows and as productivity is raised by virtue of technical progress.

The new growth theory extends the neo classical theory by making the rate of technological progress as endogenous factor. Endogenous growth theory [Uzava (1965), Romer (1986) and Lucas (1988)] holds that investment in human capital, innovation, and knowledge are significant contributors to economic growth. The theory also focuses on positive externalities and spill-over effects of a knowledge-based economy which will lead to economic development. The relation between output and technology is not same as between output and other inputs, capital and labour. This is because in Romer's model, the output of an individual firm not only depends on its own level of capital and labour but also the technology used by other firms whose benefits also accrue to it. That is, the benefits of the new technology discovered and used by a firm will spill over to the other firms in the economy (Romer, 1990). It is clear from this that, the technological improvements have

positive externalities that improves the conditions inside and outside the firm and thus accelerates the process of economic developments.

By considering these theories that focuses the role of technology in growth of output, the present study develops its framework for analysis. The researcher used the neo-classical frame work of production function (the Cobb-Douglas production function) for explaining the impact of technology on the performance of coir industry where as the technology is treated as the use of electric machines in coir production and is determined exogenously. This production function is utilised to measure the efficiency parameter, TFP, marginal productivities, returns to scale and factor shares. The study also made use of the Marxian explanation of labour productivity growth through the technology and related implications in the exploitation of the labour force and changes in the distributive shares of output.

2.2.2 Choice of Technique

A choice between alternative techniques of production is a major problem in the planning for developing countries. This is because a particular choice of technique of production affects not only the magnitude of unemployment but also the rate of economic growth. Schumpeter's theory of development (1961) assigns paramount role to the entrepreneur and the innovations introduced by him in the process of economic development. In a world of high degree of risk and uncertainty, only entrepreneurs will be able to undertake innovations not only for profit but also due to a desire for conquests in the competitive world or have the joy of creating, he continues. Thus he pointed out the role of entrepreneurs or manufacturers in technology decisions.

Technological advance involves considerable uncertainty. When a person or organization begins a search for a new product or a process it is never clear exactly what the precise outcome will be. It is very difficult to predict with any accuracy which future technologies will be useful, and which will be bought at a profitable volume and price (Nelson, 1982). Thus the innovations and the resulted introduction of new techniques in the process of production involve risk and uncertainty regarding its effects. The risks and the returns are connected. Those having high risks may accrues high returns and vice versa. Thus a decision regarding new production techniques also involves the choice of risk-return portfolio. This also can be interpreted as; those who have high returns only look for technical advancements.

The dilemma of the latest technology versus intermediate/ appropriate technology impinges both on physical investments and investment in human capital (Dube, 1988). The Third World cannot opt permanently for low technology. This would lead yet again to the perpetuation of the great divide between the more developed and less developed. Small may be beautiful, but it does not always work and it does not solve all problems. Therefore depending on the nature of activity, a country would have to choose from high, medium and low technology. Two considerations in this respect are paramount. Technology must function as an instrument in the service of humanity and not the reverse. Second, the less developed countries must not be persuaded to choose options that will relegate them to permanently retarded scientific and technological positions.

Galenson & Leibenstein (1955) put forwarded the criteria of maximum re-investible surplus for choosing production techniques. In their view, the choice of technique in planning for developing countries is not to be decided from the point of view of private profit maximisation or private cost minimisation. In it, choice of capital intensity has to be decided keeping in view the problem of mass unemployment and the need for rapid economic growth to raise the levels of living of the people. For the optimum choice of the technique of production or capital intensity, two alternative criteria have been compared by them. They are the maximum output and the maximum re-investible surplus criteria.

With a higher capital intensity and higher rate of growth, the rate of growth of employment will be higher, though the level of present employment will be less. On the contrary, with lower capital intensity, the surplus is smaller and concurrently the rate of growth of output and employment will be smaller, though the present level of employment will be large. Thus the choice of capital intensity implies the choice between the higher levels of present employment and output on the one hand and the higher rates of growth of employment and output on the other. Thus it is argued if you are interested in maximising the current level of employment and output choose a lower capital intensive technique. On the other hand, if you want a higher rate of growth of employment and output, choose a capital intensive technique.

Sen (1975) also propounded surplus maximisation criterion by introducing time horizon and social welfare function in deciding about choice of technique by the planning authority or Government. To resolve conflict or dilemma in choosing between present consumption and future consumption, Prof. Sen has proposed the ‘time series criterion’. On the basis of this time series criterion, Sen argues that if social welfare function of a society is such that it is

prepared to wait up to time (thirty years) output and employment sacrificed at present could be fully compensated and after this time, the society would enjoy higher levels of consumption and employment by choosing capital intensive technique. However, if social welfare function is such that society prefers present output and employment to future consumption and employment, then it may choose labour intensive technique (Sen, 1975). For creating adequate employment opportunities through industrial growth, there is a need for developing and adopting an 'intermediate technology' which requires less capital per work place without loss of efficiency (Schumacher, 2011).

Schumacher (2011) also argued that, given the limited investible resources, developing countries would fail to create enough jobs by concentrating on the modern capital intensive industries with high capital requirement per job. In the report which Schumacher prepared for the Indian Planning Commission, he argued that 'a technology must be evolved which is cheap enough to be accessible to a larger sector of the community than the very rich and can be applied on a mass scale without altogether excessive demands on the savings and foreign exchange resources of the country'. Schumacher has recommended the use of intermediate technology or what is also known as appropriate technology by the developing countries like India. By intermediate or appropriate is meant the technology which is labour intensive and yet highly productive so that with its use enough employment opportunities are created along with more production.

George McRobie (1977), another principal exponent of 'Appropriate Technology Movement' argues that, 'to be appropriate the technology should be capable of local operation and maintenance, and local or at least indigenous manufacture; it should be owned and operated by its users, and result in a significant increase in their net income; it should utilise to the maximum extent local and renewable raw materials and energy; and it should lend itself to widespread reproduction using indigenous resources and through the medium of local markets.

Considering these theoretical developments, the present study is trying to explore the appropriate technology for coir industry by considering the factor productivities and efficiency of the production process. The present study considers that, an appropriate technology for an industry like coir should be that one which enhances both productivity and efficiency.

2.2.3 Diffusion and Adoption of New Techniques of Production

Diffusion of Innovation Theory (Roger, 1995) points out that there are four elements that influence the spread of a new idea: the innovation, communication channels, time and social system. The process of diffusion consists of five stages, namely, knowledge, persuasion, decision, implementation, and confirmation. It results in six categories of users: innovators, early adopters, early majority, late majority, laggards and the leap forgers. This theory provided the concept of S-shaped curve of adoption which was also called as the epidemic model of adoption. According to this curve, spread of infections among the population can be held as an analogy to the pattern of spread of a new technique or idea. According to this analogy, initially the rate of spread is slow. In the mid range, the rate of spread accelerates and finally the rate of spread tapers off resulting in an S-shaped curve.

Through Technology Acceptance Model (TAM), Fred D Davis (1989) explains how users come to accept and use a technology. The model suggests that when users are presented with a new technology, a number of factors influence their decision about how and when they will use it, notably, "perceived usefulness" and "perceived ease of use". Perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" and perceived ease of use is "the degree to which a person believes that using a particular system would be free from effort".

Based on the theories on diffusion and adoption of new techniques of production, the researcher tried to understand the factors that determine the mechanisation levels of coir industry of Kerala.

2.3 Empirical Literature

The survey of empirical literature focused the issues like the present status of the coir industry and its modernisation, the diffusion and adoption of new production techniques and its determinants, the impacts of the new production techniques on the performance, and the governmental role in industrialisation. So the empirical literature surveyed are presented under five broad categories such as, coir industry and its modernisation, technology diffusion and adoption, determinants of technology adoption, impacts of the adoption of new manufacturing techniques, and the government and Industrialisation.

2.3.1 Coir Industry and its Modernisation

In a developing economy like India the small and medium scale industries are important due to its contribution in rural employment and livelihood. Joseph & Kaul (2017) examines the role of various micro, small and traditional industries in employment and income generation in Indian economy and have made detailed discussions on key issues relating to the concerned sectors, various aspects of the revitalisation of traditional industries, problems related to the implementation of programmes and also perspectives to micro, small and traditional industries in the state during 13th five year plan (2017-2022). They aims to examine the current status, challenges and opportunities in regard to traditional, micro and small industries in Kerala.

An industry like coir, which uses traditional outdated technology in this modern era, may confronts so many problems. These issues with its reasons and possible solutions are addressed by a number of literatures. Prakash (1977), Jose (2002), Coir Board (2008), Amutha (2013), Mohanasundaram (2015), Ashik (2018) and Titty (2015) made attempts in this field. They listed some problems of coir industry of Kerala, like unavailability of labour, lack of government support towards traditional methods, and the problems faced by labours like low wage rate and health issues, obsolete production technology, difficulties in the adoption of modern technology, labour scarcity during the harvesting periods of agricultural crops, absence of an effective marketing system, lack of marketing infrastructure, concentration of markets and demand in select regions, production in only sunny days, irrational selection and mismanagement of human resources in all its functional areas, environmental problems and unhealthy competition between mechanised units and non-mechanised units. Due to paucity of work, there has been reports that the workers engaged in the small scale product manufacturing sector have been migrating to other greener pastures as the sector is unable to provide regular employment and decent wages (Coir Board, 2008). Prakash (1997) pointed out the existence of dual prices for coir products in domestic and international markets. Ashik (2018) concludes that there is lack of technological up gradation in coir industry and the manufacturers are unaware of the market price of coir products and technological up-dation.

Amidst of these problems some studies pinpoints some prospects also for this industry due to its eco- friendly nature and increasing awareness and consciousness towards environment. Amutha (2013) points out that, the coir products are eco-friendly and relatively durable when

compared with the other competitive products. The future of a nation could obviously depend upon the protection of its environmental and natural resources, she continues. The conduct of awareness programme frequently would result in the consumer awareness and encouragement of consumers to utilize coir products. Some other solutions are provided by Jose (2002) and Mohanasundaram (2015). Improving value addition and access to technology and information would solve most of the operational problems (Mohanasundaram, 2015) and diversification is essential to gain competitive advantage (Jose, 2002).

Apart from the problem faced by the industry as a whole, the manufacturer or owner who suffering these issues have their own problems also. Venugopal (2019) focused on the problems of small coir manufacturers. He opined that the small coir manufacturers are at once employers and labourers. They work along with their workers, arrange the raw materials, collect orders, make sales, disburse weekly wages and pay bonus. Each of these apparently simple tasks has assumed gigantic proportions that are too hazardous for small manufacturers with meagre resources to handle.

The factors that led to these problems are also important for seeking solutions. Sathish & Krishnathulasimani (2016) focused on the determinants of the problems of coir industry in Tamil Nadu which adopted large amount of technology and reaping its benefits. They pointed out that, rural industrialization plays a key role in the Indian economic development. Among the rural small-scale industries, coir industry is the traditional agro based rural industry, which has got the attention of both the entrepreneurs and the government today. However, there are number of problems arise practically at every stage from collection of raw materials to marketing of coir products. There are number of factors determining problems in coir industry that includes, the supply of power, supply of labour, labour co-ordination, labour performance, availability of raw material, less production innovation, government concession for coir production, problem on exporting goods, raw material cost, transportation cost, labour cost, cost of power and overhead cost.

Rosario et al., (2004) analyze the crisis situation of coir industry in Srilanka, to find the causative factors and to propose recommendations for the development and sustainability of the industry. According to them, the main factors contributing to the crisis are unfavourable trade policies, trade barriers, human resource problems, poor trade behaviour, export barriers, poor product marketing strategy, high cost of production, poor industry regulation, and threats from the global marketing environment. Their recommendations for the development

of the industry include policy changes, improved working conditions, trade strategies, product diversification, mechanization, quality assurance, market development, strengthening of market position, and regional cooperation.

From its origin, coir industry faces some shifts in its development process. For evaluating the problems, prospects and performances this also is taken in to consideration. This sort of an attempt is made by Isaac (1982), Rajan & Kumar (2004) and Indu (2014). Isaac (1982) analyses the transition of coir industry and opined that, it is the class struggle between capitalists and labour force taken place in the case of mechanising the industry and viewed as the process of transformation of a capitalistic system. He has the view that the attempts to mechanise the coir industry became a failure because that, the rural labour so cheap as to compete out even a mechanised large scale production system. Indu (2014) focuses on the changing nature of organisation of coir production in Kerala by assessing the transitions among different forms of organisations engaged in various production activities. But Rajan & Kumar (2004) noted that, the history of coir industry in Kerala has undergone many shifts. These shifts are, moving the industry to other states, manual to mechanisation, non availability of labour for the traditional extraction works, scattered type of plantations and organised plantations in other states make differences in husk collection and fibre extraction and introduction of substitutes like, jute, plastics, sisal, paper pulp etc. They recommended action plans that includes introduction of a new husk collection system by incorporating kudumbasree, gramasree and other self employment groups, creating awareness on the potentials of the coir industry that help to store and sell the husk by people, mechanisation (low cost and low power consuming ones should be invented and implemented) and adapting the RUBCO model for the production of fibre and form a consortium to create the competitive advantage based on the lines of Industrial Infrastructure Upgradation Scheme (IIUS)

As a solution to the various problems faced by the coir industry many studies lifted mechanisation and following modernisation of the industry. The focus of Isaac et al., (1992), Rammohan (1999), Sabarinath (2000), Menon (2005) and Isaac & Mathai (2017) are in the field of mechanising coir industry. The concept of modernisation of coir industry is well explained by Rammohan (1999). As per his opinion, technological change is, however, not merely a matter of finding new machines for old. It involves several other important social questions. The new techniques could be ideal from the efficiency point of view but it could

be inappropriate to the social economy where these are applied. The ongoing technological change in the industry addresses some important issues like the physical conditions of work, environmental implications of production processes, and possibilities of value-addition. He assured that the new technology resolves these issues with varying degrees of success. He concluded by saying that, the ongoing technological change appears to have been more successful in improving the physical conditions of work and reducing ecological consequences but less successful in increasing productivity and workers' income.

Sabarinath (2000) had the view that, technological change takes place in various spheres of the industry as a part of the modernisation process. He has of the opinion that, technological change is not a homogeneous process, but one which involves the application of widely varying types of scientific and technical knowledge to production problems. A shift from an existing technology to a higher technological frontier is a complicated move because the level of technology in use is shaped by a host of factors other than economic factor. A higher technology may be ideal from the point of view of productivity but may not be advisable to the social economy where they are applied. Regarding the mechanisation of coir industry, Menon (2005) has the view that the phase of modernisation of different sectors of the industry needs to be accelerated and pave way for cost effective and productive equipment and machinery to replace the age old tradition and outmoded production and processing equipment. According to him, training forms an integral part of modernisation process.

Isaac et al., (1992) and Issac & Mathai (2017) attempted to outline a strategy to arrest the decline and revive the coir industry to its past glory but in a new paradigm by the efforts of modernisation. They recommended wide scale mechanisation of activities across all elements of that value chain - fibre production, spinning of yarn, weaving of mats and mattings and diversification of production in to non-woven products. It involves a fresh approach to existing and new markets for the conventional use of coir and also new industrial and commercial application. But it is also necessary to play the balancing act between the old and the new: Mechanisation without losing the extensive variety of Kerala's coir product legacy and a transition into the future without rejecting the historic fabric. However, technological up-gradation of these industries may not only bring about increases in gainful employment but might also result in a reduction of the labour force involved in the industries concerned, unless it is complemented by a substantial expansion of the industrial base and a simultaneous creation of new employment opportunities therein (Isaac et al., 1992).

It is evident that the efforts to modernise this industry faced serious resistance were there from the various sides especially from labour union due to the fear of huge labour displacement by the introduction of machinery. Isaac (1983) mentioned that, the trade unions and small producers are aware that handlooms cannot compete with the machine. The fear of unemployment has forced them into a vigorous struggle against mechanisation. In this view Kannan (1976) opined that the switchover to a different technology demanding use of energy and skill that will increase productivity and hence the surplus generated per worker and the rate of surplus will be higher. But here the switchover has to be seen in the light of the magnitude of displacement of labour that will follow. Switchover to a new technology of large scale processing will mean displacement of large numbers of persons without any prospect of alternative employment. Once a changeover from the traditional method is made, the organisation and the ownership of production and therefore the composition of beneficiaries of higher surplus will also undergo a change. In the traditional method, production is mainly carried on in the household sector. Therefore whatever little surplus is generated is enjoyed by the worker households. A switchover to a mechanised system involves larger initial investment on fixed capital. Given the level of the income of the households engaged in these activities, it is certainly beyond their capacity to invest the required capital. In this respect a decision in favour of a particular technological change boils down to a political question involving also a judgement as to who should get the surplus. In this case we have seen that the workers stand to lose both in terms of employment and surplus.

The issues related to labour displacement and huge levels of unemployment are not alone the hurdles for mechanisation of this industry. Some other issues also there when switching over to a new technique. The advantages of the experienced technique, huge quantum of investment in mechanising the industry, quality and skill of the existing labour force are the major issue confronts. Menon et al., (1973) focuses on the perspectives of labour prevails in the industry of the period. He has the view that, technological change has invariably led to resistance because its long term benefits are accompanied by short term losses especially to labour. In the developing countries of today, a serious dilemma exists between the maximisation of employment on the one hand and maximisation of growth and productivity on the other in a finite time horizon. The arguments about technological transformation and employment generation generally lead to a vicious circle. It is true that mechanisation can bring steady employment to the few who would be considered fit to be absorbed into that

sector. The situation can be remedied if a composite plan for the development of an area is thought of and chalked out along with the implementation of the innovative measures in the coir industry. This may be possible by a rearrangement and a simultaneous development of other industries in and around centres where coir industry has developed at present.

Kannan (1998) takes a critical look at the political economy of labour and development by examining the roles of labour unions, State, and capital. He traced out the three dilemmas relate to technological choice in the face of high and rising labour costs in labour-intensive activities for maximising long-term growth and employment. These are the mismatch between labour-supply and labour demand as a result of changing job expectations of the younger generation in a technologically stagnant economy, lack of new investment despite growing loanable funds and declining resistance to technological change.

The impacts of the efforts to mechanise the industry was also analysed by various researchers of this field. Menon (2002) tries to measure the extent of technological change in the Coir Industry of Kerala and Tamil Nadu, analyse the growth performance, productivity (both partial and total factor productivity), capacity utilisation and capital intensity of the Coir Industry of Kerala and Tamil Nadu. He has of the opinion that, the technological change in the Coir Industry of Kerala is very meagre compared to that of Tamil Nadu. For the analysis of the growth performance of Coir Industry in Kerala and Tamil Nadu he employs the criteria like number of factories, gross value added, capital stock, number of workers and employees, total emoluments, productivity of labour and capital, capital intensity and capacity utilisation. Sujay (2018) also made an attempt to measure the impact of technological change in coir industry. He concluded that, the introduction of machines strengthened the existing division of labour, improved quality of life and productivity of coir workers. Rammohan (2000) traced the long run trajectory of technological change in coir yarn spinning industry of Kerala focussing on inter-linkages of structures and agencies. He concluded that technological change in coir yarn sinning industry of Kerala was influenced by varied set of factors at varied point of time. He also remarked that the 'Pollachi Model' cannot be replicated in Kerala because; it is not merely a combination of machines. It is the outcome of the specificities of organisation of agriculture, trade, technology and labour and thus provides certain clues regarding the technological organisation of the industry in Kerala.

2.3.2 Technology Diffusion and Adoption

The concepts of technology, its diffusion and adoption are relevant as far as a research regarding the mechanisation of coir industry is concerned. Attempts were made to define technology by Landau & Rosenberg (1986) and Evans (2019). Technology in the broader sense may be defined as the means by which man undertakes to change or influence his environment. It is the totality of methods rationally arrived at and having efficiency in every field of human activity (Evans, 2019). He also defines, appropriate technology as one that will be cheaper, smaller, giving a wider, more equitable distribution of capital investment, will create employment, providing work opportunities in areas where people live, will foster the use of local capital, skills, and raw materials and reduce reliance on the importation of these factors; will produce goods primarily for local consumption and use. But Landau & Rosenberg (1986) defines it as an extroverted activity involving a search for workable solutions to problems. They have the view that, markets are the basic institutional framework within which new technologies are evaluated and thus the long-term economic growth relies on the performance of new technologies within the framework of markets.

From the general definition of technology, we are focusing on the manufacturing technology since the present study is concentrated on coir manufacturing. Manufacturing technology is concerned with the flow of materials from the acquisition of raw materials, through conversion in the workshop to the shipping of finished goods to the customer (Hitomi, 1996). He has of the view that, production management deals with the flow of information, by which the flow of materials is managed efficiently, through planning and control techniques. Industrial economics focuses on the flow of production costs, aiming to minimise these to facilitate competitive pricing. As advanced economies shifts from a post- industrial to an auto industrial model, all kinds of routine work is being replaced by machines (Murphy, 2015). Economists see modernisation primarily in terms of man's application of technologies to the control of nature's resources in order to bring about a marked increase in the growth of output per head of population (Weiner, 1966).

Adopting a technical innovation, the first stage is its diffusion. Diffusion of the technological knowledge was the centre of the analysis of Comin & Hobijn (2004) and Spencer et al., (2012). Most of the technologies considered, originated in advanced economies and are adopted there first. Subsequently, they trickle down to countries that lag economically (Comin & Hobijn, 2004). They also have the view that the most important determinants of

the speed at which a country adopts technologies are the country's human capital endowment, type of government, degree of openness to trade, and adoption of predecessor technologies. Whereas, Spencer et al., (2012) tries to assesses the diffusion of innovation theory and the technology acceptance model, and explores the factors influencing the decision to engage in technology adoption in small owner-managed travel firms. Their work aims to identify the genesis of adoption decisions in particular where owners are themselves the managers and provide leadership for the organization. They found that due to simple hierarchical structures and decision-making processes which are further exacerbated by immediate self-interest. Leadership is the most significant driver of technology diffusion.

In developing countries, technological shifts are prompted chiefly by external stimuli (injections of technology, competition from foreign goods and the demands of the world market) and only partly by internal factors (Skorov, 1978). Technological innovations penetrate the developing countries as separate additions to existing productive capacity. According to him, it form isolated centres of modern manufacturing production and infrastructure amidst a mass technically backward, small scale craft and artisan production units which essentially belongs to a different historical epoch. The isolated nature of the diffusion of technological innovations means that the process of technical renewal does not affect the main mass of productive assets.

Gaps appear between the different parts of production capacity leading to the emergence of serious disproportions in the economy. Due to the pattern of diffusion of technology, there is reason to suspect that technology use in rural regions may lag behind adoption in urban areas (Gale, 1998). Models of technology diffusion and product industry cycle models often assume that new inventions and techniques are devised and adopted first in cities, where contacts and communication are plentiful, later spreading to rural areas. But, he finds essentially no difference in technology use due to urban versus rural location. Designing appropriate policies for innovation and technology requires an understanding of how technology is generated and diffused (Papaconstantinou, 1997).

One important feature of the technology is the externality it creates. Endogenous growth theory (Romer, 1994) focuses on positive externalities and spill over effects of a knowledge-based economy which will lead to economic development. Katz & Shapiro (1986) analyze technology adoption in industries where network externalities are significant. Their key findings include compatibility tends to be undersupplied by the market, but excessive

standardization can occur; in the absence of sponsors, the technology superior today has a strategic advantage and is likely to dominate the market. When one of two rival technologies is sponsored, that technology has a strategic advantage and may be adopted even if it is inferior. When two competing technologies both are sponsored, the technology that will be superior tomorrow has a strategic advantage.

Some inhibitions are there in the adoption decisions of a modern technology instead of a used and experienced technique even in large firms. So it is interested to examine this matter in small firms. This is attempted by Langley & Truax (1994) and Antonioli & Mazzanti (2009). The former develops an inductive process model that views the technology adoption process as a partially nested set of three parallel and interacting sub-processes that are different in nature: the strategic commitment process, the technology choice process and the financial justification process. While the later analysed what innovation drivers, with a particular focus on environmental innovations, are spurring SME labour productivity, the principal source of firm competitiveness. Their results show that training and organisational innovations are the main "non environmental" significant drivers, operating effects through various elements.

In a similar way, Kamath (2014) offers an innovative examination of how 'low–technology' industries operate. Based on extensive fieldwork in India, he fuses economic and sociological perspectives on information sharing by means of informal interaction in low-technology clusters of a developing country. In doing so, he sheds new light on settings where economic relations arise as emergent properties of social relations. He examines industrial innovation and microeconomic network behaviour among producers and clusters, perceiving knowledge diffusion to be a socially-spatial, as much as a geographically spatial, phenomenon and stated that, not mere acceptance of a technology is a matter.

2.3.3 Determinants of Technology Adoption

For adopting a new production technique, the awareness of it is a prerequisite. The awareness of the technology is influenced by various socio, economic, demographic characteristics in which the technology is adopted. The determinants of technology awareness is analysed by Daberkow et al.,(2003) and Adewuyi et al., (2006). Daberkow et al., (2003) identified that the education and computer literacy of the operator, full-time farming and farm size positively affected the awareness while the effect of age is negative. Adewuyi et al., (2006)

pointed out that the age of the manufacturer, education, farm size and exposure to extension agents are the factors determining the awareness.

The decision to adopt a new technology is not an easy thing. It varies between firms due to factors internal and external to firm. Efforts were made by many economists in this field and the works done by Nelson et al., (1967), OECD (1974), Atanu et al., (1994), Gale (1998), Burton et al., (1999), Mitropoulos & Tatum (1999), Gonzalez (2005), Lippert & Davis (2006), Koundouri et al., (2006), Katungi (2007), Varukolu (2007), Lin & Zhang (2009), Saberi et al., (2010), Gosh (2010), Kuriakose et al., (2011), Okello et al., (2014), Narayanamoorthy et al., (2014) and Oladeji et al., (2015) examined various determinants of the adoption of new manufacturing techniques. Saberi et al., (2010), provide a guide to successful implementation of Advanced Manufacturing Technology (AMT) and to determine the most critical organisational and strategic elements that make a firm able to use AMT in enhancing performance. They suggest that, the utilisation of AMT will not also ipso facto guarantee performance but will further require appropriate changes in the firm's structure and infrastructure and continue with performance appraisal to improve the ability.

Nelson et al., (1967) and Mitropoulos & Tatum (1999) focused on the factors that influences technology decisions but in different aspects. Two broad factors are at work in influencing the direction of technological advance (demand factors and supply factors) (Nelson et al., 1967). They explain that, demand factors are the differences and changes in the rewards from particular kind of technological advance. Two factors lay behind the changes in the demand for particular advances. First, there was an increase in the demand for the product to which the advance is applicable. Second, there was a growing shortage of a factor of production which led to effort aimed at mitigating the effect of that shortage. Thus efforts to advance technology will tend to be drawn toward reducing cost and increasing product performance in industries and classes of products where demand is raising, and toward saving on factors whose relative cost is rising. Supply factors are differences and changes in the stock of relevant components and materials, and of knowledge, and the number of people who possess the knowledge. They concluded that, three broad factors lie behind the changes in these variables, viz, industry size and growth, advances in science and education, and the development of a scientific base under the technology of an industry. Mitropoulos & Tatum (1999) presents the decision-making processes managers' use in the adoption of new technologies, the factors affecting these processes, and the strategies managers use to deal

with the uncertainty involved in such decisions. Their recommendations focus on the strategies that managers can use to increase the likelihood of successful adoption of new technologies.

What stimulates or prevents the technological adoption is a key factor that determines the extent and speed of it. Gonzalez (2005) made this kind of an analysis. According to him, three sets of interrelated factors prevent but also stimulate the widespread adoption and diffusion of technology: these are factors external and internal to the firm, conditions of the potential adopters and characteristics of the technology. These factors are included in the so-called 'triangular model'. His empirical study shows that clean technology adoption decisions are the result of an interaction between these factors, often involving contradictory signals for the potential adopter. He also has the view that, technological change has a relevant role to play in the transition towards a sustainable industry.

In recent years, development practitioners and policy makers have increasingly become interested in social capital as an additional instrument for economic development (Katungi, 2007). She develops a model of technology adoption that incorporates social capital and offers two explicit mechanisms through which social capital may influence technology adoption. The results of the study indicate that different aspects of social capital shape the decision to use and the extent of use of an improved management practice, but the nature of effect is specific to the practice as well as the form of social capital. Participation in associations and the characteristics of those associations are important determinants of production management decisions. Aside from social capital, market incentives and household factor endowments were the most important factors in decisions regarding use of improved production techniques, she continues. The human and financial capital play important role in awareness and adoption of new techniques in production (Okello et al., 2014).

The lost productivity and high costs associated with the existing framework necessitate the identification of alternative frameworks for facilitating the successful acceptance and continued internalization of new technologies (Lippert & Davis, 2006). Internalization is defined as the effective and continued use of a technology over time. They introduce a conceptual model for examining the effect of trust and planned change initiatives on technology adoption behaviour. They also propose that technology trust and interpersonal

trust, when coupled with planned change initiatives, lead to greater technology adoption and internalization.

Technology decisions are important because it involves twin choices of increased risk and returns. Innovation and adoption of new manufacturing techniques involves considerable uncertainty. Atanu et al., (1994) and Koundouri et al., (2006) analyses the technology decisions under production uncertainty and incomplete information. Atanu et al., (1994) identified economic and subjective factors affecting technology adoption and its intensity. Producers' adoption intensity is conditional on their knowing about and deciding to adopt the new technology. They find that larger and more educated operators are likely to adopt more intensively. In contrary to this, Koundouri et al., (2006) found that, farmers choose to adopt the new technology in order to hedge against production risk. In addition, they show that the farmer's human capital also plays a significant role in the decision to adopt modern, more efficient irrigation equipment.

The appropriateness of a technology to be adopted cannot emerge out of an exercise deliberately undertaken with some preconceived ideas; rather, it is the knowledge, experience, hereditary skills, the requirements of the trade, the suitability of the raw materials for being processed by an appropriate system of technology etc. which will enable an entrepreneur to decide for himself the technology should adopt (OECD, 1974). The OECD examined the process of adoption across industries and countries, its impact on productivity, on employment and skills, and the role of technology in shaping international competitiveness. The study points out that, capacity of firms to innovate depends on a multitude of factors, not least the efforts they make to create new products or improve production processes, the extent of skills in their work force, their ability to learn, and the general environment within which they operate.

The various characteristics of the plant are one major determinant of technology adoption. The characteristics of a plant are a more important determinant of technology use than a plant's location (Gale, 1998). In particular, technology use varies with plant size, the nature of the production process and the plant's industry. A few location characteristics are associated with technology use. The plants tend to use more technologies in locations with higher levels of schooling. Technology use is associated with lower concentration of minority population and younger labour force. A rural urban technology gap may still exist due to concentration of technology, intensive industries in urban centres and concentration of low-tech industries

in rural locations, he continues. Varukolu (2007) analyses the status and effects of organisational factors on the level of technology adoption. He considers firm size, export orientation, top management's commitments, cost of capital, technical skills and competitive advantages and remarked that, firm size positively and export orientation negatively influences the technology adoption. This matter is also analysed by Burton et al., (1999). According to them, the age of the manufacturer, firm size and gender are the significant variables to determine the adoption of new production techniques. Besides, gender and firm size, access to credit, access to media, household size and income also determines the awareness and adoption of technology (Oladeji et al., 2015). Narayanamoorthy et al., (2014) opined that output varieties, farm characteristics and human labour determine the use of machines. A set of interrelated variables like size of farm, irrigation, access to credit, government extension support services and experience of the farmer determine the farm mechanisation (Gosh, 2010). He also noted that, irrigation, access to credit and size of land holding positively influences mechanisation whereas, age negatively. Kuriakose et al., (2011) identified that, the firm employment, R & D, export status, foreign ownership/ FDI status, subsidiary status, financial constraints, intellectual property rights, registration of industrial design and registration of a trade mark are the important determinants of technology adoption and opined that, a positive correlation exists between technology and export status.

Production technology changes overtime and these changes in technology have some effects on production function itself. The attitudes of the producers towards changing technology may differ and this resulted in differences in degrees of adoption of various technologies (Lambert, 1966). He points out the determinants of adoption of a new technology are the number and complexity of the operational steps required in the manufacturing process, the number and complexity of the operations assigned to each man-cum-machine and the extent to which the skill requirements are transformed from man to machine. As each of these three dimensions changes, the nature of the workforce tends to change. A macro level perspective of determinant of technology adoption is given by Lin & Zhang (2009). They analysed the appropriate technology in LDCs and remarked that, an LDC's optimal industrial structure and the most appropriate technology are exogenously determined by that economy's endowment structure.

2.3.4 Impact of Technology Adoption

The enquiry towards the stimulus of economic growth is the centre theme of analysis in development economics. Traditionally, economists have considered the accumulation of conventional inputs such as labour and capital to be the primary force behind economic growth. The natural resources a country possesses are a factor in development but the amount of man-produced capital and the rate of capital formation play a more important role in development than the primary resources (Wellisz, 1966). He continues by pointing out that, a worker with adequate tools can produce more goods than one who is ill equipped. Yet, technology imposes limits on the usefulness of capital. With the help of new technology, a resource poor country can overcome its natural handicaps. Now, however, many macroeconomists place technological progress at the centre of the growth process (Helpman, 1998). This shift is due to new theoretical developments that allow researchers to link microeconomic aspects of the innovation process with macroeconomic outcomes. Most economists have viewed technological progress as an incremental process. A few have focused on the role of drastic innovations (those that introduce a discontinuity). Helpman (1998) concerned with the type of drastic innovation called General Purpose Technologies (GPTs). A GPT has the potential to affect the entire economic system and can lead to far-reaching changes in such social factors as working hours and constraints on family life.

Verspagen (2006) also addresses the issue of technology and growth, and argues that technological and organizational innovations are responsible for the lengthy period of gradually accelerating growth. He also tries to compare the two major approaches of growth, neo-classical and endogenous growth theories and argues that the gap between these two approaches is rooted in fundamental differences in their basic world views. The neo-classical tradition adheres to a world view in which cause and effect are clearly separable, and growth is a steady state phenomenon, the evolutionary worldview is one of historical circumstances, complex causal mechanisms, and turbulent growth patterns that appear to be far from a steady state. Greenwood et al., (1997) also made an attempt in this field. They examine the role of investment-specific technological change played in generating post-war U.S. growth. The premise is that the introduction of new, more efficient capital goods is an important source of productivity change, and an attempt is made to disentangle its effects from the more traditional Hicks-neutral form of technological progress. The quantitative analysis suggests that investment-specific technological change accounts for the major part of growth.

The similar view on technology, technology as the centre of economic growth, is analysed by Malecki (1997), Mehta (1980) and Stoneman (1983). Mehta (1980) had the view that, technological progress is one of the most important factors responsible for economic growth. He analysed the role and rate of technological change in the Indian industrial sector. He opined that, the Total Factor Productivity calculated shows that the conventionally measured inputs, labour and capital explain only a minor percentage of growth of output. The factor productivity indices estimated exhibits a declining trend implying the decline in overall efficiency. Thus he concluded that the technological changes accelerate industrial growth and thus economic growth. Stoneman (1983) goes further by analysing the impact of technology on output, employment, growth and income distribution. He argued that, technological change is a change in economy's information set detailing the relationship between inputs and outputs in the economy. To be even more concrete, technological change is the process by which economies change over time in respect of the products they produce and the process used to produce them. Thus put a positive impact of technology on the economy. Malecki (1997) uses the framework of regional development to encompass economic dynamics at all spatial scales: national, regional and local. The concept of regional development is introduced as the qualitative or structural features of a region's economy, as opposed to its sheer size or growth rate. He argued that, technological capability is closely related to capability in R&D and concluded that, economic change, including technological change, is an evolutionary process.

It is also interesting to enquire the path by which the technological progress happens to influence the growth. In this respect, Sun (2011) provides a unique environment for accelerating technological innovation and he infer that, industrialists should not only enhance their managerial skills but also increase and improve innovative performance. Government also plays an important and critical role that enables business and consumers to adapt to the demands and opportunities of the new economy.

The theoretical framework in which the growth analysis was taken place is criticised by Mowery & Rosenberg (1991). They argue that the large potential contributions of economics to the understanding of technology and economic growth have been constrained by the narrow theoretical framework employed within neoclassical economies. A richer framework will support a more fruitful dialogue among economists, policymakers and managers on the organization of public and private institutions for innovation. They demonstrate the

importance of a historical perspective in understanding the role of technological innovation in the economy.

Innovation and technological progress not only brings growth but have some uncertain and risk components also. Since the production technology is concerned, its impact on factor combinations, especially on labour, has sought significant enquiries. Demand for less skilled workers decreased dramatically in the US and in other developed countries over the past two decades (Berman et al., 1998). They argued that pervasive skill-biased technological change, rather than increased trade with the developing world, is the principal culprit. The pervasiveness of this technological change is important for two reasons. Firstly, it is an immediate and testable implication of technological change. Secondly, under standard assumptions, the more pervasive and skill biased technological change, the greater the increase in the embodied supply of less skilled workers and the greater the depressing effect on their relative wages through world goods prices. Thus, pervasiveness deals with a major criticism of skill-biased technological progress as a cause. Testing the implications of pervasive, skill-biased technological change, they find some strong supporting evidence. Firstly, across the OECD, most industries have increased the proportion of skilled workers employed, despite rising or stable relative wages. Secondly, increases in demand for skills are concentrated in the same manufacturing industries in different developed countries. Jin & Jorgenson (2010) present a new approach to econometric modelling of substitution and technical change. Substitution is determined by observable variables, such as prices of output and inputs and shares of inputs in the value of output. Their principal innovation is to represent the rate and biases of technical change by unobservable or latent variables. An added advantage of the new representation is that the latent variables can be projected into the future, so that the rate and bias of technical change can be incorporated into econometric projections.

No single aspects of the economy are free from the effects of technological change due to its vast and deep roots. So the impact of the technological change is viewed from many aspects. Hope the performance can be connected to the technology usage was opined by Zahra & Covin (1993). They also studied the relationships among selected business strategy dimensions, technology policy dimensions, and firm's performance. Their research sought to identify how these variables interrelate at the bivariate and multivariate levels. Results show that technology policy choices vary widely across firms with different business strategies,

and that business strategy affects the strength of the relationship between firm performance and particular technology policies.

Technology adoption and its impacts on performance have micro level perspective also. The impact of the technology on the performance of a firm is the centre of analysis in this field. Acevedo (2002) and Varakolu (2007) attempted in this area. Acevedo (2002) measures performance in terms of wages, productivity, net employment growth, job creation and job destruction. He concluded that, technology positively related to firm's performance. The effect of new technology on firm's performance also correlates positively and strongly with firm size and proximity to the city. He also have the opinion that, technology adoption improves the wages of both low skill workers and high skill workers although of improves later more. Varakolu (2007) opined that technology adoption has emerged as an important determinant of competitiveness in recent global trade.

What happens to productivity when the new production techniques adopted is a serious platform of research. This was taken in to consideration by Bedi (2003), Kumari (2010), Trivedi et al., (2011), Pall (2011) Apiors et al., (2016) and Singh (2016). As part of India's major economic reforms in 1991, there has been vast changes in technology policy in India for improving the productivity and competitiveness of firms (Kumari, 2010). She analysed the impact of these changes in technology policy on productivity growth of firms in Indian pharmaceutical industry. The study shows that the technology policy has played an important role in the productivity performance of firms in Indian pharmaceutical industry in the post reform period. Bedi (2003) studied the structural changes in the composition of spun yarn, age of installed spindles and its impact on the efficiency and the productivity of spindles. He employs the productivity analysis along with the state of spinning industry and future requirement of spun yarn is used in forecasting the future requirement of spindles. He concludes that, the adoption of modern techniques have an advantage that the already installed and this technological gap are due to the increased productivity of the modern technique.

Apiors et al., (2016) opined that the intensity of the use of mechanisation have both positive and negative impacts on productivity. They noticed that, the land size cultivated, agro-chemical expenditure, tillage intensity, threshing intensity and education and transport intensity affects positively the partial productivities whereas, reaping intensity, over use of fertilizers and age of farmers negatively. Trivedi et al., (2011) opined that in order to

maximise growth from limited resources, the importance of increasing productivity, efficiency and competitiveness needs no justification. They consider productivity, efficiency and competitiveness as the indicators of performance. Pal (2011) noticed a falling labour productivity in many labour intensive sectors and highest TFP growth in capital intensive sectors.

Measurement of performance is another issue when the impact of technology is concerned. The production function approach was the most dependable model for measuring the impact of the technology usage and adoption levels on the performance. This approach was followed by Brada (1989) and Goldar (2012) but using different functional forms. Towards this method, Goldar (2012) estimates a production function for Indian organized manufacturing to make an assessment of import substitution possibilities and the pace and bias of technical change using annual survey of industries pooled data for 22 two digit industries for the period 1973-74 to 2007-08. He infer that, while in the period up to 1992 there was no significant factor saving bias of technical change, in the subsequent period, technical change in India's organized manufacturing was capital using and energy saving in character. Thus, the enhanced substitution possibilities of energy by non energy inputs (coupled with a rise in the relative price of energy input) and a capital using energy saving bias of technical change in the period after 1992 have caused a significant decrease in energy intensity of Indian manufacturing in post 1992 periods.

Brada (1989) estimated Frontier production functions for the industrial sector of four East European countries. The estimates reveal that the slowdown in industrial growth in these countries is due to a decline in the efficiency or intensity of factor-utilization rather than to declining rates of growth of technological progress. He tried to distinguish between the effects of improvements in technical knowhow and in the application of new technologies to production and the effects of changes in the efficiency with which available factors of production are utilized. The former concept is technological progress in the strict sense, the latter is technical efficiency. Changes in total factor productivity obtained from conventional estimates of production functions are the sum of these two effects, but if technical efficiency changes systematically over time, then the conventional production function estimates of technical progress will be biased.

Total Factor Productivity (TFP) used as the key indicator of the impact of technology on performance by Pall (2011) Goldar (2012) and Singh (2016). Pall (2011) found a highest TFP

growth in capital intensive sectors of Indian economy during 1998-99 to 2006-07. Goldar (2015) estimated the growth in Indian manufacturing industries during 1999-2011 in terms of TFP and observed a rapid rapid growth in productivity. Singh (2016) opined that, TFP is the driving factor of competitiveness. He decomposed the TFP growth in to technical change (frontier shift) and technical efficiency change (catch up effect). He observed that, TFP growth rate is negative 0.7% per annuam in Indian sugar industries for the period 2004-05 to 2013-14 due to technological regress and this negative growth in TFP is only due to technical regress as the technical efficiency witnessed a moderate positive growth.

2.3.5 Government and Industrialisation

In industrialisation and resulted developments of the economy, various agents have to play different roles. Since the industrial investment is risky and for creating optimism among the investors, the investment scenario has great roles. For fostering investment, it necessitates an atmosphere in which the investor can invest with confidence. For this, the government can perform better than any agency. The role of government in industrialisation is the focus of the analysis of Jahanshahi et al., (2011), Awasthi (2011), Barbieri et al., (2012) and Stephen (2013).

Stephen (2013) noted that, industrial growth in all countries is inextricably linked to and connected to the business environment where it is situated. Specifically he found that the main empirical constraint to the performance of industrial sector in Nigeria is corruption and political instability while poor infrastructure and macroeconomic instability have played significant roles. The study recommended that the policy makers should pay greater attention to the bad investment climate and put in place macroeconomic policies that can eradicate corruption and checkmate the components of macroeconomic and political instabilities .The findings equally suggested the need for the government to continue to develop the infrastructural base of the economy to boost the industrial sector.

Barbieri et al., (2012) offers an updated picture of the policies implemented by the government of the Guangdong Province (China) to foster the industrial development and the technological upgrading of its territories. In the view of the provincial and local governments the industrial development programs are used to increase firm agglomerations, spatial concentration and visibility, which in turn leads to increased specialisation, industrial output, innovation and economic growth. They offers a contribution by offering a detailed

description of the policy tools, by suggesting synthetic indexes to quantify policy efforts and industrial performances and observed an overall positive correlation over the years between the policy efforts and industrial performance indices.

It is the investor (manufacturer or entrepreneur) are to be boosted first to make investments. Therefore the role of entrepreneur and the need of entrepreneurship development programmes are the crucial factors when industrialisation was taken in to account. (Jahanshahi et al., 2011 and Awasthi 2011). Jahanshahi et al., (2011) tried to introduce and analyse the relationship between government policy and the growth of entrepreneurship in the micro, small &medium enterprises of India. They founds in the past record of MSME development that, those countries have succeeded in achieving higher growth of MSME, who have given much more emphases on Entrepreneurship Development Program (EDP). Consistently they are trying to accumulate optimum utilization of their resources in this field. Through the EDP, they have earned a very significant achievement to reach in to their development goal, they continue. Awasthi (2011) attempted to discuss the approach and strategies of promoting entrepreneurship in India through training and education. It takes a broader view of entrepreneurship development and goes beyond the conventional approach of treating entrepreneurship development as a synonym for start-up. The research encompasses various interventions to promote entrepreneurship that emerge along the life cycles of firms which include pre-start-up, start-up, survival and growth. Additionally, she argues that entrepreneurship cannot be promoted in isolation and needs government's policy support to mature. Therefore, she highlights the policy framework in which entrepreneurship has germinated and grown in India.

The production techniques prevailed is also be influenced by the governmental interventions. Nelson (1982), Lall (1992) and Wei & Liu (2015) focused the government role in innovation and technology advancements. Nelson (1982) describes the nature of the public policies that have influenced the pace and pattern of technical progress and tries to assess the broad effects of these policies. The policies he considered include funding or subsidy of certain kinds of research and development, but attention is also directed to government procurement, policies regarding education and training, information dissemination, patent protection and licensing, and regulatory and antitrust policies. The study suggests that there are four potentially fruitful routes that can be followed. They are, to associate government R&D support with procurement or other well defined public objective, to define and fund arenas of non-proprietary research and allow the appropriate scientific community to guide R&D allocation,

to develop mechanisms where by potential users guide the allocation of applied research and development funds and to identify the kind of projects that are likely to be winners in a commercial market competition, is seductive.

Government policy affects all three components of technological development, namely, physical investment, human capital and technological efforts (Lall, 1992). He concluded that interventions, carefully and selectively applied, are necessary for industrial success. Wei and Liu (2015) found that, both vertical support in the form of direct Research and Development (R&D) subsidies and horizontal support in the form of regional innovation policy positively influence the innovation performance of firms. In addition, direct R&D subsidies are more likely to experience the enhanced benefits of carrying out tax credit policy on the innovation performance of firms.

Knowles & Ozanne (2003) foresaw another view on governmental intervention. They interpret government intervention as any action taken by the government to cause a different allocation of resources from that delivered by the market, and so government spending is only one dimension of such intervention. Alternative proxies for government intervention includes extend of the price controls, the degree of government ownership in the economy, and extend of the red tape. They found that, significant negative correlation between government consumption (international prices) and economic performance implying that low levels of government consumption have a positive effect but high levels of government consumption have a negative effect on economic performance. Regarding the other proxies like the extent of government ownership, the extent of price controls, and the degree of red tape, the empirical results suggest that economies with high levels of red tape, which we use as a proxy for regulation of the economy, have higher levels of labour productivity. There are also some evidences that high levels of government owned firms are less efficient than their private sector counter parts. The evidence on price controls is not compelling, but there is weak evidence that high levels of price controls are correlated with low levels of output.

The role of various government policies on industrialisation is examined by Majumdar (1996), Banga & Das (2010) and Dinh (2013). Dinh (2013) studied the role of public poliy in promoting industrial transformation from an imitation-based low-skilled economy to an innovation-based high-skill economy. He distinguished the basic infrastructure (promotes imitation) and advanced infrastructure (promotes innovation). He viewed that, at the initial

stage, public policy should be focused on basic infrastructures to initiate growth process based on imitation and in later stage, the focus should be shifted to providing advance infrastructures to promote a shift to an innovation based process. Majumdar (1996) observed that as the public policy regime became progressive, efficiency is not progressed in Indian industries. Banga & Das (2010) remarked that, Indian manufacturing sector witnessed an unprecedented growth in the decades of 2000s. They also opined that, the reforms of 1991 played a more crucial than the reforms of 1980s in causing structural break in overall manufacturing growth in India.

The government policies have great role in industrialisation especially in the case of traditional industries. The policy framework related to the trade and investment in coir is the focus of Kalamani (2006). He attempts to critically analyse the issues that are an offshoot of the open market regime pursued in the industry. He remarked that, intense competition between exporters for developed country suppliers along with imperfections in the factor markets has resulted in the downward pressure on producer prices. He concludes that price liberalisation in the presence of distorted factor markets have not improved the lot of poor and marginal workers, despite high foreign and domestic demand as production is being reorganised in to small scale, decentralized and more flexible economic units using a flexible labour force. He also noticed that, the coir industry which traditionally employed permanent unionised workers who received a certain level of social protection is being transformed in to a reserve pool of flexible unprotected workers.

The target industry of the present study is the coir industry of Kerala. So it is interesting to examine the role of government in a traditional industry like coir from the existing literature. The government policies in coir industry is the focus of Kumar (2012), (Mishra, 2014), Narendran (2014), Singaravelu & Kavitha (2015) and Praveenkumar & Moorthi (2017). Singaravelu & Kavitha (2015) analysed the entrepreneurial development programmes in the coir industry of India. They opined that, Coir Board is engaged in sustainable development of Coir Industry through research and development, quality improvement, modernization and training, market promotion and welfare of all those who are engaged in the coir industry. Development of skilled manpower in coir industry through appropriate training programmes is one of the major activities of the Coir Board. They also observed that, the ‘process’ of technological changes in coir industry of Tamil Nadu is occurred due to tremendous progress in R&D, training, innovation and diffusion of modern technology.

It is essential to have a look on the efforts already taken by the government in coir industry. The traditional coir sector in Kerala will get a facelift through the modified Rejuvenation, Modernisation and Technology Up-gradation (REMOT) scheme of the Coir Board to facilitate the sustainable development of spinning and tiny household sectors (Mishra, 2014). In view of the difficulties faced by the beneficiaries in arranging the working capital, a component of 25% on the project cost has been added as the working capital. He hoped that the REMOT Scheme would help new entrepreneurs in the industry to create more employment opportunities and would surely pave the way for modernizing the industry at the micro – level as well.

Attempts were made to delineate the impact of national and industry-specific government interventions and the influence of political parties in power (Narendran, 2014). The study employs an interrupted time series design from the annual national coir export data (1970-2012) published by the Coir Board. The study concludes by highlighting that the significance of economic environment has a greater impact on the trends of coir exports than industry-specific interventions. A seminal finding of his study is that there is a significant difference in the coir exports during the period of governance by the two political fronts in Kerala. The study also evaluated the impact of governmental programs focusing on coir production and sales but did not find any significant positive impact of these programs on coir exports. Interventions of various promoting institutions in coir, such as Coir-fed, Coir development Department and Coir Co-operative Societies, is the focus of KILE (2016). The report also examined the scope of mechanising the coir industry.

Since coir is one of the most traditional industries that provides employment and thus livelihood to the rural poor, various lairs of governments, both Centre and State, intervene in it through various policies. Kumar (2012) and Praveenkumar & Moorthi (2017) examined these policies and their influence on the industry. Coir industry is one of the foreign exchange earners of India, it is struggling for existence because of varying reasons (Kumar, 2012) . he continues that, both the Central and State governments are giving priority support programmes in protecting the industry. Yet, the government intervention to reorganise the industry on co-operative lines has not achieved the desired results. The coir cooperatives continue to be a poor performer. The coir cooperatives failed drastically to ensure regular employment and better wages to the coir workers. Praveenkumar & Moorthi (2017) focused on the various schemes for coir development and analyzes the production and export of coir

products. They came to the conclusion that, government provides various types of schemes for developing the coir industry but manufacturers had not aware about the schemes.

A policy framework for revitalisation of coir industry in Kerala is given by Isaac & Raghavan (1990). They provided a new method for procuring husk by utilising the husk potential of Kerala by deregulating husk market and thus procure the surplus husk from the northern districts of the State. They also recommended removing the restrictions on the mechanical de-fibering, to encourage fibre extraction from raw fibre, usage of intermediate technology for improving quality and labour productivity and development of international markets as policies for reviving the coir Industry of the State.

The literature surveyed on various issues are summarised with its focuses and outcomes and is presented in Annexure 2.1.

2.4 Research Gap

Various studies reviewed pointed out the various problems the coir industry faces and provides some solutions also. Majority of the recent studies focuses on the mechanisation of the industry to improve productivity and thus the profitability and also points out the labour displacement due to the adoption of modern manufacturing techniques. Only few studies try to measure the mechanisation levels and related performance. But these studies provide a macro view on the extent of mechanisation and performance. Thus it is inevitable to enquire the current status of the mechanisation of the coir industry in Kerala with special focus on its micro aspects. The present study tries to have a micro founded exposition and measurement of the degree of mechanisation of the coir industry in Kerala. Each products and firms are intended to evaluate in terms of its production techniques and performance. This micro founded enquiry also tries to identify the root causes of differences in the degree of mechanisation of various firms in the industry.

CHAPTER 3

COIR INDUSTRY IN KERALA:

Origin, Developments and Trade Policies

- ***Introduction***
- ***Coir industry in Kerala; origin and development***
- ***Coir industry under trade reforms***
- ***Conclusion***

CHAPTER 3
COIR INDUSTRY IN KERALA:
Origin, Developments and Trade Policies

3.1 Introduction

Coir industry has a long history in Kerala since its origin by the first weaving factory dated 1859 in Alappuzha. Before this, there are coir related production activities are in Kerala as a household activity. With the first coir factory, it turns slowly in to factory based production. National and international development in various fields especially in manufacturing techniques and market accessibility brings out developments in this traditional industry also. So before analysing the present status of coir industry, its origin and developments need to be examined. Therefore, through this chapter, the researcher is trying to describe the history of coir industry of Kerala; the developments in production techniques, new and innovative products developed and the details of trade policies that affected the industry in general and the export performance in particular. The developments in coir industry explained in section 3.2 covers the efforts of modernisation of the industry in terms of mechanisation and related issues, the new machines developed in India in various operations of coir production namely, de-fibering, spinning, weaving and product manufacturing and the new products emerged and innovated as a result of this mechanisation. This chapter also aims to analyse the impact of trade reforms related to coir on the export performance (section 3.3). This analysis is aimed at exploring the impact of liberalised policies on the growth rate as well as the composition of export of coir and coir products. The composition of export of coir and coir products reveals the relative position of Kerala in the export market of coir and coir products and also the issues related to the availability of raw materials for manufacturing coir products in Kerala where we enjoys only the comparative advantage in recent days.

3.2 Coir industry in Kerala; Origin and Developments

The history of coir industry in Kerala, the arguments related to the modernisation efforts of coir industry through mechanisation, its recent developments both in terms of production techniques and product varieties are explained in this section.

3.2.1 Origin of the Coir Industry

Coir industry in India has a very long and glorious past. It continues to play a prominent role in the national economy of India. "Return to nature" concept has now brought intensive affinity for coir and coir products all over the world. Today Indian coir industry has come a long way from manufacturing simple ropes to various high-end lifestyle products. The history of modern coir industry in India dates back to 1859, with the starting of the first coir weaving factory in Alleppey Kerala State by Mr. James Daragh, an enterprising American of Irish origin. The name "KERALA" is derived from the Sanskrit word, "KERAL" meaning coconut. Kerala has for centuries been the natural home for Coir. The fact that the word 'Coir' is derived from the Malayalam word 'Kayar' meaning 'cord,' shows that this material first became known as a product of the Kerala coast.

The coir industry, which forms the main plank of the economy of the coastal areas of Kerala, is one of the oldest and most traditional industries in the State by providing sustenance to around 2 lakh families of the coastal belt of Kerala (Economic Review, 2017). The geographical location and climate of Kerala was suitable (now the conditions changed) for the large scale cultivation of coconut palms. Not only this, the winding network of rivers, canals, lakes and lagoons provides facilities for natural retting of husk, easy means of transportation of raw materials and finished products through water and availability of cheap but skilled labour force have helped in concentrating this industry in and around coastal areas of Kerala. These natural facilities, which do not seem to exist as such anywhere in the other large coconut producing countries, have been fully made use of by the generations of men and women who inhabit this part of the country.

3.2.2 Modernisation of Coir Industry

Transfer of production techniques with international exchange of commodities was the one important effect of trade, especially free trade. Since coir is one of the export oriented industry of the nation, the developments in the world market have transferred to India also. New products were emerged in the world market due to the technological improvements. These developments affected Indian coir industry and its international markets through trade. To retain its export market, Indian coir industry is compelled to adopt new techniques. This led to great debates on technology in this traditional industry. In the 1980's, debates on mechanisation of coir industries became stronger when the husk prices have escalated and the

overall demand for coir products declined. The wages and the days of employment in the industry fell adversely affected the standard of living of the people. It was this crisis that has mainly strengthened the arguments for reorganising the industry on a modem technical basis.
The advocates of mechanisation also pointed out the unhygienic working condition under which manual de-fibering is done. They highlighted the difficulties of open-yard wheel spinning and the strain of weaving on out antiquated handlooms. They were of the opinion that, the fear of unemployment is highly exaggerated [Kannan (1976) and Isaac (1983)]. They argued that the expansion of production due to increased demand resulting from modernisation and the new complimentary occupations that are expected to come up due to modernisation would reabsorb the displaced workers. But the opponents argued that a comprehensive mechanisation programme in defibring, spinning and weaving sector would certainly displace more than half of the labour force engaged in the industry. Similarly they denied the view that mechanisation always improves the quality. The mechanical de-fibering process in fact produces a lesser quality fibre, as it is likely to split or break the fibre.

But the fact is that, Indian coir industry in mid seventies had to face a threat of competition from other regions. The situation was that if India did not take the initiative in technology collaboration with the West, it could lead to the development of mechanised coir processing in other coconut producing countries. This would further lead to a decline in India's share in the world market. It is mainly due to the approach of Kerala, the hub of Coir Industry of the nation, towards the mechanisation. Kerala, especially the labour unions, was strictly against the mechanisation of the industry due to the fear of large levels of labour displacement that follows [Kannan (1976) and Isaac (1983)]. Strikes and protests outburst in the industry against mechanisation and as a result government never took serious policies for mechanisation of the industry. Kerala has been characterised by low productivity and traditional technology.
As Kerala coir industry is concerned, apart from competition from outside, it faces competition from within the country. In the seventies and eighties there had been a tremendous increase in the coconut production in states other than Kerala especially in Tamil Nadu and Karnataka. As raw material (coconut husk) easily available in these states, coir industry is developing in modem lines with sophisticated machines there. As a result, coir industry (especially the production of fibre and yarn) is no more a monopoly of Kerala. Such a stiff competition both from within and outside the country forced a change in the outlook towards modernisation of the industry among the trade unions in Kerala. At the same time

there were strong signals of a good market for coir products. The first half of nineties appeared like the dawn of prosperity for the coir industry. Preference for the biodegradable and natural products is the order of the time and the slogan of the environmentalists all over the world. British Government had banned the use of polyurethane foam for mattresses and upholstery for reasons of safety. Similar bans will soon be imposed in all the western countries due to the environmental awareness. This is likely to promote a wider use of mattress fibre. The new coir products like coir Geo-textiles and poly-coir seems to have unlimited scope for marketing. Modernisation process is in its full swing in India now to make use of this opportunity. Consequently the modernisation process in the Coir industry in Kerala commenced all on a sudden in the year 1990-91. By this time, the domestic coir industry had spread its wings, with coir factories coming up in several states including Karnataka, Tamil Nadu, Andhra Pradesh, Orissa and Goa, and there was no doubting the fact that Indian Coir Industry was on broad footing.

All these developments caused for a threat of shifting the coir industry from Kerala to the neighbouring coconut producing states such as Tamil Nadu, Karnataka and Andhra Pradesh. A re-examination of the issue of mechanisation assumes special significance in such a context. Accordingly the State Planning Commission in 1987recommended for second phase of mechanisation. Its recommendations emphasised mechanisation on one hand and strengthening of co-operative organisational structure on the other to infuse new energy to the coir industry.

3.2.3 Manufacturing Techniques in Coir Industry

As a result of the various Research and Development (R&D) activities of the Coir Board through its research centres, so many new techniques are invented and diffused. These techniques are described under this head. These are techniques used in various stages of coir production like de-fibering, spinning and weaving with product manufacturing. In each of the activities of coir production, de-fibering, spinning, weaving and manufacturing, new methods evolved. A summary of various machines available in various stages of coir production (de-fibering, spinning and product manufacturing) with its advantages is presented in this section. The techniques developed in de-fibering are described in Table 3.1.Similarly new techniques are developed in spinning, weaving and product manufacturing sector also. These are described in Table 3.2 and Table 3.3 respectively.

Table 3.1 Coir Manufacturing Techniques Developed in India – De-fibering

Manufacturing technique (Institute develops)	Advantages
Coir-ret (CCRI)	A faster process of retting in the RCC tanks using a bacterial cocktail named as 'Coir-ret' which takes only 3 months to carry out retting. If the mechanically extracted fibre bundles are treated with the 'Coir-ret' it can produce the retted quality of fibres in a period of 72 hours.
Mobile fibre extraction machine (CCRI)	This machine works with only 10 HP and can be transported anywhere and operated by diesel engine also. The machine can extract fibre from 400 husks per hour. It could be taken to the remote villages so that vast untapped potential for utilization of husks.
Bio-chem softening of coir fibre (Fibre Magic)	Quality improvement of machine extracted coir fibre. It is a zero effluent process and cost effective.

Source: Authors compilation

Table 3.2Coir Manufacturing Techniques Developed in India - Spinning

Manufacturing technique (Institute develops)	Advantages
Spinning Wheel	Production of unique quality of coir yarn from each of the regions.
Ratt	A set of two spinning wheels, a movable one and women can operate ratt.
Treadle Ratt (Coir Board)	The fibre fed manually and operation by the spinner in a sitting position
Motorized Ratt	Can spin all major types of coir yarn available in the trade
Motorized Traditional Ratt	A quarter HP motor to the traditional spinning wheel with low cost and reduced drudgery.
Automatic spinning Machine – VAJRA (Coir Board)	Higher productivity that can spin a wide variety of yarn with a productivity of at least 50kg of single yarn per 8 hours. It does not require core thread and easily operated by the women workers.
High Speed Doubling Machine	Can cater to ten spinning heads in eight hours. This machine can be converted to multiple heads also.

Source: Authors compilation

Table 3.3Coir Manufacturing Techniques Developed in India - Weaving

Manufacturing technique (Institute develops)	Advantages
Uday Pneumatic handloom (Coir Board	A pneumatic cylinder was fixed on the traditional handloom that reduced the manual power usage.
Semi-automatic loom (CCRI)	Shedding, Beating, and Winding are performed through the 7HP motor to reduce drudgery in the weaving operation and women workers can easily operate it.
Anugraha Handloom (CCRI)	For weaving coir matting and geo-textiles without any drudgery. Women workers can operate this loom in their household.
Pneumatic Anugraha Handloom	Takes care of the beating uniformity to keep the weft straight and to produce a uniform product of required density as per specifications. The operation of the handloom becomes further easier for the women workers to operate.
Anupam loom (CCRI)	A versatile semiautomatic loom for weaving all type of coir products and operated by pneumatic force to reduce the strain. It can be operated by the single woman whereas the traditional looms require two healthy males.
Power loom (Coir Board)	A fully automatic power loom where the output per weaver is around 20 -25 times higher than the output of a manual weaver.
Mini Tufting machine for Coir (CCRI)	This facilitated micro and small manufacturers to establish PVC tufted units at low cost.

Source: Authors compilation

3.2.4 Innovative Products of Coir Industry

As a result of the serious efforts to develop new techniques for coir production, some innovative products also developed. These products with their utilities are described in this section. Details are furnished in Table 3.4.

Table 3.4 exhibits the new coir products produced after mechanisation. These varieties of opportunities in the product possibilities put some lights in to the future potentials of the coir industry. By this research, it is tried to explore how these potentials are explored by the traditional coir industry of Kerala. The different varieties of coir producing machines are the main reason for the product varieties and the future potentials to tap. This gives a background for analysing the present issue.

Table 3.4 Innovative Coir Products

Innovative Product	Utilities
Composting of Coir Pith (CCRI)	Valuable organic manure for agri/ horti purposes. It is eco-friendly and retains moisture (eight times its weight). It is a substitute for peat moss and therefore has a lot of potential for export and economic benefit for the coir industry. It can also be used for production of bio-fuel and lingo-sulphonates which are important industrially.
Coir geo textiles (Coir Bhoovastra)	Capable to control soil erosion. It protects the earth and promotes vegetation retaining precious topsoil. Can be used in modern soil conservation, landscaping and mulching, soil erosion control of road embankments, canal bank protection and other geo technical fields.
Garden articles	Woven coir nursery pots and shaped fibre pots, coir fibre poles, germination trays, moulded rubberized coir fibre liners , grow bags for plants as a replacement to plastics in commercial plant nurseries and in home gardens. The liners are useful for climbers and hanging plants.
Coco-lawn (CCRI)	A readymade lawn using coir netting, coir non -woven felt, coir pith and composted coir pith on which the lawn grasses could be planted and the lawn can be cut to any size and shape that is easy to transport and could be laid instantaneously at any site.
Coir wood	Economic and effective substitutes of commercial plywood. These products find use for making false ceiling, doors and panels etc and are being extensively used by the CPWD.
Binder-less boards	These Boards can be used as packaging materials and tea-poys etc.
Coir Moulded Handicrafts	Unbreakable and having good aesthetic appeal. Polyester resin is the material used for producing fibre glass boats and can be processed at room temperature.
Janatha Mattresses	Made from softened coir fibre and cost half the price of the rubberized coir mattresses.
Coir Ornaments	Coir fibre is used for making ornaments such as chains, necklace, bangles, ring and earring as eco friendly tourist souvenir.
Handmade Papers	Handmade papers were developed by using coir fibre up to 40% by weight.
Other Coir Products	The coir fibre is blended with other natural fibres and spun in to thin yarn for manufacture of thin fabrics and to make handicraft and other items like chappals, bags, umbrella, lamp shades, watch straps, pen stands and similar gift articles. It can even used to make jackets using these blended yarns which can be used for protection of Jawans in the Army at high altitudes.

Source: Authors compilation

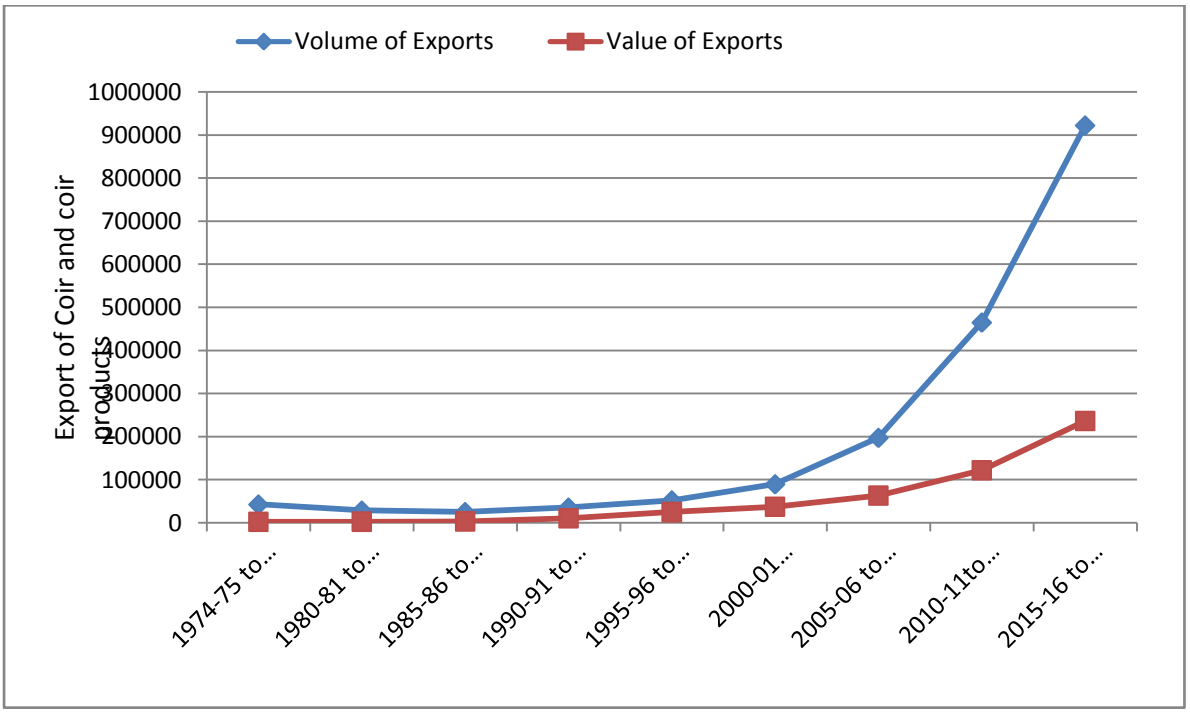
3.3 Coir Industry under Trade Reforms

The performance of an industry is mostly depends on the export performance even though the domestic market plays some significant roles. Export performance not only shows the extent of market that the commodity has but also the quality of the product exported. So the export performance can also be linked with the production techniques which in turn determine the product quality. But the extent of trade is influenced by some other factors also. Trade reforms, both domestic and international, have in-depth and long term impacts on the export performance of a nation and thus on the growth. An attempt is made to explore the export performance of Indian coir industry first and then the impacts of various trade reforms on the export performance of the industry.

3.3.1 Coir Exports from India

India is one of the major suppliers of coir and coir products in international market from a long period of time. As a result, a major share of coir production of the world is from India, especially from Kerala. Even though there were fluctuations in the quantity exported during various periods due to various reasons, now we are recovering from the pathetic situation of export sluggishness of coir and coir products. These variations in the export volume can be connected to so many variables especially to the trade reforms which have direct impacts on export. Before going in to the details of trade policies, have a look on the volume of exports of coir and coir products from India during 1974-75 to 2018-19. This period is chosen to examine the impact of various trade regimes on the export of coir and coir products. The exports of coir and coir products from India, both in terms of its quantity and value during 1974-75 to 2018-19 are described in Figure 3.1.

Figure 3.1 Exports of Coir and Coir Products from India



Source: Coir Board data (1974-75 to 2018-19)

It is noted from the Figure 3.1 that the coir and coir products export show an upward trend especially after 1991 and its rate have significant hike after 2000's. By noticing this trend in coir exports an enquiry is done on the various trade reforms that affected the coir exports. This gave a clear idea about this shift. As the coir industry is concerned, three major trade policies are there during 1974-75 to 2018-19. These are;

- Multi-Fibre Agreement (MFA)
- Phase out of MFA and
- Agreement on Textiles and Clothing (ATC)

The Multi Fibre Agreement (MFA) was introduced in 1974 as a short term measure intended to allow the developed countries to adjust to the imports of fibre and fibre products from the developing countries by means of quotas. This form of protection provides a limited shield to local industry against foreign competition. So this aimed to provide sufficient time for the developed nations to develop their fibre industries and thus to reduce the imports of fibre and fibre products from developing nations (Alberto & Wilson, 2010). This is applicable to all types of fibres soft and hard. Developing and exporting countries opposing it and continued to call for a liberalisation of textile and clothing trade. As a result, in 1991that versions of what was to become known as the Agreement on Textiles and Clothing (ATC) – negotiated

as part of GATT's Uruguay Round trade negotiations – were presented. A final version of the ATC, which set out a definitive plan for the structured removal of quantitative restrictions, was finally implemented on 1 January 1995.

The ATC set a four-stage quota liberalisation schedule, and is outlined in Article 2 of the Agreement. Each phase foresaw the integration of a specific percentage of textile categories based on 1990 levels. The scheduled removal of MFA quotas over the decade 1995 – 2005 under WTO Agreement on Textiles is like that 16% quota were removed by 1st January 1995 followed by 17% in 1st January 1998, 18% in 1st January 2002 and the remaining 49% in 1st January 2005.By doing this, the integration of the textile sector into the mainstream of WTO disciplines is embodied in the Agreement on Textiles and Clothing (ATC) which was negotiated during the Uruguay Round and is being implemented in stages over a period of 10 years. The two most significant features of the ATC are: (i) the phase-out of restraints on a predetermined schedule and within a stipulated period of 10 years and (ii) an improved, multilateral policing of additional restraints and other measures during the phase-out period through the Textile Monitoring Body (TMB) envisaged in the ATC. Therefore these three different policy frames may affect the trends in exports of coir and coir products. These trends are analysed using the growth rates. For this purpose, the Compound Annual Growth Rate (CAGR) is calculated for different trade policy periods. The CAGR of overall exports from India is also computed to elicit more clearly the influence of trade policies on the export of a particular group of commodity, coir. The results are shown in the table 3.5

Table 3.5: CAGR of Exports of Coir and Coir Products & Total Exports from India under Different Trade Policies

Trade Reforms		CAGR		
		Quantity of coir exports (%)	Value of coir exports (%)	Overall exports (%)
MFA	1974-75 to 1994-95	0.67	11.68	17.32*
Phase out of MFA	1995-96 to 2004-05	9.8	8.63	13.34
ATC	2005-06 to 2018 -19	16.68	13.08	11.74

Source: Computed from the data provided by Coir Board and Ministry of Commerce and Trade (1974-75 to 2018-19).

*CAGR from 1979-80 to 1994-95.

From the Table 3.5, it is evident that during the periods of quantitative restrictions on fibre products (MFA) there is only a nominal rate of growth in the volume of the export of coir and coir products from India. The total quantity of exports rose from 41834 tonnes in 1974-75 to 48086 tonnes in 1994-95. Comparing to this, during the periods of phasing out of MFA quota there was high percent annual growth in the exports of coir and coir products. During this 10 years the quantity of export increased by 74650 tonnes. Again during the period of ATC, from2005-06 to 2018-19, the quantity of coir export had shown a drastic growth of 16.68%, increased from 136026.97 tonnes in 2005-06 to 964046.4 tonnes in 2018-19. Value of coir exports also had shown a positive growth rates during all these reform periods and it is highest during ATC. The CAGR of total exports of India shown a declining trend in growth rate in contradiction to the growth rates of coir and coir products when we are analysing across these reform periods. So it is evident that even the growth rates of total exports declines the growth rates of the exports of coir and coir products rises over years. So it can be concluded that, the free trade policies boosted the exports of coir and coir products from India.

From the above analysis, it was evident that relaxations in trade restrictions boost the export performance of Indian coir industry. If trade become more free, it brought new technologies of productions which in turns lead to increase in production and productivity with innovative products. All these resulted in a better performance of coir production. But when we are focussing the scenario of Kerala's coir industry, we can see that it cannot reap these benefits of liberalised trade and technology transfer. This is due to the fact that since it is a traditional industry of the State, it cannot adopt the new manufacturing technology very easily due to many reasons. Therefore, the neighbouring States like Tamil Nadu and Karnataka adopted these technological advancements very soon and started the coir production there. Therefore the new products which is technology driven came in to the market and dominated in the export basket also. Therefore the share of Kerala in total coir export decreased and that those of the other states increased. This can be better understood from the composition of Indian coir export during all these reform periods (Table 3.6).

Pattern of exports exhibits the composition of different products of the coir industry in the total export basket of coir and coir products. This is also analysed under various reform periods. Table 3.6 exhibits the top five products in terms of both quantity and value in the total exports of coir products during different trade reform periods. The table of top five products of coir exports reveals the impact of different trade reforms in the composition of

coir exports. During the initial periods of MFA coir yarn dominates in total exports both in quantity (53.82%) and value (47.14%) and next is handloom mats. But during the last periods of MFA, handloom mats dominates both in quantity (42.01%) and value (53.27%) and next is the coir yarn. This is the reason for increasing the export in terms of value during this period even with quantitative restrictions (due to the dominance of finished and value added goods). That is, due to quantitative restrictions, the composition of exports changed in favour of more finished and value added goods.

Table 3.6 Top Five Products in Coir Export Basket

MFA period				Phase out of MFA				ATC period			
1974-75		1993-94		1995-96		2003-04		2005-06		2018-19	
Q	V	Q	V	Q	V	Q	V	Q	V	Q	V
Coir yarn (53.82)	Coir yarn (47.14)	Handloom mats (42.01)	Handloom mats (53.27)	Handloom mats (42.13)	Handloom mats (48.98)	Handloom mats (39.27)	Handloo m mats (58.72)	Coir pith (39.29)	Handloo m mats (52.51)	Coir pith (58.78)	Coir pith (45.16)
Handloom mats (27.06)	Handloom mats (36.87)	Coir yarn (35.96)	Coir yarn (20.39)	Coir yarn (30.73)	Handloom matting (22.34)	Coir pith (25.02)	Tufted mats (9.78)	Handloom mats (31.26)	Tufted mats (22.83)	Coir fibre (31.04)	Coir fibre (22.05)
Handloom matting(8.45)	Handloom matting (10.01)	Handloom matting (13.87)	Handloom matting (17.91)	Handloom matting (15.72)	Coir yarn (16.6)	Coir yarn (13.63)	Handloo m matting (9.25)	Tufted mats (14.46)	Coir pith (7.62)	Tufted mats (5.62)	Tufted mats (19.14)
Coir rugs and carpets (3.46)	Coir rugs and carpets (4.76)	Coir rugs and carpets (4.31)	Coir rugs and carpet (6.49)	Coir rugs and carpets (5.83)	Coir rugs and carpets (9.03)	Tufted mats (7.63)	Coir yarn (8.5)	Coir yarn (7.04)	Coir yarn (5.94)	Handloom mats (2.01)	Handloo m mats (8.03)
Curled coir (1.82)	Curled coir (0.59)	Curled coir (1.58)	Rubberise d coir (0.77)	Curled coir (2.39)	Coir other sorts (0.85)	Handloom matting (5.67)	Coir pith (4.23)	Handloom matting (2.14)	Handloo m matting (3.76)	Geo-textiles (0.80)	Geo-textiles (2.19)

Source: Coir Board on exports (1974-75 to 2018-19)

*Note: Values in brackets show the percentage share of each product in total coir exports.

During the entire period of the Phase out of MFA, the handloom mats dominates in total coir exports. At its initial time handloom mats constitutes 42.13% in terms of quantity and 48.98% in terms of value. At the end periods of the phase out of MFA the handloom mats' share in total coir exports becomes 39.27% and in terms of value it was 58.72%. In this period also, the value added products dominated due to some quantitative restrictions to keep the growth of export earnings. But it is also noted that during the last periods of MFA, one of the technology driven product, coir pith, occupies in the second place in terms of quantity and fifth in terms of value which passes through only one stage of production and treated as a waste when the traditional techniques of production were used and created much environmental problems.

While considering the period of ATC, coir pith ranks first in terms of quantity and third in terms of value in the initial periods. But a remarkable change is happened during the last years, coir pith ranks first both in terms of quantity (58.78%) and value (45.16%). It is also noted that coir fibre, which is the major raw material for coir products, occupies the second position both in terms value (22.05%) and quantity (31.04%). This change in the pattern of exports is unfavourable to Kerala since it is concentrated on the manufacture of coir products. The direct export of the raw materials creates shortage and high price of it. This worsens the condition of Kerala's coir industry further since it concentrated more on finished products.

3.4 Conclusion

The coir industry of Kerala witnessed many developments in its traditional production techniques. These developments led to the introduction of new and innovative products. This in fact changes the traditional nature of this industry to some extent. The policies of the government regarding trade are also having significant influence in the performance of the coir industry, especially in the growth and composition of export. The results show that, the more liberalised trade regime boosts the coir exports from India in terms of growth rates. It is also noted that, different trade regimes changes not only the growth patterns but also the composition and direction of coir exports from India. The composition of coir exports during liberalised regimes turns in favour of primary products like fibre and pith and against the more value added products. Hence it can be concluded that, the mechanisation and trade reforms are unfavourable to the coir manufacturing sector of Kerala, especially the weaving and product manufacturing sector where Kerala concentrates more in recent days.

CHAPTER 4

MECHANISATION IN COIR INDUSTRY:

Measurement and Determinants

- ***Introduction***
- ***Primary Details of the Sample Units***
- ***Degree of Mechanisation: Measurements***
- ***Firm Characteristics and Mechanisation***
- ***Degree of Mechanisation: Determinants***
- ***Conclusion***

CHAPTER 4
MECHANISATION IN COIR INDUSTRY:
Measurement and Determinants

4.1 Introduction

This chapter dealt with the analysis of the primary data for measuring the degree of mechanisation in the selected coir firms of Kerala. Before entering in to the details of mechanisation, some features of the sample firms are described as the first section of this chapter. This includes the location and year of starting of the firm, nature of ownership, type of ownership, category of industry, type of industrial settlement, firm size, owned plant area and details of raw material purchase. The second section deals the measurement of degree of mechanisation of the coir industry of Kerala using micro level data. Based on the degree of mechanisation, the firms are categorised in to different levels of mechanisation and this degree and levels of mechanisation are analysed across various features of the firm. Adoption of any innovative practices depends on many factors. The characteristics of a plant are more important determinant of mechanisation. In particular, mechanisation varies with plant size, the nature of the production process and the plant's industry (Gale, 1998). Since the present study considers the case of mechanisation, it may be influenced by the factors both endogenous and exogenous to the firm. The endogenous factors are the socio-economic and demographic features of the manufacturers and labour force and some particular features of the manufacturing firm in which the machines are applied. Therefore this chapter also aims at identifying the firm specific factors that determines the degree of mechanisation in a traditional industry like coir.

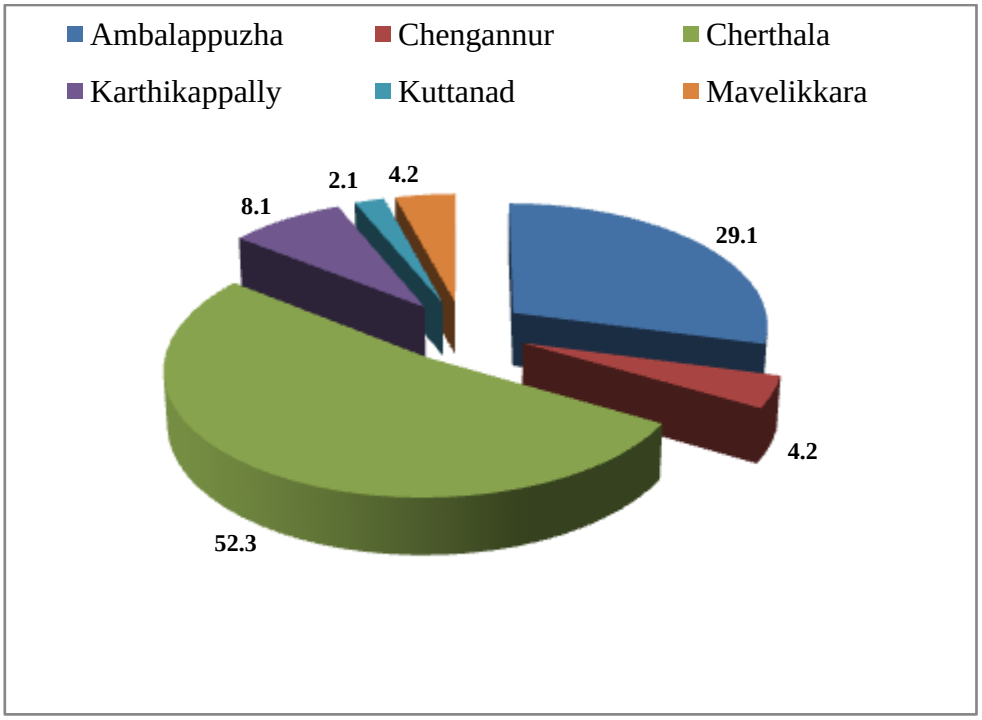
4.2: Primary Details of the Firms

The primary details of the firms help to overview the current status of the coir industry in Kerala. This also brings some idea about the features of the industrial set up that prevails in coir industry which throws light on the possibilities of further developments of the industry. The description of the features of the coir producing firms is presented in following sections.

4.2.1 Locale of the Sample Firms

The study carried out in Alappuzha district, which is the hub of coir industry. A total of 115 sample firms were surveyed for getting the primary information regarding the degree of mechanisation. Before entering in to the details of the sample, the locale of the total registered coir manufacturers of Alappuzha district is examined and is presented in Figure 4.1.

Figure 4.1 Taluk-Wise Distribution of Registered Coir Firms in Alappuzha District



Source: Coir Board (2017)

Figure 4.1 shows that majority of the registered coir units (81.4%) of the district is concentrated in two taluks namely Cherthala and Ambalappuzha. The rest are scattered in 4 taluks. It indicates that the coir industry is location specific. The survey covers 6 Panchayaths (Aryad South, Kannhikkuzhy, Mararikkulam, Mannanchery, Muhamma and Pathirappally) and 2 Municipalities (Alappuzha and Cherthala) of the district and the distribution of the sample firms across area is depicted in Table 4.1.

Most of the selected coir units belongs to Aryad South followed by Alappuzha Municipality. Only a few are belongs to Mararikkulam Panchayath. This reveals that the coir production is location specific. It concentrated in some specific areas due to its traditional features,

availability of raw materials and other facilities for setting up of industries. This result coincides with the location specificity feature of the population of the study. Along with this, the concentration of the industry has rural urban differences also. Out of the selected sample industries, 79.1% is located in rural areas where the remaining 20.9% are in its urban counterparts.

Table 4.1 Distribution of Sample Firms: Local Government-wise

Location	Firms (%)
Alappuzha Municipality	19.1
Aryad South Grama panchayath	34.8
Cherthala Municipality	7.8
Kannhikkuzhy Grama panchayath	6.1
Mannanchery Grama panchayath	11.3
Mararikkulam Grama panchayath	3.5
Muhamma Grama panchayath	12.2
Pathirappally Grama panchayath	5.2
Total	100

Source: Primary data

4.2.2 Nature of Ownership

Here the sample firms are presented on the basis of its nature of ownership (See Table 4.2). It is clear from the Table 4.2 that, the sample units belong to three categories of ownership, namely, government, co-operative and private in which majority of the sample firms belong to the private sector.

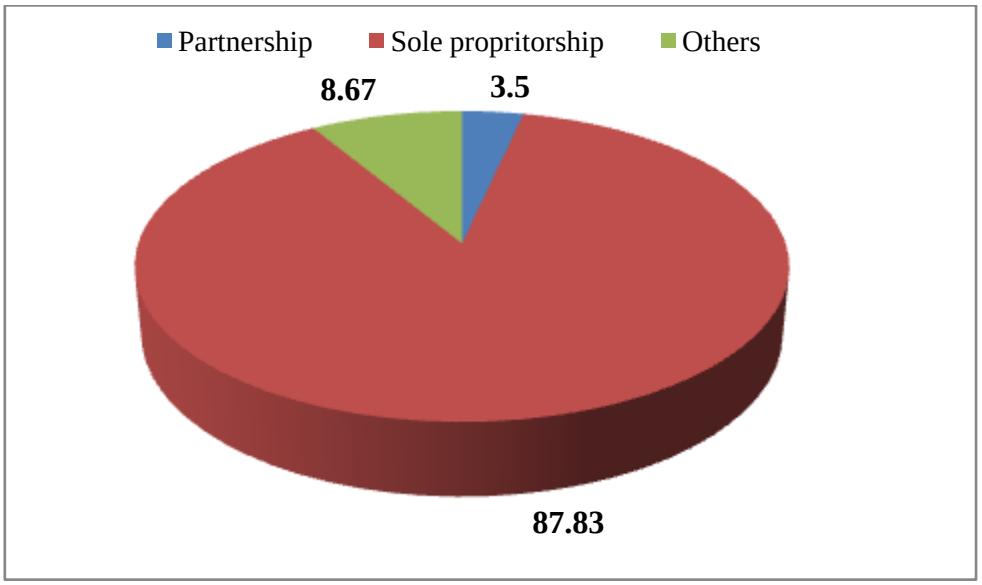
Table 4.2 Nature of Ownership

Sectors	Firms (%)
Government	1.7
Co-operative	7
Private	91.3
Total	100

Source: Primary data

The type of ownership is categorised in to sole proprietorship, partnership and others. Others constitutes the units belongs to cooperative and government sectors. The distribution of the ownership pattern in terms of sole proprietorship and partnership is expressed in Figure 4.2.

Figure 4.2 Type of Ownership



Source: Primary data

Figure 4.2 shows that, the sole proprietorship is the prominent type of ownership of the coir units. This may be due to the fact that it belongs to the category of micro, small and medium enterprises. Under MSME the investment limit is low (with a maximum ceiling on investment of 25 lakhs for micro, 25 lakhs to 5 crores for small and 5 crores to 10 crores for medium – MSME Act 2006). So one entrepreneur itself is enough to control and manage the unit. The risk is also low in these industries due to its small scale of operations. All these are considered while analysing the mechanisation.

4.2.3 Manufacturing Category of Firms

The production activities of coir industry can be categorised as de-fibering, spinning and product manufacturing. Here some firms are doing more than one production activity. And so, this also considered when categorising the sample firms based on the production activity. The detail regarding this is illustrated in Table 4.3.

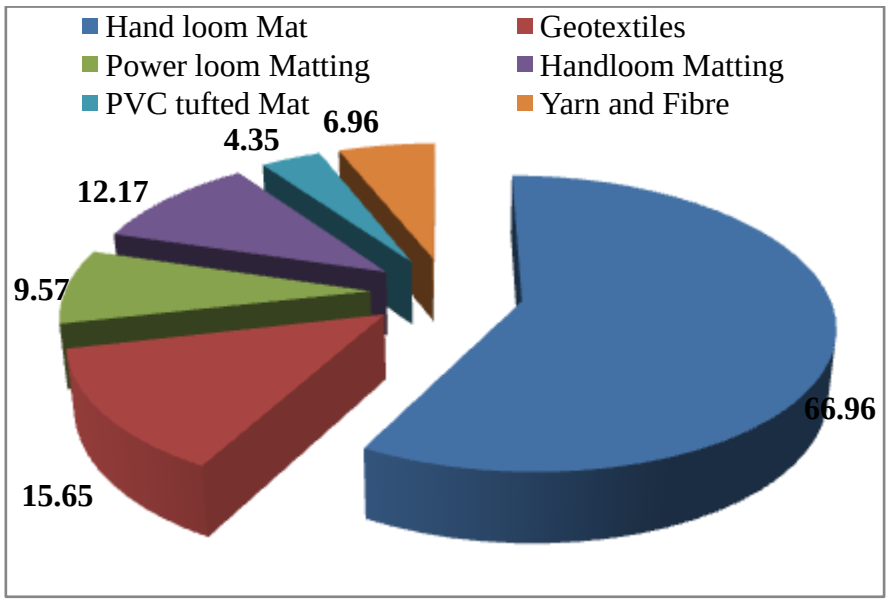
Table 4.3 Manufacturing Category of Firms

Manufacturing Category	Firms (%)
Spinning	4.3
Product Manufacturing	93.0
Spinning and Product Manufacturing	1.7
De-fibering, Spinning and Product Manufacturing	1.0
Total	100

Source: Primary data

Substantial share of the sample firms are manufactures of coir products (see Table 4.3). Only a few firms produce fibre and yarn. It reveals that the coir industry of Kerala depends on other states for its raw materials such as, fibre and yarn for manufacturing the coir products. It may lead to the emergence of monopoly in the raw material market and for high prices of both fibre and yarn. This high price for the raw materials is one of the main problems faced by the coir industry of the State presently. The study examined product wise distribution of the firms and is presented in the Figure 4.3.

Figure 4.3 Composition of the Coir Products



Source: Primary data

Figure 4.3 reveals that the handloom mat is the prominent product of the sample firms which composed off different varieties. The varieties of handloom mat includes handloom fibre mat,

VC8, karnattic mat and pappada thadukk. Out of these varieties, majority producing handloom fibre mat. Power loom matting, PVC tufted mat and yarn and fibre are the other products, where the scope for using machines is higher, but only a few sample firms (20.78%) are producing these products.

Since coir is one of the major traditional industries of Kerala, it is mostly concentrated in the household sector during its older days. But the process of modernisation through the use of machines changes this household nature of the industry and now most of the firms (83.5%) are working in factory sector and only a few (16.5%) are kept in household sector. But it is important to note that, most of these factories are settled in their homestead itself. A separate building is maintained in the homestead as factory, where all activities of the coir production carried on. One major advantage of this is that, all the family members can engage in production activities. There are no restrictions in working time. Both the hired labourers as well as family labourers are engaged in many activities relating to coir production.

4.2.4 Method of Industrial Operation

The sample firms are classified in to three based on the major source of energy used for production activities as firms using manual energy, mechanical energy, and both manual and mechanical energy sources. Firms which use manual power as a major source of energy for production activities were grouped in manual method of operation whereas the major production activities are carried using machines are grouped under mechanical operation. Firms which depend both on manual and mechanical energy for their production activities clubbed under the head both. The distribution of the firms based on their method of operation is better described in Table 4.4.

Table 4.4 Method of Operation of Firms

Method of operation	Firms (%)
Manual	54.8
Mechanical	13.0
Both	32.2
Total	100

Source: Primary data

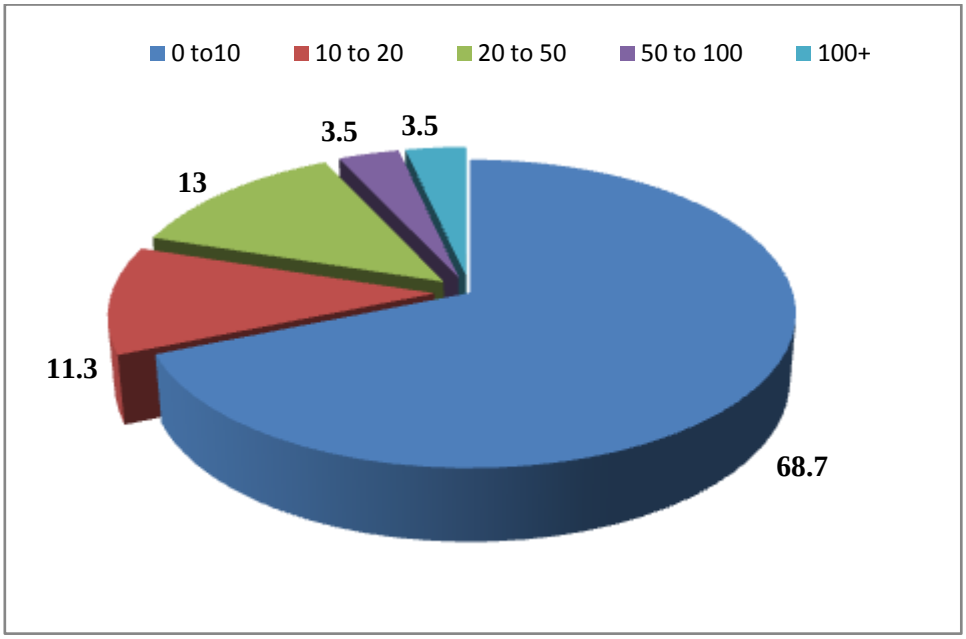
Table 4.4 indicates that majority of the firms use only manual power for manufacturing their product and a few (13%) depend on mechanical power. This indicates the low level of mechanisation in coir industry since machines consumes electrical energy. For mechanisation, electricity connection is a prerequisite. Therefore, the electricity status of the firms is also examined. This reveals that about half of the units (49.6%) are not electrified at all. This indicates less use of electrified machine in this industry and thereby low level of mechanisation. Hence the modernisation through mechanisation of the coir industry in Kerala demands the need of electrification of the firms as a prerequisite. The existing literature (Menon, 2002) on measurement of the intensity of mechanisation in coir industry of Kerala focuses these aspects (whether used manual or mechanical energy and electrified or not) only. Hence a firm specific enquiry is essential to measure the extent and degree of mechanisation and to know the firm specific determinants of it. So the present research draws its significance in this respect.

It is also clear from the enquiry that more than 96% of the sample units work six days per week. The lack of demand for the products and scarcity of raw materials are the main reasons raised by some firms for their fewer working days. Those who work six days per weeks also opined that if the present situation (low demand, unsold stock and scarcity of fibre and yarn for manufacturing) prevails and prolongs, they cannot work for six days. They tied up from the two ends. One is the scarcity and high price of the raw materials and other is the insufficient demand for their product. Because of these, they have foreseen a nearest shut down of their firm and thus hesitated to go with mechanisation.

4.2.5 Firm Size

Primarily the study describes the firm size in terms of total number of workers and the infrastructure of the plant especially in terms of area of land in which the firm is situated and the plinth area of the of the firm. The firm size is classified into micro, small and medium according to the criteria of number of workers and investment in plant and equipments. This will be analysed later, in the second part of this chapter, in connection to the degree of mechanisation of the firm. The details of the total workforce of the sample firms are presented in Figure 4.4.

Figure 4.4 Number of Workers



Source: Primary data

From the Figure 4.4 it is clear that majority of firms have less than ten workers. Only 7% have more than 50 workers. The average number of workers (Mean) is 18 with a standard deviation of 42. This reveals that most of the firms are small sized. There are some units with single labour (lower range) and some others with 380 (upper range) workers. So mean is not enough to represent the data and so the median is calculated and it is 6. So it can be taken as the average number of workers of the majority of the firms surveyed and thus concluded that most of the surveyed firms belong to micro size as per the definition of firm size according to number of workers.

The firm occupied land is another important variable in determining the firm size and production technique. Mechanised production demands large factory and thus possession of huge acreage of land. The distribution of the sample firms across the area of land they possessed is exhibited in the Table 4.5.

Table 4.5 Possession of Land by the Firms

Land (in Cents)	Firms (%)
0-10	29.6
10-50	50.4
50-100	10.4
100+	9.6
Total	100.0

Source: Primary data

Table 4.5 describes that majority of the firms are instituted in a land area below 50 cents[1]. This is nominal as an industrial unit is concerned. This is mainly because of its small scale of operation, traditional and household nature. Only a few firms are situated in a large area of above one acre. The average (mean) land area is 124.83 cents with a standard deviation of 558.78. The high value of average and S.D of land holdings shows the influence of extreme 11 firms whose land area is above 100 cents (highest is 5500 cents and lowest is 2 cents). Therefore the median and mode are computed as the average and the both measures have a unique value of 20 cents. This represents the land area possessed by most of the firms surveyed and it is very small to function a manufacturing firm. This average value is also higher than the actual value of the land area of the firms because most of the coir factories are situated in their homestead itself and they responds the total area of land they possessed as the area of land occupied for the factory also. The plinth area of firm where production activities are carrying is depicted in Figure 4.5.

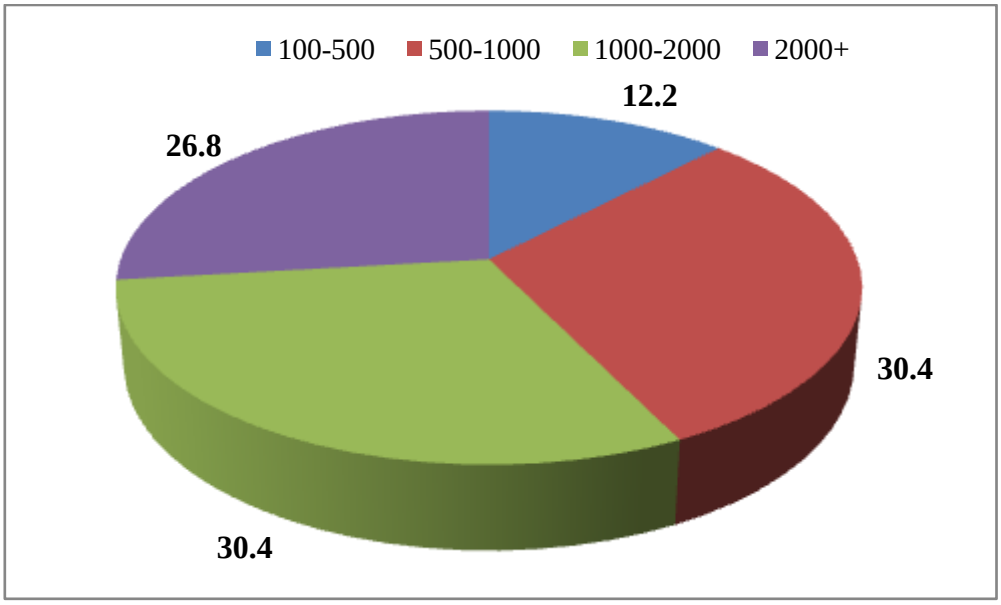
The Figure 4.5 depicts the distribution of the sample coir units based on the area of the building. It reveals that 60.8% of the firms are working in a building with an area between 500 and 2000 square feet. The mean of the area of building is 4404.87 square feet with a S.D of 12994.81 square feet[2]. Since the variation in the data is much high, the median is found and it is 1500 square feet and this can be considered as the size of building of the majority of

[1] Some firms are located in homestead itself and in such cases, the whole area is considered as the firm occupied land.

[2] highest is 120000 square feet and lowest is 200 square feet

the firms. From the average area of building also, we can infer that the coir producing firms of Kerala are small sized.

Figure 4.5 Plinth area of Building



Source: Primary data

*Note: Plinth area in square feet

Besides the small plinth area of the coir factory, its roof and floor are not well finished. Majority of the factory is tin roofed and the floor is concrete. Majority of the factories are working in a building without wall. Only a few are well finished with concrete roof and tiled floor.

4.2.6 Year of Starting the Firm

Adoption of production technique of any firm at any given time is a function of the techniques available during that time. So the year of starting of the firm is relevant regarding the techniques of production. Firms are categorised in to three on the basis of year of starting of the firm for the sake of analysis. These are the firms those started

- Before New Economic Policy (Before 1991)
- In between New Economic Policy and before Agreement on textiles and Clothing (ATC – 1991to 2005)
- After ATC.

New Economic policy was implemented in the India during 1991 featured by liberalisation, privatisation and globalisation. So as far as any tiny section of the economy is concerned, these LPG (Liberalisation, Privatisation and Globalisation) policies have significant impacts. Since the coir industry is an export oriented industry and Kerala was a significant contributor of the coir exports of the nation at that time, these policies have its impact on the coir sector. Especially the adoption of mechanised manufacturing techniques is concerned; these policies have a key role. The technology transfer, imitation, adoption and adaptation are the results of free trade and therefore, in coir sector also, this may create some changes, as production techniques are concerned. The year 2005 is taken as another turning point where coir trade enters to the regime of free trade under ATC. So the years 1991and 2005 are the milestones and the distribution of sample coir units based on its year of starting is shown in the Table 4.6.

Table 4.6 Starting Year of the Firm

Year	Firms (%)
Before 1991	44.3
1991-2005	40.0
After 2005	15.7
Total	100

Source: Primary data

Table 4.6 reveals that only a few firms started after ATC. About half of the sample firms (44.3%) are started before 1991. It is because coir industry is a traditional industry which born and brought up in Kerala. Not only that, the coir became a loss suffering business in the State and so new manufacturers hesitating to enter. Because of this, the number of newly started firms is very few in Kerala.

4.2.7 Sources of Raw Materials for Manufacturing Coir Products

The raw materials for manufacturing coir products are coconut husk, coir fibre and coir yarn. The coir industry was originated and developed in Kerala especially due to the easy availability of raw materials. As the time passes, the availability and use of new techniques for processing raw materials leads to emergence of innovative products. This changed both the raw materials and product markets. Apart from that, the approach that Kerala taken

towards mechanization of the industry due to the fear of labour displacement before 1990's caused a shift of the production of fibre and yarn to the neighbouring States especially to Tamil Nadu and Karnataka. So these changes led to monopoly in the raw material market and thus caused not only for huge hike in prices but also for scarcity of the raw materials. This affected the product manufacturing sector of the coir in which the State now enjoys some dominance due to the skill and experienced labourers in weaving and manufacturing coir products.

The availability of raw materials affects the production activities, its speed and productivity. Thus the sources of various raw materials for coir manufacturing and the prices of these are analysed here. The various sources of different raw materials of the sample coir manufacturing units are presented in Table 4.7

Table 4.7 Sources of Raw Materials

Sources of raw materials	Firms (%)		
	Husk	Fibre	Yarn
Own Production			1
Local source	100	58.46	39.61
Co-operative Society		20	17.80
Coir fed		4.62	24.75
Outside the State		16.92	15.84
Other sources			1
Total	100	100	100

Source: Primary data

Table 4.7 states that only one producer produces some part of his raw material requirements. No others directly produce the raw materials. It is noted that 16.92% of coir manufacturers buy the fibre and 15.84% directly buys the yarn from other States especially from Tamil Nadu. Those purchase raw materials from local source also actually coming from Tamil Nadu. Only a few (24.62%) buys fibre from Co operative society and from Coir fed, but in the case of yarn it is comparatively high (42.55%). Even at the subsidised rates offered by primary coir cooperatives and Coir-fed, only a minority purchases raw materials from there.

This is due to the scarcity of the raw materials there. Sometimes these agencies also depends other states for raw materials for supplying to the manufacturers.

This reveals that in Kerala, coir manufacturers are not much engaging in the first two processes of coir industry that is de-fibering and spinning in which we have clear monopoly in earlier times due to its skill requirements. But mechanisation of these activities replaced this skill. At the same time the quality of the retted fibre and yarn disappears with the introduction of machines. Now the coir manufacturers of Kerala are more concentrating in the product manufacturing sector, where the skill is still required. For the raw materials they are depending on neighbouring States, especially Pollachi, to a large extent. The liberalised trade practices (WTO regime - ATC) led to the direct export of fibre. This caused price hikes and scarcity of fibre. This high priced fibre and yarn reduces the profitability in the manufacturing sector and this lead the coir industry of the State in to the path of decay. The high price and scarcity of the raw materials are the major problems faced by the coir manufacturers at present and thus they required government interventions in the raw material market by regulating price and by procuring raw materials. This was analysed in detail in Chapter 6. The prices of various raw materials for manufacturing of coir products in comparison with the sources are depicted in Table 4.8.

Table 4.8 Average Price of Raw Materials – Source-wise

Sources of raw materials	Average price of raw materials (Rs)		
	Husk (100 Nos)	Fibre (Kg)	Yarn (Kg)
Local source	30	31.08	54.15
Co-operative Society	-	30.92	49.50
Coir fed	-	31.00	49.36
Outside the State	-	31.27	47.94
Other sources	-	-	54.00
Average	30	31.08	51.12

Source: Computed from primary data

The husk price is calculated for 100 coconut husks and only 2 sample coir manufacturers purchase it. It is from the local source and paid rupees 30/-(Table 4.8). From the Table 4.8 it was also clear that the average price of fibre purchased per kilogram is rupees 31.08/- and it

varies between sources and this variability is meagre. All are purchased the machine fibre which is directly separated from the green husk using machines. No fibre varieties are purchased and so it is almost homogeneous. But the price was high for the purchases directly from the other States. This is due to high transportation costs.

In the case of yarn, there are huge variations in prices between sources. The least priced yarn is those purchased from the other states. This is because the yarn purchased from other states consist only a single variety, that is, spinned using machines. This was not suitable for all the coir products. The coir yarn purchased from within the State consists different varieties like Vaikkom coir, Mangadan coir Arattupuzha coir etc. These are high cost yarns which are spinned by the skilled labour force and from the retted fibre. So, average price is taken for yarn. A comparatively low price is charged for those purchased from Primary coir cooperative societies and from Coir fed. This is due to raw material subsidy given by these agencies to the coir manufacturers who are the members of Primary Coir Cooperative Societies.

4.3 Degree of Mechanisation: Measurements

Modernisation of industry is the most significant aspect of economic growth in the last 150 years. But it is important to note that modernisation of industry is most unequally spread among various nations of the world economy. Introduction and implementation of new techniques of production involves some disruptions. The problems of modernising industry are smaller today than they were a century ago, but they are considerable, nonetheless, and should not be underrated. Although imitation is easier than invention, it cannot be applied automatically, but requires adaptation. But the process of adaptation is not easy due to many internal characteristics of the industry or firms. It is mainly due to the differences in labour force and lack of technical support and services (Rodan, 1966).

Since a traditional and small scale industry like coir is concerned, the process of modernisation is more difficult comparing to heavy, modern and large industries. There are attempts to measure the extent of mechanisation of coir industry of Kerala and evaluate the performance using the variables number of factories, gross value added, capital stock, number of workers and employees, total emoluments, productivity of labour and capital, capital intensity and capacity utilisation by Menon (2002). The present study uses a micro

approach (firm specific) for measuring the degree of mechanisation of coir industry of Kerala for the purpose of categorising the firms in to various levels of mechanisation and to evaluate the performance. Before measuring the degree of mechanisation and accordingly the categorisation, the awareness status of the coir manufacturers about the available machines in coir production are checked. The results are summarised in section 4.3.1. After that, the degree of mechanisation is measured and the sample firms are categorised in to various levels of mechanisation in section 4.3.2.

4.3.1 Awareness Status

Awareness is the first stage in the adoption process (Olumba & Rahji, 2014). Even though awareness is a precondition for adoption, in implementation of new techniques in manufacturing, the mere awareness not matters. They have to familiarise it and sometimes verify the risk and return associated. Only then, the adoption is possible. Anyway, as the pre-requisite of adoption, the awareness is checked. Then only the study moves to the next stage, adoption of machines for manufacturing coir. This part examines the awareness status of the coir manufacturers about the machines available for production. The results reveal that majority (61.7%) of the coir manufacturers are aware about the machines available for their production process (Table 4.9). At the same time, it is important to note that 38.3% of the coir manufacturers are not at all aware about the machines available for them in this information era. Now a day, it is a large number. So it can be infer that the awareness level about available machines in manufacturing is low in coir industry. That is, the trickle down of technology in coir industry is low and it may be because of its traditional nature.

The awareness status of the manufacturers is influenced by the demographic features of the manufacturer and exposure to extension agents (Adewuyi et al., 2006). Therefore, the education of the manufacturer, years of experience in manufacturing coir and participation in promotional programmes like exhibitions, seminars and trade fairs where the information about the machines are acquired and diffusion take place are considered to examine its association with awareness.

- **Education and Awareness Status of the Manufacturer**

Considering the awareness status, the education of the manufacturer has prime importance. The education has some positive effects on the awareness. The education is measured in terms of the years of schooling. The education and awareness status of the coir manufacturers about the machines available for manufacturing their product is exhibited in Table 4.9.

Table 4.9 Education and Awareness Status of the Manufacturer

Education of the manufacturer (years of schooling)	Coir Manufacturers (%)	
	Not Aware	Aware
0-4	20.0	80.0
5-7	75.0	25.0
8-10	42.9	57.1
11-12	25.0	75.0
13+	14.3	85.7
Total	38.3	61.7

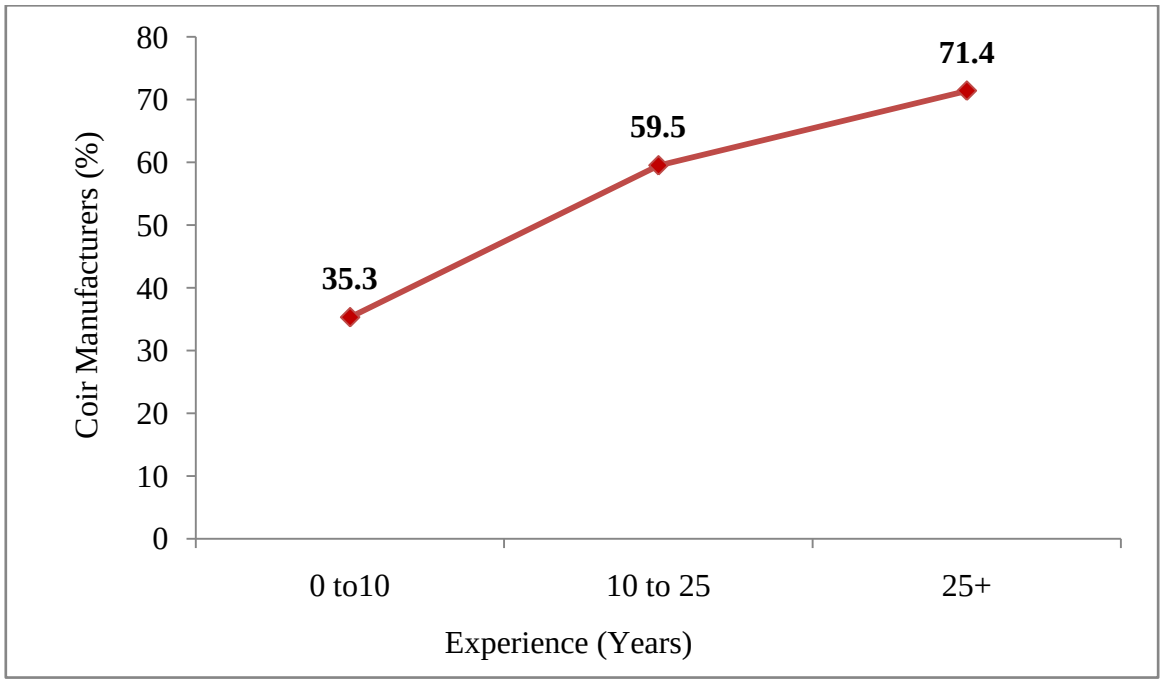
Source: Primary data

Table 4.9 expresses the awareness status of the manufacturers about available machines and education status. It is noted that as education goes up, the manufacturers belongs to aware category increases except in the low education group (0-4). The Chi square value of association between education and awareness is calculated as 7.255 (0.007). Thus this association is significant and can conclude that education and awareness status are directly associated.

- **Experience and Awareness Status**

The experience of the manufacturer (years) in the industry is another major factor taken in to consideration to affect the awareness status of the manufacturers about the available mechanised production techniques. The association between the years of experience and awareness status is summarised in Figure 4.6.

Figure 4.6 Years of Experience and Awareness Status



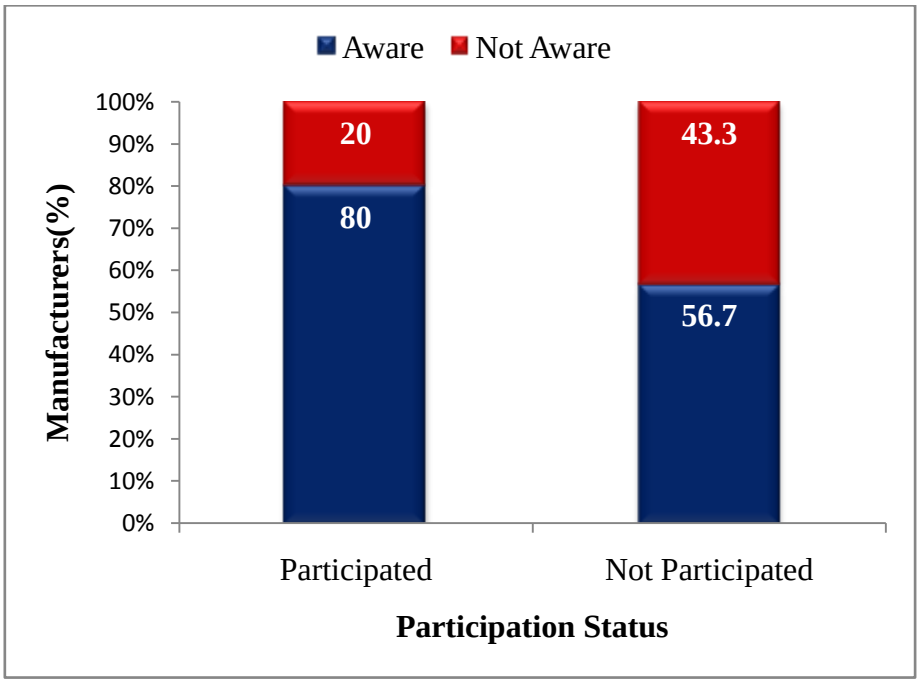
Source: Primary data

It is clear that as the years of experience increases, those who are aware about the various new manufacturing techniques also increase (Figure 4.6). Those who have less than 10 years of experience in the field of coir manufacturing are less aware where with more than 25 years of experience have better aware. The Chi square value of association between years of experience and awareness status is calculated as 5.68 (0.05). This association is significant and can infer that years of experience and awareness status are positively associated.

- **Participation in Promotional Programmes and Awareness Status**

Adewuyi et al., (2006) and Oladeji et al., (2015) pointed out that, the exposure to extension agents determines the awareness. Hence the study made an attempt to examine the awareness status of the coir manufacturers with their participation in the promotional programmes like Coir Kerala, other exhibitions and seminars. It is because these are the venues where the new machines are exhibited and marketed and thus leads to awareness, diffusion and adoption. So this factor is taken in to consideration to influence the awareness level and is exhibited in Figure 4.7.

Figure 4.7 Participation in Promotional Programmes and Awareness Status



Source: Primary data

While 80% of the participated manufacturers are aware about available machines for manufacturing coir, it is only 56.7% in the case of not participated manufacturers (Figure 4.7). The Chi square value of association between participation in promotional programmes and awareness is calculated as 4.51 (0.03). This association is also significant and thus can say that the participation of the manufacturers in the promotional programmes increases their awareness about available machines for production activities. After checking the association between the different variables to influence the awareness status of the manufacturers, their individual influence on the awareness is checked using a regression model which is given in the following section.

4.3.2 Determinants of the Awareness: Binary Logit Regression Model

The awareness of the manufacturer is determined by various factors (Adewuyi et al., 2006 and Daberkow et al., 2003) like age of the manufacturer, education and computer literacy of the operator, full-time farming, farm size and exposure to extension agents. Awareness promotes demand and demand is a force for rapid adoption and spread of innovations (Olumba & Rahji, 2014). Since the awareness is a pre-requisite for adoption and usage, and

influence its rate and speed, this analysis put lights on what kind of preliminary steps should be taken to increase the awareness and thus to mechanise the coir industry. The present study associated the awareness status with different characteristics of manufacturers namely, education, years of experience and the participation of the manufacturers in promotional activities like exhibitions, seminars and trade fairs. After identifying the relevant variables influencing the awareness, to elicit their individual influences on awareness status, a Binary Logit regression model is used. The binary Logit model is used in this situation because the dependant variable is the awareness status of the manufacturer having two categories, aware and not aware. A binary Logit regression model of the form 4.1 is used, to elicit the determinants of awareness status of the coir manufacturers about the machines available in producing their product.

$$Y_i = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + Ui \text{.....(4.1)}$$

Where,

Y_i = Awareness status (1= Aware and 0= Not Aware)

X_1 = Education of the manufacturer (Years of schooling)

X_2 = Years of experience

X_3 = Participation in promotional programmes (1 = Participated and 0= Not participated)

U = Random error term

4.3.2.1 Check for Basic Assumptions

Before estimating a Logit regression model, the major assumptions of the model were checked. Linearity, homoscedasticity and no autocorrelation are not the necessary assumptions of a logit regression model whereas; no perfect multi-collinearity is an important assumption. Therefore the collinearity between the independent variables of the model is checked using Variance Inflation Factor (VIF). Minimum possible value of VIF is 1.0 and values greater than 10.0 may indicate a collinearity problem. The VIF of the variables of the Model 4.1 is summarised in Table 4.10.

Table No. 4.10 Variance Inflation Factors -Determinants of Awareness

Explanatory Variables	VIF
Education	1.20
Years of Experience	1.19
Participation in promotional programmes	1.23

Source: Estimated from Primary Data

The result of collinearity check (Table 4.10) reveals that there is a very low (almost = 1) collinearity between the explanatory variables of the model and therefore satisfies the basic assumption of no perfect multicollinearity in the binary logit regression model. Then one can proceed with the model 4.1

4.3.2.2 Regression Results and Interpretation

The basic assumptions of Binary Logit regression model 4.1 are satisfied and therefore it is employed to identify the determinants of awareness and the results are summarised in the Table 4.11.

Table 4.11 Regression Results- Determinants of Awareness

Explanatory Variables	Coefficient	Std. Error	z	p
Const	−1.71	0.79	−2.16	0.03
Education	0.15	0.07	2.06	0.03
Years of Experience	0.02	0.015	1.44	0.15
Participation in promotional programmes	0.59	0.59	0.99	0.32
Number of cases "correctly predicted" = 67.3% Likelihood Ratio test: Chi-Square = 12.37				

Source: Estimated from primary data

The result of the binary Logit regression model 4.1 presented in Table 4.11 reveals that the model is significant. For checking the model adequacy in a Logit regression model, the explanatory power of the model is expressed not in terms of R^2 or Adjusted R^2. It is the number of cases "correctly predicted" and it is, 67.3%. This is comparatively a very high

value. The Chi-Square value (12.37) is also significant (p=0.006). So these results exhibit the model adequacy of the fitted regression. Individual influences of the variables considered in the regression model on the awareness status were measured by the individual beta coefficients and their significance level. Out of these beta coefficients, the influence of education is only significant.

In a Logit model of regression, beta coefficients (See Table 4.11) do not measure the marginal effects of the independent variables on the dependent. It just shows the log odds. In a binary logit model, log odds is the logarithm of odds (p/1-p) where p is the probability. Odds ratio in a logit regression explains the constant effect of a predictor X, on the likelihood that one outcome will occur[3]. The odds ratio of the fitted binary logit regression model is shown in the Table 4.12.

Table 4.12 Odds Ratio

Explanatory Variables	Odds-ratio	95 % conf. interval
Education	1.16	(1.007, 1.338)
Years of Experience	1.02	(0.99, 1.051)
Participation in promotional programmes	1.79	(0.57, 5.698)

Source: Estimated from primary data

Table 4.12 shows that all the odds ratios are greater than one and thus show the positive association between the regressors and the regressant. In the case of binary variable, participation in promotional programmes has the odds ratio 1.79. This indicates that those who participated in the product promotional programmes are aware 1.79 times than those who do not participated. In the case of continuous variables like education and years of experience, the odds ratio of education is greater than that of years of experience. The odds ratio of education reveals that corresponding to each unit increase in the years of schooling the odds of being aware about the machines available for the coir production increase by 1.16 times. In the case of years of experience, it is 1.02 times.

[3] https://www.theanalysisfactor.com

In a Logit regression model, the influence of each independent variable on the awareness status of the manufacturers about machines available for coir production can be expressed in terms of the marginal effects. Table 4.13 presents the marginal effects of the independent variables on the awareness status of coir manufacturers.

Table 4.13 Marginal Effects - Determinants of Awareness

Explanatory Variables	dp/dx	SE	Z	P
Education	0.04	0.02	2.08	0.04
Years of Experience	0.005	0.003	1.46	0.14
Participation in Promotional programmes	0.13	0.12	1.07	0.28

Source: Estimated from primary data

Table of marginal effects (Table 4.13) depicts the marginal change or influence of each independent variable namely education, years of experience and the participation status in product promotional programmes on the awareness status of coir manufacturers about machines available for production. As education of the entrepreneur goes up their awareness about the machines available for coir production also increases. Therefore, the attainment of general education has significant influence on awareness of the machines available for coir production and thus on the mechanisation levels. So measures may be taken for the improvement of general education for increasing the awareness of mechanised techniques and mechanisation in coir industry.

4.3.3 Measurement of Mechanisation: A Micro Level Approach

After analysing the awareness status and its determinants, the next attempt is to measure the degree of mechanisation of coir producing firms of Kerala. The degree of mechanisation of coir industry in Kerala is measured using two indices, namely, Extent of Mechanisation (EM) scores and Mechanisation Index (MI) using the firm level data. EM scores measures the degree of mechanisation of each coir products whereas the MI score measures the degree of mechanisation of a firm, which may or may not produce multiple products. These two indices employed in the study are derived from the work of Kamble (2016).[4] The index used by

[4] - These indices were used by Kamble Babasaheb in his doctoral thesis and was originally developed by two agricultural universities of Maharashtra, The Mahatma Phule Krishi Vidyapeeth (MPKV) Rahuri and Marathwada Agricultural University (MAU) Parbhani for examining the extent of agricultural technology among farmers of Maharashtra.

Kamble is adapted to the context of the present study with some modifications by the researcher in consultation with the experts.

4.3.3.1 Extent of Mechanisation (EM)

Extent of Mechanisation is estimated to analyse the individual mechanisation scores of each coir product. EM is the ratio of actual mechanisation scores to recommended mechanisation score. It measures the degree by which the available machines are used by the manufacturers for producing each coir products. The scores of Extend of Mechanisation is calculated for each product of the firm by using the equation 4.2

Extent of Mechanisation = Actual Mechanisation Score (AMS) / Recommended Mechanisation Score (RMS)

That is, EM = AMS/ RMS ..... (4.2)

In the context of present study these are,

RMS = Number of stages of production where machines are available
AMS = Number of stages of production where machines are used

The value of EM lies between zero and one. Zero indicates the absence of usage of any available machines for the production whereas one indicates use of all available machines for manufacturing the product. Here the study estimated EM scores for each individual product. Different varieties of coir products may have different mechanisation scores depending on the nature and stages of the process of production. Narayanamoorthy et al., (2014) opined that output varieties determine the use of machines. Here the extent of mechanisation scores of each individual coir products is calculated and the product wise mechanisation scores (EM) are presented in Table 4.14.

Table 4.14 Extent of Mechanisation (EM) Scores of Coir products

Products	N	Mean (EM)	S.D (EM)
Handloom Mat	77	0.15	0.17
Geo textiles	18	0.02	0.08
Power loom Matting	11	0.21	0.34
Handloom Matting	14	0.12	0.28
PVC Tufted Mat	5	0.96	0.09
Yarn and Fibre	8	0.42	0.29

Source: Computed from primary data

*Note: the sum need not added up to 115 because some firms produce more than one product

From Table 4.14, it is clear that the handloom mat is the item that is produced by the majority of the surveyed coir units and its average mechanisation score is 0.15 and it is very low. The mechanisation score of handloom mat reveals that only 15% of production stages out of available mechanised stages use in handloom mat production. Similarly we can interpret all other coir products. From Table 4.14, it can be infer that PVC tufted mat have the highest mechanisation score of 0.96 (96% of the available mechanised stages are used in manufacturing PVC tufted mat). Geo-textiles have the least score of adoption of 0.02 (ie, only 2% of the available mechanised stages are employed). Even in the case of power loom, the extent of mechanisation is low (only 21% of available mechanical stages are used), ie, all stages of production are not mechanised.

From Table 4.14, it is also evident that, within the coir manufacturing itself the products are different in its extent of mechanisation. The average of EM scores is different for different coir products and the study used one way ANOVA to test whether these differences in the EM scores are significant. Before using the ANOVA, the assumption of normality of distribution of the EM scores is tested using Kolmogorov-Smirnov test. The normality test results rejected the hypothesis of normality of the distribution of EM scores. Thus the parametric ANOVA test for checking the mean difference of EM scores of different coir products cannot employ. So the non parametric ANOVA test, Kruskal-Wallis test, is used and the results are shown in Table 4.15.

Table 4.15 Kruskal-Wallis Test Results – EM Scores of Coir Products

Null Hypothesis	Test	Test statistic	p
The distribution of Extent of Adoption is the same across different Products.	Independent-Samples Kruskal-Wallis Test	31.638	.000

Source: Computed from primary data

Table 4.15 reveals that, the Kruskal-Wallis test rejected the hypothesis of equality of means of EM scores of different coir products at 1% level of significance. That is, the test result says that the average mechanisation scores of different coir products are significantly different. This does not mean that all products are different in EM scores. A post hoc analysis of ANOVA is conducted to check which specific product is significantly different from others in EM score. This is performed in terms of the pair-wise comparison of EM scores among coir products and the results are summarised in Table 4.16.

Table 4.16 Pair-wise Comparison of EM Scores among Coir Products

Sample 1- Sample 2	Test statistic	Std. error	Std. Test statistic	Sig
Geo textiles – Handloom matting	-8.96	12.04	-.74	.457
Geo textiles – Power loom matting	-24.02	12.93	-1.85	.063
Geo textiles – Handloom mat	25.09	8.85	2.84	**.005**
Geo textiles – Yarn and Fibre	-45.14	14.36	-3.14	**.002**
Geo textiles – PVC Tufted mat	-85.59	17.08	-5.01	**.000**
Handloom matting – Power loom matting	15.07	13.61	1.11	.268
Handloom matting – Handloom mat	16.13	9.82	1.64	0.10
Handloom matting – Yarn and Fibre	-36.18	14.98	-2.42	**.016**
Handloom matting – PVC Tufted mat	-76.63	17.60	-4.35	**.000**
Power loom matting – Handloom mat	1.07	10.89	0.098	.922
Power loom matting – Yarn and Fibre	-21.11	15.7	-1.35	.179
Power loom matting – PVC Tufted mat	-61.56	18.22	-3.38	**.001**
Handloom mat – Yarn and Fibre	-20.05	12.55	-1.59	.110
Handloom mat – PVC Tufted mat	-60.49	15.59	-3.39	**.000**
Yarn and Fibre – PVC Tufted mat	40.45	19.26	2.1	.360

Source: Computed from Primary Data

Table 4.16 reveals that all the products except coir yarn and fibre are different in average EM scores in comparison to PVC Tufted mat, which is the highly mechanised product. Apart from this, the average of EM scores of geo textiles (least mechanised product) is different with that of coir yarn and fibre (the product with second highest EM score) with power loom matting and with handloom mat.

4.3.3.2 Mechanisation Index (MI)

After analysing the EM scores of individual coir products, the degree of mechanisation of each firm is calculated. Some firms are producing more than one product and so the EM scores of the products are not capable of explaining the degree of mechanisation of one firm. Hence, a Mechanisation Index (MI) is computed with some modification from the index used by Kamble (2016). MI is a weighted average of EM scores of individual coir products, where the relative share of each product in the total output of the firm is considered as the weights. The calculation of MI is described in equation 4.3.

$$MI = EM_1 \times W_1 + EM_2 \times W_2 + EM_3 \times W_3 + \ldots\ldots\ldots\ldots\ldots + EM_n \times W_n \quad \ldots\ldots\ldots\ldots\ldots (4.3)$$

Where,

$EM_1, EM_2, EM_3, \ldots\ldots$ EM_n = Extent of Mechanisation scores of 1,2,3....n products

$W_1, W_1, W_1 \ldots\ldots\ldots W_1$= Relative shares of 1,2,3....n products in total product(weights)

Simply we can denote MI as,

$$MI = \sum_{k=1}^{n} EM_k \times W_k \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.4)$$

Where,

EM_k= Extent of Mechanisation scores of 1,2,3....n products

W_k= Relative shares of 1,2,3....n products in total product (weights)

The Mechanisation Index (MI) is used to measure the degree of mechanisation of one coir manufacturing firm. The value of MI is also lies between zero and one. The average MI of the sample coir firms is 0.18. This reveals that on an average, only 18% of the available mechanised production stages are used by the selected coir manufacturing firms in Kerala.

This indicates a very low level of mechanisation in coir industry of Kerala in general and in the selected firms in particular. The details of MI of the firms are exhibited in Table 4.17 where the MI is examined across the category of the industry (de-fibering, spinning and weaving and product manufacturing). The average Mechanisation Index across each category of the industry is computed and summarised in Table 4.17.

Table 4.17 Category of the Industry and Average MI

Category of Industry	Firms (%)	Average MI
Spinning	4.35	0.53
Product Manufacturing	93.04	0.16
Spinning and Product Manufacturing	1.74	0.22
Defibering, Spinning and Product Manufacturing	0.87	0.00
Total	100	0.18

Source: Computed from primary data

Table 4.17 shows that the average MI of the spinning firms is comparatively high (0.53). There was only one firm doing all the activities and it not at all mechanised. Majority of the firms are specialised in manufacturing various coir products and its average MI is too low (0.16). Therefore we can conclude that the degree of mechanisation is low and differ in different categories of coir units.

4.3.4 Mechanisation Levels

The purpose of the measuring the degree of mechanisation of coir producing firms using MI is to categorise it in to various levels of mechanisation. The categorisation criteria based on MI is also modified (different from the criteria used by Kamble, 2016) by the researcher with the consultation of experts to apply to the context of study. Based on the value of MI, the firms are categorised in to four levels of mechanisation as follows.

$MI = 0$ – Traditional firms

$0 < MI < 0.5$ – Low mechanised firms

$0.5 \leq MI < 0.75$ – Medium mechanised firms

$0.75 \leq MI \leq 1$ – High mechanised firms

Distribution of the sample firms based on the mechanisation levels is presented in Table 4.18.

Table 4.18 Mechanisation levels

Mechanisation Levels	Firms (%)
Traditional firms	56.5
Low mechanised firms	35.7
Medium mechanised firms	3.5
High mechanised firms	4.3
Total	100

Source: Computed from primary data

Table 4.18 reveals that majority of the sample coir units belongs to the category of traditional firms with MI is equal to zero. This shows the attitude of a traditional industry towards machanisation. Altogether 92.2% of the sample coir units have a MI less than 0.50 and so belongs to traditional and low mechanised categories (together can be termed as lower mechanised categories). The rest 7.8% of the sample coir units have a MI equal and above 0.50 and belongs to medium and high mechanised categories (together can be termed as higher mechanised category). These scores and the distribution of the firms in each category depicts a low level of mechanisation in the coir industry of the Kerala. This may be due to various reasons which are analysed in detail in the section 4.5.

The nature of the production process carried out influences the extent of usage of machinery (Gale, 1998). Therefore, based on the production activity, the coir industry can be categorised into de-fibering units, spinning units and product manufacturing units. In the sample, some of the coir units may have more than one production activities. It is also noted that the de-fibering and spinning activities are almost transferred to neighbouring states like Tamil Nadu and Karnataka and rare in Kerala now a days. The distribution of the sample firms across mechanisation level based on the category of the industry (de-fibering, spinning and weaving and product manufacturing) are examined and summarised in Table 4.19.

Table 4.19 Category of the Industry and Mechanisation Level

Mechanisation Level		Firms (%)				Total
		Spinning	Product Manufacturing	Spinning and Product Manufacturing	Defibering, Spinning and Product Manufacturing	
Traditional firms	within Mechanisation Level	0	98.5	0	1.5	100
	within Category of Industry	0	59.8	0	100	56.5
Low mechanised firms	within Mechanisation Level	7.3	87.8	4.9	0	100
	within Category of Industry	60	33.6	100	0	35.7
Medium mechanised firms	within Mechanisation Level	25	75	0	0	100
	within Category of Industry	20	2.8	0	0	3.5
High mechanised firms	within Mechanisation Level	20	80	0	0	100
	within Category of Industry	20	3.7	0	0	4.3
Total	within Mechanisation Level	4.3	93	1.7	0.9	100
	within Category of Industry	100	100	100	100	100

Source: Computed from primary data

Table 4.19 reveals that there is only one firm performs all activities of the coir industry and it belongs to the traditional category. It is also clear that, only two firms doing the activities of spinning and manufacturing and it lies in low mechanised category. Comparing to product manufacturing (6.5%), more spinning firms lie in higher mechanised category (40%). It is important to note that 93.5% of the coir product manufacturing firms belong to lower mechanisation categories. From this it was clear that, the coir product manufacturing units employs a production technique which they were following for years and may have some advantage of using the experienced method. They also revealed that the products produced using the traditional techniques have greater demand in foreign markets and so received high price also.

4.4 Firm Characteristics and Mechanisation

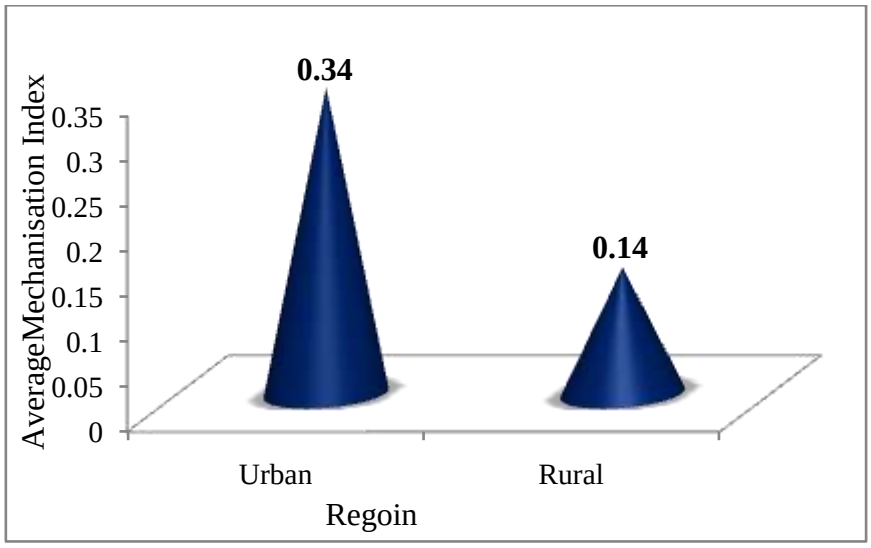
Adoption of any innovative practices depends on many factors among which the firm characteristics are more important determinant of mechanisation. Specifically, mechanisation varies with plant size, the nature of the production process and the plant's industry (Gale, 1998). Since the present study considers the mechanisation of coir industry in Kerala, it may

be influenced by the factors both endogenous and exogenous to the firm. The endogenous factors are the socio-economic and demographic features of the manufacturers and labour force and some particular features of the manufacturing firm. As exogenous variables to influence the level of mechanisation of coir industry, the government interventions are taken into account and are examined in detail in Chapter 6. This section examines the various characteristics of the sample firms that influence the mechanisation.

4.4.1 Mechanisation across Regions

A rural urban technology gap may exist due to concentration of technology intensive industries in urban centres and concentration of low-tech industries in rural locations. There is reason to suspect that mechanisation in rural regions may lag behind in urban areas (Gale, 1998). Thus the mechanisation of the coir industry is examined by considering the rural-urban difference of the firms. For this, the average Mechanisation Index is computed region wise and is summarised in Figure 4.8.

Figure 4.8 Average Mechanisation Index –Region-wise



Source: Computed from primary data

The average Mechanisation Index is higher in coir units situated in urban area compared to rural area (Figure 4.8). Therefore it can be infer that, the mechanisation is area specific. The region of the industrial unit influences the level of mechanisation. It may be due to the urban

specific characters and thus coincides with the results of Gale (1998).The level of mechanisation of the firms situated in urban and rural areas is shown in Table 4.20.

Table 4.20 Region of the Firm and Mechanisation Level

Mechanisation Level		Firms (%)		Total
		Urban	Rural	
Traditional firms	within Mechanisation Level	15.4	84.6	100
	within Region	41.7	60.4	56.5
Low mechanised firms	within Mechanisation Level	17.1	82.9	100
	within Region	29.2	37.4	35.7
Medium mechanised firms	within Mechanisation Level	50	50	100
	within Region	8.3	2.2	3.5
High mechanised firms	within Mechanisation Level	100	0	100
	within Region	20.8	0	4.3
Total	within Mechanisation Level	20.9	79.1	100
	within Region	100	100	100

Source: Computed from primary data

Table 4.20 reveals that, the coir units in urban areas increase as the level of mechanisation increases and vice versa. Lower mechanised coir units are concentrated in rural area where as the higher mechanised coir units in urban area.

4.4.2 Year of Starting the Firm and Mechanisation

Year of starting of a firm influences its production techniques in many ways. When a firm starts the production; it uses the available manufacturing techniques of that period. Hence a sudden change in the experienced production process may not be possible as time passes and when new machines are available. It may take time. Therefore the new firms have greater possibility for adopting mechanised methods comparing to the old firms. The firms started at different periods are analysed in connection to mechanisation. The firms are categorised in to three based on its year of starting such as firms started before New economic Policy (before 1991), after New economic Policy and Before ATC (1991-2005) and the firms started after ATC (after 2005). The justification of this type of classification is explained in Chapter 3. The average Mechanisation Index of the firms started during different time periods are computed and described in Table 4.21.

Table 4.21 Year of Starting of the Firm and Average MI

Year of Starting	Firms (N)	Average MI	S.D
Before 1991	51	0.18	0.26
1991-2005	46	0.17	0.21
After 2005	18	0.17	0.30
Total	115	0.18	0.25

Source: Computed from primary data

From Table 4.21, it is evident that, average MI is not significantly different among older and newer firms. It is noted that, the MI is higher in the older units comparing to newer even though the difference is meagre. The distribution of the firms started at different time and belongs to various levels of mechanisation is examined and described in Table 4.22. Table 4.22 reveals that most of the units (88.3%) started before 1991 belongs to the lower mechanised categories and the rest 11.7% lies under the higher mechanised categories. This is same in the case of the units started between 1991 and 2005 and after 2005. That is, 97.9% and 88.9% respectively comes under lower mechanised categories. So this is contradictory to the notion that it is easy to adopt the mechanised techniques in newer units compared to older units especially in the case of coir industry.

Table 4.22 Year of Starting the Firm and Mechanisation Level

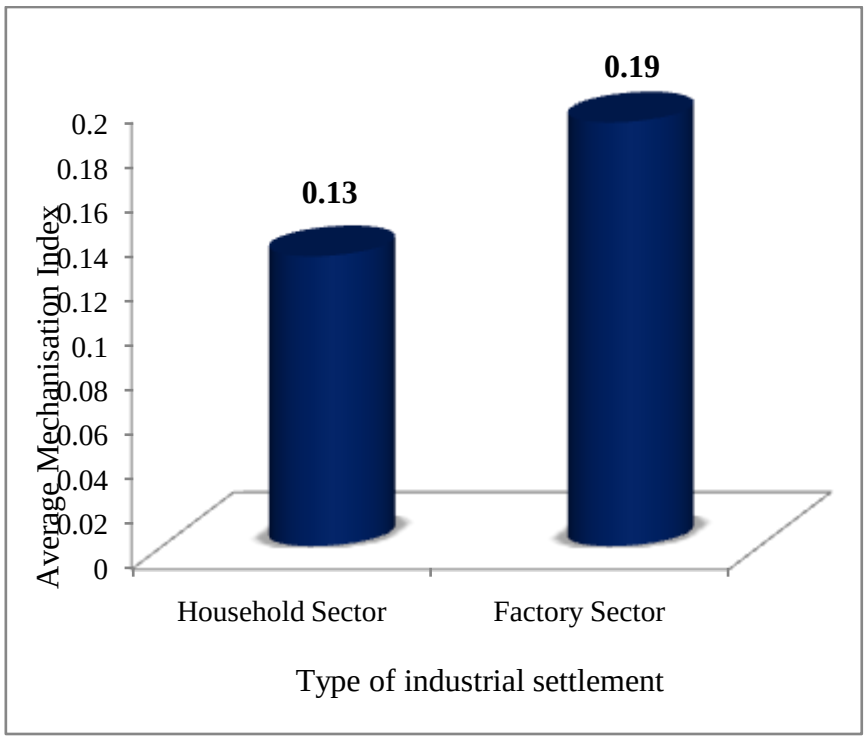
Mechanisation Level		Firms (%)			Total
		Before 1991	1991-2005	After 2005	
Traditional firms	within Mechanisation Level	44.6	36.9	18.5	100
	within Year of Starting	56.9	52.2	66.7	56.5
Low mechanised firms	within Mechanisation Level	39	51.2	9.8	100
	within Year of Starting	31.4	45.7	22.2	35.7
Medium mechanised firms	within Mechanisation Level	100	0	0	100
	within Year of Starting	7.8	0	0	3.5
High mechanised firms	within Mechanisation Level	40	20	40	100
	within Year of Starting	3.9	2.2	11.1	4.3
Total	within Mechanisation Level	44.3	40.0	15.7	100
	within Year of Starting	100	100	100	100

Source: Computed from primary data

4.4.3 Type of Industrial Settlement and Mechanisation

Since coir is one of the traditional industries of the State, production activities are carried both in the household sector and in the factory sector. The sample firms are categorised based on its industrial set up in to household sector firms and factory sector firms and the mechanisation is examined. The average MI of the units belongs to these categories is computed to derive a clear picture of the degree of mechanisation of household and factory sector firms (Figure 4.9).

Figure 4.9 Type of Industrial Settlement and Average MI



Source: Computed from primary data

It is clear from the Figure 4.9 that, the average MI of factory sector firms is higher (0.19) compared to household sector firms (0.13). But only a minor difference exists in the Mechanisation Index among the household and factory sectors. The firms belong to household sector and factory sector is examined across the mechanisation levels and the results are presented in Table 4.23.

Table 4.23 Type of Industrial Settlement and Mechanisation Level

Mechanisation Level		Firms (%)		Total
		Household Unit	Factory Unit	
Traditional firms	within Mechanisation Level	21.5	78.5	100
	within Industrial Settlement	73.7	53.1	56.5
Low mechanised firms	within Mechanisation Level	7.3	92.7	100
	within Industrial Settlement	15.8	39.6	35.7
Medium mechanised firms	within Mechanisation Level	50	50	100
	within Industrial Settlement	10.5	2.1	3.5
High mechanised firms	within Mechanisation Level	0	100	100
	within Industrial Settlement	0	5.2	4.3
Total	within Mechanisation Level	16.5	83.5	100
	within Industrial Settlement	100	100	100

Source: Computed from primary data

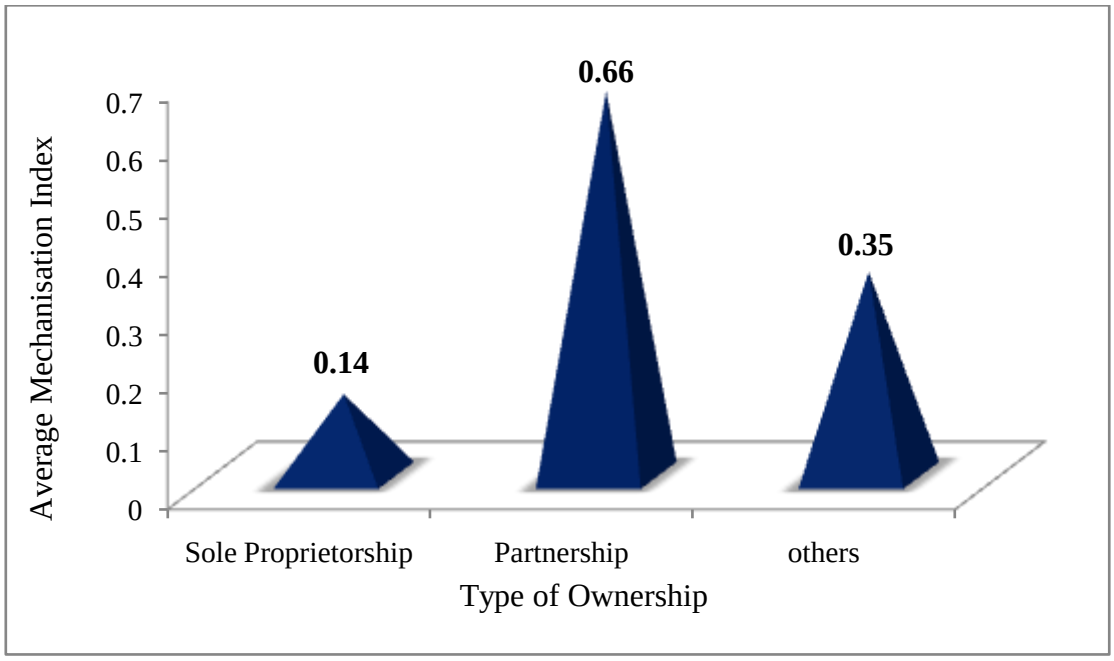
Table 4.23 exhibits that, the mechanisation levels are not much different in household sector firms and factory sector firms. Lower mechanised categories are dominant (89.5% of household sector firms and 92.7% of factory sector firms) in both types of industrial settlement. It is important to note that, all the high mechanised firms belong to the factory sector.

4.4.4 Type of Ownership and Mechanisation

Ownership is categorised into sole proprietorship and partnership. Mechanisation involves huge investment and thus risk. Technological decisions are important because it involves twin choices of increased risk and returns. Innovation and adoption of new manufacturing techniques involves considerable uncertainty [Atanu et al., (1994) and Koundouriet al., (2006)]. So the attitude of the entrepreneurs towards investment and risk plays a major role in mechanisation. Along with this, there are risks related to the market when production shifted to machines from the traditional methods. The product quality may differ and thus affects the durability of the product. All these reflect in their demand and thus on the performance.

As decision makers, the type of ownership is important when mechanisation of the coir industry is concerned. The average Mechanisation Index of the different firms with different type of ownership is computed. This is depicted in Figure 4.10.

Figure 4.10 Type of Ownership and Average MI



Source: Computed from primary data

Figure 4.10 reveals that, comparing to the sole proprietorship, the firms under partnership have a high mechanisation index. The difference in the mechanisation index is significant between sole proprietorship and partnership. This may be due to the reason that the partnership firms are comparatively large. The sole proprietorship and partnership firms belong to private sector. Others constitute the firms under government and co-operative sector and the mechanisation index of this category is high comparing to sole proprietorship and low comparing to partnership.

Mechanisation levels are examined in sole proprietorship and partnership firms and the results are summarised in Table 4.24. The coir units under cooperative and government sectors were taken in the category of others. Table 4.24 exhibits that 75% of partnership units belongs to higher mechanised categories whereas it is 3.9% in the case of units under sole proprietorship. 96.1% of the sole proprietorship units belong to lower mechanised groups. This may be due to the fact that the mechanisation requires huge investments and cannot be done by a single owner and may easier in the case of partnership. Apart from this, the innovation and its adoption are risky also. This risk spreading is possible in the case of partnership where as it cannot be applied in the case of sole proprietorship.

Table 4.24 Type of Ownership and Mechanisation Levels

Mechanisation Level		Firms (%)			Total
		Sole Proprietorship	Partner ship	Others	
Traditional firms	within Mechanisation Level	93.8	1.5	4.6	100
	within Type of Ownership	60.4	25	30	56.5
Low mechanised firms	within Mechanisation Level	90.2	0	9.8	100
	within Type of Ownership	36.6	0	40	35.7
Medium mechanised firms	within Mechanisation Level	25	25	50	100
	within Type of Ownership	1	25	20	3.5
High mechanised firms	within Mechanisation Level	40	40	20	100
	within Type of Ownership	2	50	10	4.3
Total	within Mechanisation Level	87.8	3.5	8.7	100
	within Type of Ownership	100	100	100	100

Source: Computed from primary data

4.4.5 Nature of Ownership and Mechanisation

The firms are categorised in to the government sector, cooperative sector and private sector based on its nature of ownership. The average of Mechanisation Index is computed in the categories of nature of ownership to have clear picture of the degree of mechanisation. The summary of results is presented in Table 4.25.

Table 4.25 shows that there are only two surveyed coir units come under government sector and they have a highest (0.67) average MI comparing to the coir units under co-operative (0.27) and private sectors (0.16). The private sector units are having the least average MI among all the three categories of ownership. The firm size may also different in all this three ownership categories. Hence, size of the firm is to be taken in to consideration while analysing the extent of mechanisation (section 4.4.6).

Table 4.25 Nature of Ownership and Average MI

Nature of Ownership	N	Average MI	S.D
Government Sector	2	0.67	0.47
Co-operative Sector	8	0.27	0.30
Private Sector	105	0.16	0.23
Total	115	0.18	0.25

Source: Computed from primary data

The mechanisation levels are examined across the nature of ownership and the results are summarised in Table4.26.

Table 4.26 Nature of Ownership and Mechanisation Levels

Mechanisation Level		Firms (%)			Total
		Government	Co-operative Sector	Private	
Traditional firms	within Mechanisation Level	0	4.6	95.4	100
	within Nature of ownership	0	37.5	59	56.5
Low mechanised firms	within Mechanisation Level	2.4	7.3	90.2	100
	within Nature of ownership	50	37.5	35.2	35.7
Medium mechanised firms	within Mechanisation Level	0	50	50	100
	within Nature of ownership	0	25	1.9	3.5
High mechanised firms	within Mechanisation Level	20	0	80	100
	within Nature of ownership	50	0	3.8	4.3
Total	within Mechanisation Level	1.7	7	91.3	100
	within Nature of ownership	100	100	100	100

Source: Computed from primary data

From Table 4.26, it is clear that there are only two government sector firms and one of them belongs to low mechanised category and the other belongs to highly mechanised category. In the case of firms under cooperative sector 25% belong to Medium mechanised category and the rest 75% are in the lower mechanised category. 94.2% of the private sector firms belong to lower mechanised category. Thus it is evident that more private sector firms belong to lower mechanisation.

4.4.6 Firm Size and Mechanisation

Firm size is an important determinant of adoption of new production techniques (Gale, 1998; Burton et al., 1999; Varukolu 2007; Gosh, 2010 and Oladeji et al., 2015). Thus the firm size and mechanisation are examined in the present study. Present study defines the firm size in terms of 2 criteria for analysing the mechanisation. These criteria are,

- The number of employees
- The size of investment in plant and equipments

After categorising the firms according to the above criteria, the association between firm size and mechanisation is examined.

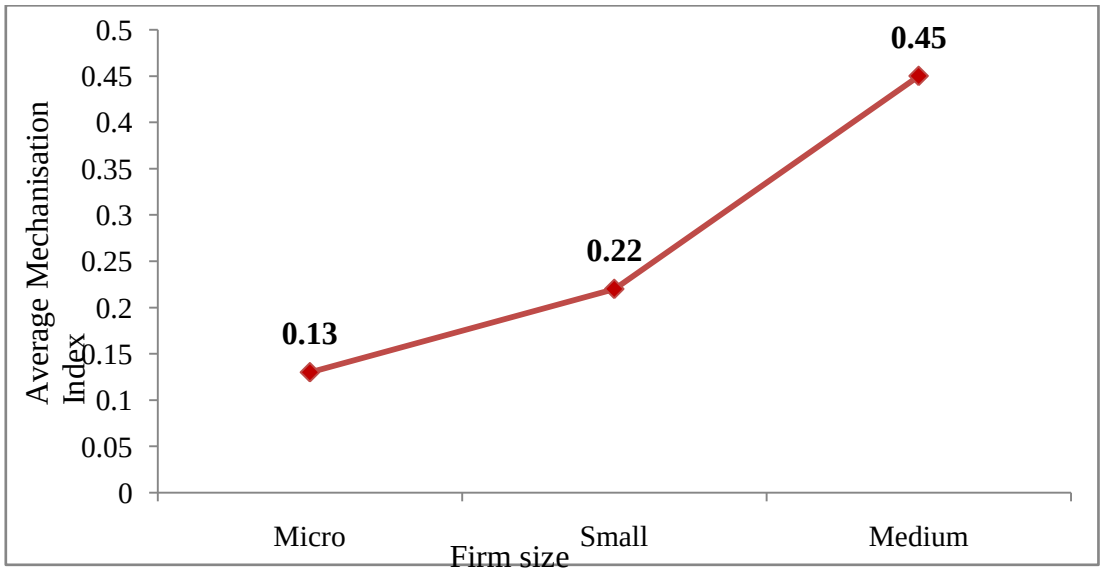
4.4.6.1 Firm size in terms of the number of the employees

European Union (EU) has defined Small and Medium Enterprises (SMEs) in EU law: EU recommendation 2003/361 which has come into force from 1 January 2005. According to this, the category of micro, small and medium-sized enterprises is made up of enterprises which employ fewer than 250 persons and which have an annual turnover not exceeding 50 million euro, and/or an annual balance sheet total not exceeding 43 million euro respectively.

According to this definition, a micro enterprise is one with less than ten employees whereas; it is less than fifty in the case of small enterprises and less than two hundred and fifty for medium enterprises. The association between the firm size and the Mechanisation Index were examined after categorising the sample firms in to micro, small and medium. For this the two variables, firm size in terms of number of employees and the average MI are plotted and the result is depicted in Figure 4.11.

Figure 4.11 exhibits a positive association between firm size in terms of the number of employees and Mechanisation Index. Medium firms have a high Mechanisation Index comparing to small and micro. Therefore it can be infer that the firm size influences the degree of mechanisation, positively.

Figure 4.11 Firm Size based on Number of Employees and Average MI



Source: Computed from primary data

The firm size and the mechanisation levels were cross examined and the results are summarised in Table 4.27.

Table 4.27 Firm Size based on Number of Employees and Mechanisation Level

Mechanisation Level		Firms (%)			Total
		Micro	Small	Medium	
Traditional firms	within Mechanisation Level	78.5	18.5	3.1	100
	within the Firm Size	64.6	42.9	25	56.5
Low mechanised firms	within Mechanisation Level	63.4	31.7	4.9	100
	within the Firm Size	32.9	46.4	25	35.7
Medium mechanised firms	within Mechanisation Level	0	25	75	100
	within the Firm Size	0	3.6	37.5	3.5
High mechanised firms	within Mechanisation Level	40	40	20	100
	within the Firm Size	2.5	7.1	12.5	4.3
Total	within Mechanisation Level	68.7	24.3	7	100
	within the Firm Size	100	100	100	100

Source: Computed from primary data

From Table 4.27, it can see that only 7% of the firms belong to medium size and majority belongs to micro enterprises. Some firms (24.3%) belong to the category of small enterprises. The mechanisation levels are examined across firm size and the result shows that 97.5% of the micro firms are under the lower mechanisation category, and in this, 64.6% is traditional firms. No micro firms are there in medium level of mechanisation. Two micro firms are high

mechanised because they are producing the PVC Tufted Mat, which is a fully mechanised product. In the case of small firms, 89.3% are lower mechanised (42.9% in traditional and 46.4% in low mechanised). Only three small firms belong to higher mechanised categories (one in medium mechanised and two in high mechanised). Considering the medium firms, 50% are lower mechanised (25% each in traditional and low mechanised) and the rest 50% belongs to higher mechanised category (37.5% in medium mechanised and 12.5% in high mechanised).

4.4.6.2Firm Size in terms of the Size of Investment in Plant and Equipments

Small and Medium scale Enterprises (SMEs) are defined in India in terms of investment in plant and machinery, where it is between Rs. 25 lakhs to Rs. 10 crores in case of a manufacturing industry and between Rs. 10 lakhs to Rs. 5 Crores in case of a service sector enterprise. This definition is provided in Section 7 of Micro, Small & Medium Enterprises Development Act, 2006 (MSMED Act) and was notified in September 2006. The Act provides for classification of enterprises based on their investment size and the nature of the activity undertaken by that enterprise. As per MSMED Act (2006), enterprises are classified into two categories - manufacturing enterprises and service enterprises. For each of these categories, a definition is given to explain what constitutes a micro enterprise or a small enterprise or a medium enterprise. What is not coming under the above three categories would be considered as a large scale enterprise in India.

Manufacturing Enterprises are the enterprises engaged in the manufacture or production of goods pertaining to any industry specified in the first schedule to the Industries (Development and Regulation) Act, 1951 or employing plant and machinery in the process of value addition to the final product having a distinct name or character or use. The Manufacturing Enterprises are defined in terms of investment in Plant & Machinery. Service Enterprises are the enterprises engaged in providing or rendering of services and are defined in terms of investment in equipment.

As per MSMED Act 2006, in the case of a manufacturing enterprise, a micro enterprise is one with less than 25 lakhs of investment in plant and machinery where as the small enterprise in one with this investment in between 25 lakhs to 5 crores. In the case of a medium enterprise the limit of investment in plant and machinery is in between 5 and 10 crores. A need for

change in definition has been raised by the various stakeholders from time to time. The MSME related Parliamentary Standing Committee on Industry had taken up this issue and in its 245th Report had recommended that, considering the inflation and dynamic market situation, the definition of MSME as provided in the MSMED Act may be revised every five years. Further, in its 258th Report, it had recommended that "if needed, the Act should be amended to make definition flexible". Ministry of MSME has accordingly decided in November 2014 for an amendment to the MSMED Act, 2006 to double the investment limits of micro and small enterprises and triple the investment limits of medium scale enterprises. The existing and proposed criteria are presented in Table 4.28.

Table 4.28 Definition of MSME in India

Manufacturing Sector	**Existing Definition**	**Proposed Definition**
	Investment in plant & machinery	
Micro Enterprises	Does not exceed 25 lakhs rupees	Does not exceed 50 lakhs rupees
Small Enterprises	More than 25 lakhs rupees but does not exceed 5 crores rupees	More than 50 lakhs rupees but does not exceed 10 crores rupees
Medium Enterprises	More than 5 crores rupees but does not exceed 10 crores rupees	More than 10 crores rupees but does not exceed 30 crores rupees

Source: https://msme.gov.in

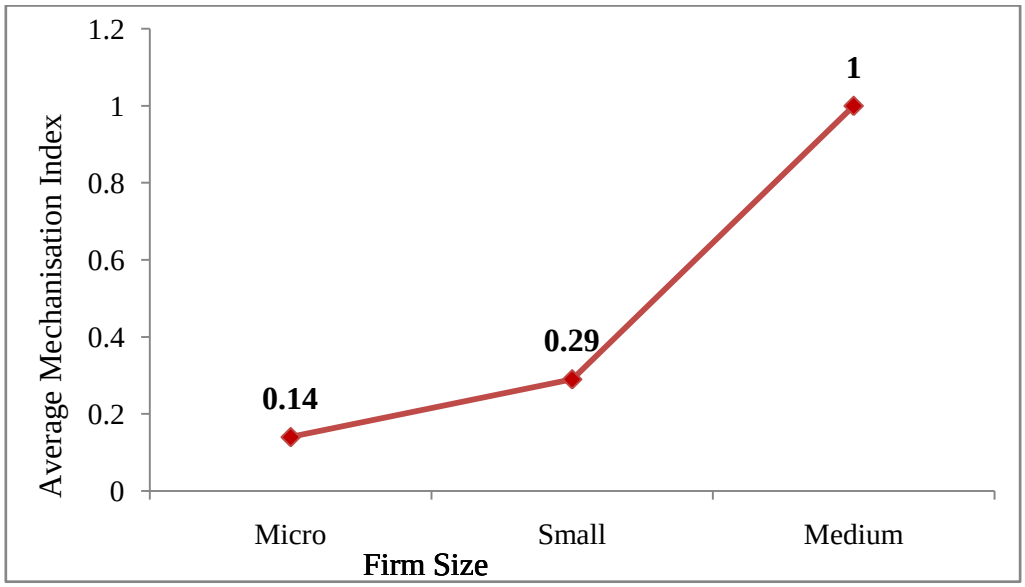
This amendment not enacted yet, but MSME was defined based on annual turnover in February 2018 by the government of India and applicable to all type of MSMEs (service and manufacturing). According to the new classification of MSMEs, a micro enterprise is a unit where annual turnover does not exceeds rupees 5 crores. A small enterprise is a unit where the annual turnover is more than 5 crores but does not exceeds 75 crores and a medium enterprise is a unit where the annual turnover is more than 75 crores but does not exceeds 250 crores.

Present study used the definition given in MSMED act 2006 and the sample firms are categorised into micro, small and medium firms based on the size of investment in plant and machinery. For calculating the size of investment in plant and equipments of the firms, the present value of the factory are taken in to account as the investment in plant since the firms

are started at various time periods. Along with this, the cost of the various equipments used for production is added. Then the total cost of equipments and present value of the plant is taken together as the investment in plant and equipments. This was done for valid comparison of firms in terms of investment in plant and equipment (started at different time periods) and to have an accurate criterion for defining the firm size. After that, the firm size is categorised according to the definition given in MSMED Act 2006 and the mechanisation of firms in each firm size are examined.

The average MI of the firms belongs to different size (micro, small and medium) is calculated and is shown in the Figure 4.12.

Figure 4.12 Firm Size based on Investment in Plant & Equipments and Average MI



Source: Computed from primary data

Figure 4.12 shows that the average Mechanisation Index raises as Firm size (in terms of investment in plant and machinery) increases. There are only one unit in the medium enterprise and it uses 100% of available machines for its production.

The firm size is examined across the mechanisation levels and the results are summarised in table 4.29. It shows that the firm size changes when the definition changes from number of workers to investment in plant and equipments. The number of medium and small firms reduced where as micro firms increased under the criteria of investment in plant and equipment comparing to the definition according to the number of employees. There is only one medium sized firm and it belongs to the category of high mechanised firms.

Table 4.29 Firm Size based on Investment in Plant & Equipments and Mechanisation Level

Mechanisation Level		Firms (%)			Total
		Micro	Small	Medium	
Traditional firms	within Mechanisation Level	86.2	13.8	0	100
	within the Firm Size	60.9	40.9	0	56.5
Low mechanised firms	within Mechanisation Level	82.9	17.1	0	100
	within the Firm Size	37	31.8	0	35.7
Medium mechanised firms	within Mechanisation Level	25	75	0	100
	within the Firm Size	1.1	13.6	0	3.5
High mechanised firms	within Mechanisation Level	20	60	20	100
	within the Firm Size	1.1	13.6	100	4.3
Total	within Mechanisation Level	80	19.1	0.9	100
	within the Firm Size	100	100	100	100

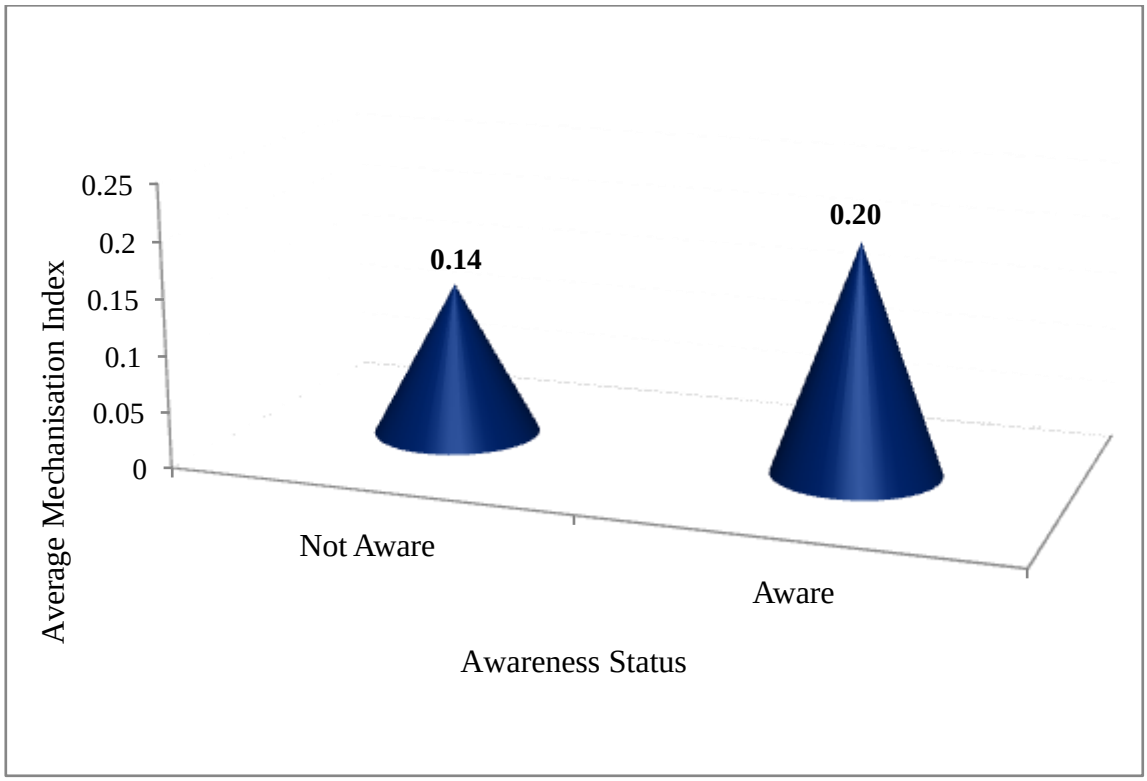
Source: Computed from primary data

Table 4.29 also shows that majority of the firms are micro enterprises and 97.9% of it belongs to lower mechanised category (60.9% are traditional firms and 37% are low mechanised firms) and only a nominal portion of firms are higher mechanised firms. In the case of small firms, 72.7% comes under lower mechanised category (40.9% in traditional and 31.8% in low mechanised) and the rest comes under higher mechanised categories. From this analysis it is evident that, as the firm size rises the number of units comes under higher mechanised categories increases. That is, under this definition of firm size also, the MI raises as the firm size rises.

4.4.7 Awareness Status and Mechanisation

Awareness level determines the extent of adoption of new manufacturing technologies since awareness is a precondition for adoption. Awareness status is classified as aware and not aware groups of the manufacturers. For analysing the association between awareness status and mechanisation, average MI of the firms belongs to various categories of awareness status is computed and depicted in Figure 4.13.

Figure 4.13 Awareness Status and Average MI



Source: Computed from primary data

From Figure 4.13 it is clear that, the average MI of the firms is high where manufacturers are aware about the available machines for coir manufacturing compared to those of not aware manufacturers but the difference is only nominal. Anyway, one can infer that the awareness status have some impacts on mechanisation. These awareness statuses are cross examined with the mechanisation levels and the results are depicted in Table 4.30.

The awareness status of the manufacturers about available machines for manufacturing coir and the levels of mechanisation of firms are compared in Table 4.30. It is clear that the manufacturers belongs to the higher levels of mechanisation (medium and high mechanised firms) are fully aware about the available machines for manufacturing coir. In lower categories of mechanisation majority (60% in traditional firms and 56.1% in low mechanised firms) are also aware about the machines available for coir manufacturing, but comparatively low when compared with higher levels of mechanisation. That is, it is noted that, the manufacturers belongs to lower mechanised categories are less aware compared to the manufacturers of the higher mechanisation levels.

Table 4.30 Awareness Status Mechanisation level

Mechanisation Levels		Firms (%)		Total
		Not Aware	Aware	
Traditional firms	within Mechanisation Level	40	60	100
	within Awareness Status	59.1	54.9	56.5
Low mechanised firms	within Mechanisation Level	43.9	56.1	100
	within Awareness Status	40.9	32.4	35.7
Medium mechanised firms	within Mechanisation Level	0	100	100
	within Awareness Status	0	5.6	3.5
High mechanised firms	within Mechanisation Level	0	100	100
	within Awareness Status	0	7	4.3
Total	within Mechanisation Level	38.3	61.7	100
	within Awareness Status	100	100	100

Source: Computed from primary data

4.4.8 Years of Experience and Mechanisation

Experience of the manufacturer influences the extent of mechanisation(OECD, 1974).Years of experience of the manufacturer is important in the case of mechanisation because of two reasons. Firstly, the year in which the firm started determines the method of production. It uses the prevailing techniques of that time. Secondly, it is difficult to change from one technique to other as time passes. The experienced techniques always accrue some advantages to this firm. Hence the years of experience is analysed with average MI is analysed to elicit the impact of years of experience on MI (See Table 4.31)

.

Table 4.31 Years of Experience and Average MI

Years of Experience	N	Average MI	S.D
Below 10	17	0.18	0.31
10-25	42	0.15	0.21
25 and above	56	0.20	0.26
Total	115	0.18	0.25

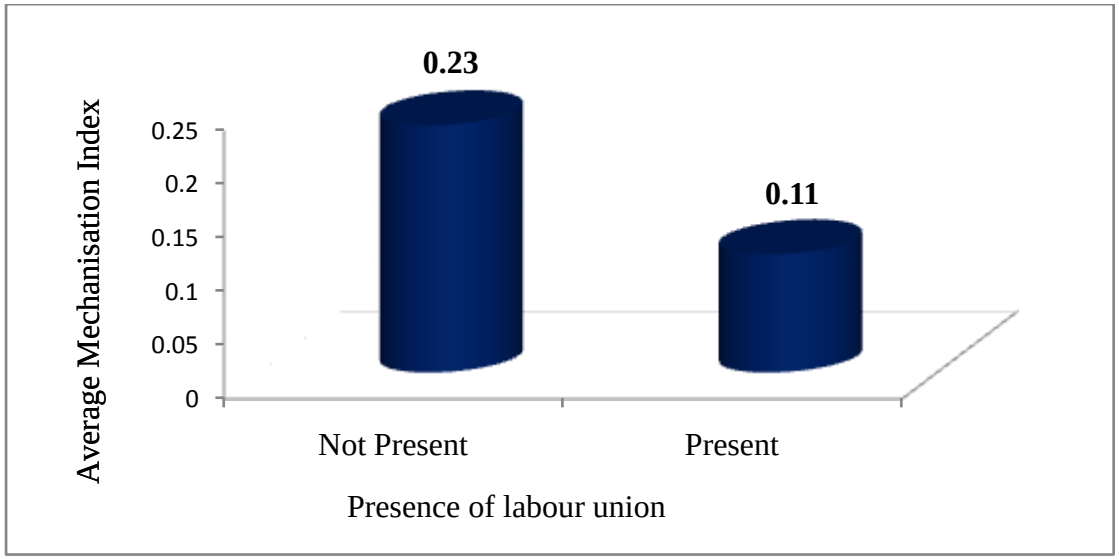
Source: Computed from primary data

It is evident that, the average MI is not much differ among the groups of manufacturers with different years of experience (Table 4.31). The average MI does not show any particular pattern as the years of experience of the manufacturer increases. It is highest (0.2) in more experienced firms.

4.4.9 Presence of Labour Union and Mechanisation

It is argued that the attitude of labour unions towards the mechanisation of coir industry in Kerala is the most important reason for labour struggles against mechanising the industry. Isaac (1983) mentioned that, the trade unions and small producers are aware that handlooms cannot compete with the machine. The fear of huge unemployment has forced them into a vigorous struggle against mechanisation. Loss of jobs of the skilled labour force is pointed out as the main reason for their protest against mechanisation in coir industry. In this context, the study attempts to examine the presence of labour union and the MI among the sample firms. The result is summarised in Figure 4.14.

Figure 4.14 Presence of Labour Union and Average MI



Source: computed from primary data

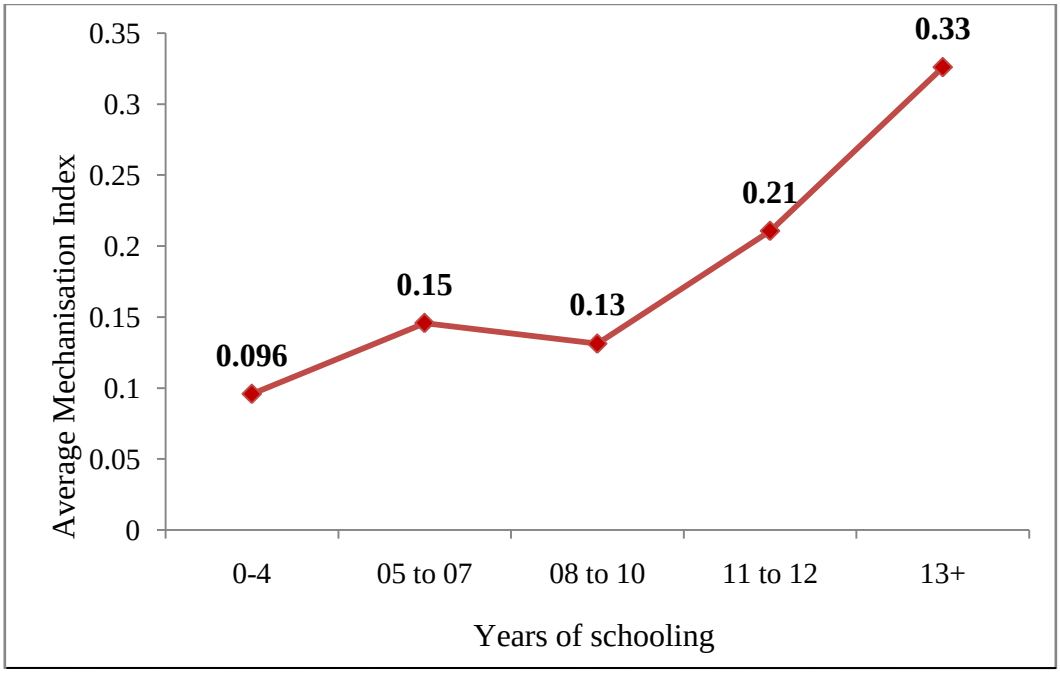
It is noted that the workers of 54.78% of sample coir units are not the members of any labour unions. This is interesting to note because the labour union was very prominent in coir industry in its history and political movements in Kerala. From Figure 4.14, it is clear that, the mechanisation index of the firms where labour unions are absent is slightly higher (0.23)

than that of the firms whose workers are the members of labour unions (0.11). But the labourers and manufacturers opined that, presently no labour unions are against mechanisation. Instead, they promoted it for the betterment of the industry. Earlier it was due to the fear of mass labour displacement by machines and the resulting threat of huge unemployment. Now the scenario has changed. Workers realised that, for sustaining the industry in the State, mechanisation is essential.

4.4.10 Education of the Manufacturer and Mechanisation

Decision regarding the techniques of production is taken by the owner of the firm. The human capital plays an important role in awareness and adoption of new techniques in production (Koundouri et al., 2006 and Okello et al., 2014). Education of the manufacturer is one of the key determinants of mechanisation (OECD, 1974). So the education of the decision maker and average MI is taken in to consideration. For private sector firms, it is the education of the owners whereas, for cooperative sector firms the education of the secretary is taken in to account. Government sector firms (2) are excluded from this analytical category. The association between the education of the manufacturers and the average MI are clearly depicted in Figure 4.15.

Figure 4.15 Education of the Manufacturer and Average MI



Source: Computed from primary data

Figure 4.15 shows that the average MI increases as the years of schooling of manufacturer increases. It is also evident that, only a few of them (6.08%) have more than 12 years of education but most of them (73.91%) have 8 to 12 years of schooling. One more interesting feature about the education of the owner is that 37.39% of the coir manufacturers have more than secondary education, even though it is a traditional industry. To verify the association between the education of the manufacturer and MI, the Karl Pearson's correlation coefficient is calculated and it is 0.251 which is significant at 1 percent level. Thus it can be concluded that the average MI and education of the manufacturer are positively related. The higher educated manufacturers have more chances to mechanise their firm.

4.4.11 Age of the Manufacturer and Mechanisation

Mechanisation involves the replacement of an experienced production technique and hence the age of the adopter plays a crucial role. Age of the manufacturer is a prominent factor determines the level of mechanisation and its influence on mechanisation is negative (Gale, 1998; Burton et al., 1999 and Gosh, 2010). So this factor is also taken into consideration and the average MI is computed and analysed across various age group. The results of the analysis are presented in Figure 4.16.

Figure 4.16 Age of the Manufacturer and Average MI

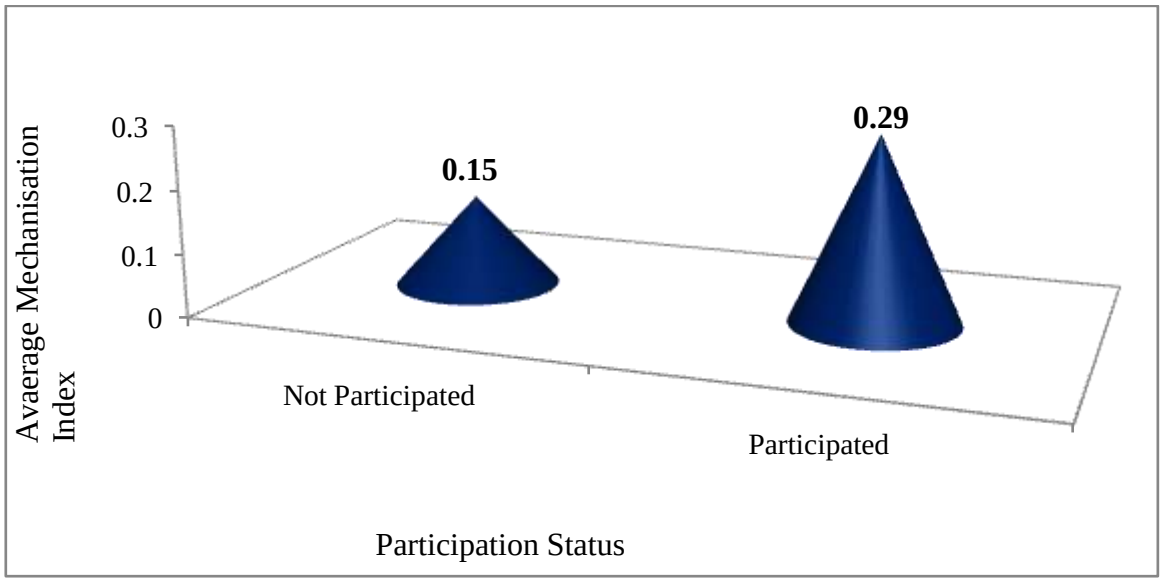
Source: Computed from primary data

From the Figure 4.16, we can infer that there is no clear pattern between the age of the manufacturer and average Mechanisation Index. But it is clear that the average MI of the younger manufacturer (25-45) is comparatively high (0.27) compared to the elder manufacturer (0). It also reveals that the average MI declines as the age increases except the age group 70-80. The average MI is the highest (0.29) for the age group 70-80. Therefore to have a valid conclusion, the Karl Pearson's correlation coefficient is also calculated between the age of the coir manufacturer and the MI. The value thus calculated is -0.112 but this correlation was not significant.

4.4.12 Participation / Provision of Promotional Programmes and Mechanisation

Access to extension services is a major factor determines the mechanisation (Adewuyi et al., 2006; Gosh, 2010 and Oladeji et al., 2015).The participation or provisions of various product promotional programmes by the coir manufacturers are taken as extension services and examined its effect on mechanisation. The programmes considered include exhibitions, seminars and trade fairs of various institutions or self sponsored. In these promotional programmes, the new machines are exhibited and the diffusion of information and technological knowledge are taken place. So this may influence the awareness level and thus the level of mechanisation. Thus this relation is examined and the results are presented in Figure 4.17.

Figure 4.17 Participation in Promotional Programmes and Average MI



Source: Computed from primary data

The Average MI presented in Figure 4.17, among the manufacturers those who provided or participated in promotional programmes or not, shows that the average MI of those who provided or participated in promotional activities is higher than those who do not avail this facility. Thus it can be infer that the Mechanisation Index is influenced by the provision or participation of product promotional programmes.

4.4.13 Research and Development Expenditure and Mechanisation

Research and Development (R&D) expenditure is the most crucial variable to influence the mechanisation of firm or an industry (Kuriakose et al., 2011). Thus this relation is examined in the case of coir industry of Kerala. Majority of the firms belongs to micro and small size and their expenditure towards research and development was meagre. Most of them have no research and development activities. Even though, the relation between R&D expenditure and MI are examined using Karl Pearson's correlation coefficient. The value of correlation coefficient is 0.143 but not significant statistically. So one can infer that, in a traditional industry like coir, the firm's R&D expenditure is not significant to influence the level of mechanisation.

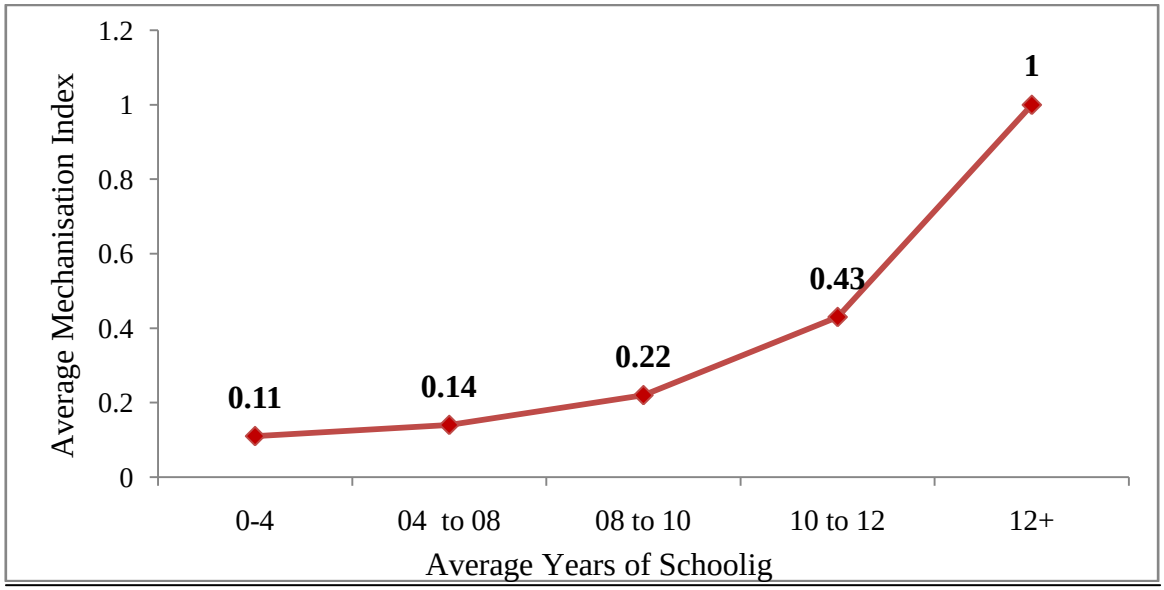
4.4.14 Average Education of the Labour Force and Mechanisation

Labour is the active input used in any productive activity. The skill and education of the labour force is one of the key determinants of the extent of mechanisation (Koundouri et al., 2006 and Narayanamoorthy et al., 2014). Education increases the efficiency to work with machines that requires additional skills. The skill acquisition is easy for the educated labour force comparing to others. So the average education of the workers is examined to infer its influence on the mechanisation of the firm. For this purpose, the average years of schooling of the labour force of each firm are calculated first and then it was examined in relation to the MI. This detail is depicted in Figure 4.18.

Figure 4.18 shows the positive association between the education of the labour force and MI. As average education of the labour force increases, the average MI of the firm also increases. To confirm the association between education of the labour force and MI, Karl Pearson's correlation coefficient is calculated and it is 0.309 and significant at 1 percent level. Thus we

can infer that the Mechanisation Index and the education level of the labour force are positively associated.

Figure 4.18 Average Education of the Labour Force and Average MI



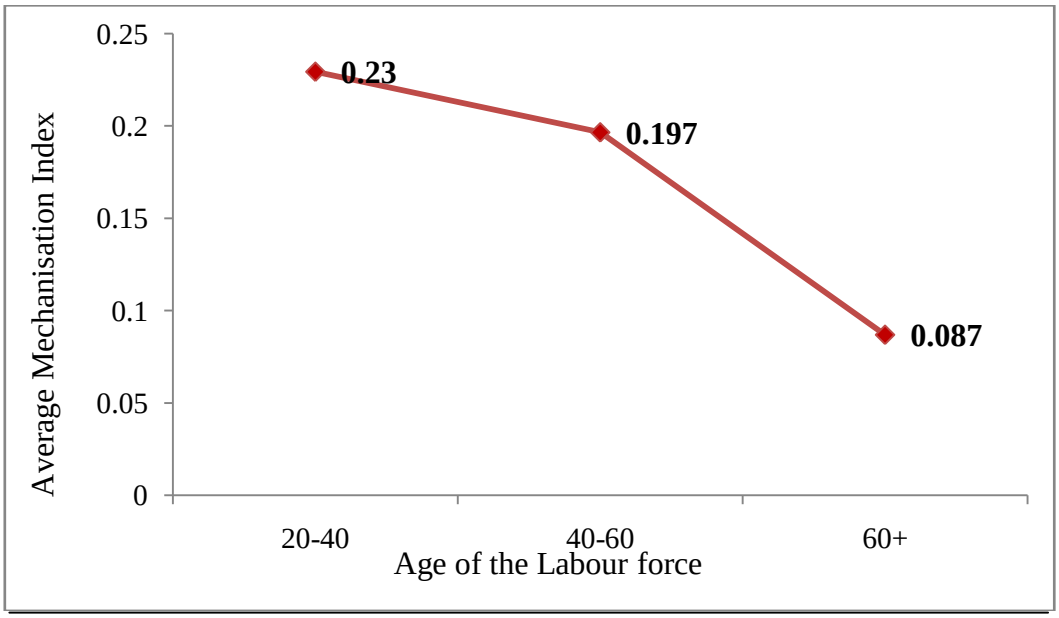
Source: Computed from the primary data

4.4.15 Average Age of the Labour Force and Mechanisation

It is easy to adopt new technologies for the firms with younger labour force (Gale, 1998). The age of the work force reflects their skill and experience in the manufacturing of coir. It is believed that it is easy for a younger labour force to learn new skills and it is comparatively difficult for an aged and experienced person to change accordingly. So it is essential to examine whether the age of the labour force influences the mechanisation of the firms. So the average age of the labour force of each firm are computed first and is examined in relation to average MI. The result is exhibited in the Figure 4.19.

Figure 4.19 shows that, as the average age of labourers goes up the average MI decreases and vice versa. There exists a negative association between the average age of labourers and the average MI. To check this relation, the Karl Pearson's coefficient of correlation is estimated and it is -0.16 and significant at 10 percent level. So it can be concluded that the average age of the labour force inversely related to the MI.

Figure 4.18 Average Age of Labour Force and Average MI



Source: Computed from the primary data

From the analysis of characteristics of firms and mechanisation, it is clear that the mechanisation index of coir manufacturing was related to the firm specific factors. From the above analysis some relevant variables that influence the degree of mechanisation are identified. The study employed a regression analysis to understand the extent of the influence of the each of these characteristics on the mechanisation index, and to get more scientific result. Since the value of mechanisation index lies between zero and one and the majority (56.5%) of the coir manufacturers have a zero score for Mechanisation Index (MI), it is a case of censored distribution and thus the censored regression model, the Tobit regression model, is used.

4.5 Determinants of Mechanisation: The Firm Specific Factors

The adoption of new manufacturing techniques is determined considerably by the characteristics of a firm where it applied (Burton et al., 1999; Varukolu 2007; Lin & Zhang 2009; Gosh 2010; Kuriakose et al., 2011 Okello et al., 2014; Narayanamoorthy et al., 2014 and Oladeji et al., 2015). Therefore, the study attempts to identify the firm specific factors that determine the degree of mechanisation of the selected coir manufacturing firms.

4.5.1 Determinants of Mechanisation: A Tobit Regression Approach

The firm specific determinants of mechanisation, identified from the literature surveyed and from the analysis of the primary data regarding the characteristics of the firm and MI, includes, firm size, awareness status of the manufacturer, education of the manufacturer, provision / participation in promotional programmes, average years of schooling of employees, average age of the employees and presence of labour union. To elicit the firm specific factors that determine the extent of mechanisation of coir industry, a regression analysis is employed. The value of the Mechanisation Index ranges between 0 and 1 and the majority (56.5%) of the coir manufacturers have a zero score for Mechanisation Index (MI), it is a case of censored regression model. Therefore, the Tobit Model of regression, is suitable to explain the factors determining the MI. A Tobit regression model, where the Mechanisation Index is the dependent variable (Yi) and the firm specific factors as the explanatory variables is presented in Model 4.5.

$$Yi = \beta_1 + \beta_2 X_1 + \beta_3 X_2 + \beta_4 X_3 + \beta_5 X_4 + \beta_6 X_5 + \beta_7 X_6 + \beta_8 X_7 + Ui \text{.....} (4.5)$$

Where;

Yi = Mechanisation Index

X_1 = Firm size

X_2 = Awareness status of the manufacturer (X_2=1 for aware and =0 for not aware)

X_3 = Education of the manufacturer

X_4 = Provision / participation in promotional programmes (X_4=1 for provided/ participated and = 0 for not provided/ not participated)

X_5 = Average years of schooling of the labour force

X_6 = Average age of the labour force

X_7 = Presence of labour union (X_7 = 1 present and =0 for not present)

and

Ui = Stochastic random variable

In order to estimate the regression coefficients of the Tobit model, the Maximum Likelihood (ML) method is used since the OLS estimates are inconsistent. Before running the regression, it is essential to check the basic assumption of the model.

4.5.1.1 Checking for Basic Assumptions

One of the basic assumptions of the Tobit regression model is that there is no perfect multi-collinearity between the explanatory variables included in the model. So as a first step of running the model 4.5, the assumption of no perfect multi-collinearity is checked to proceed with the regression model. The multi-collinearity among the explanatory variables is tested using Variance Inflation Factors (VIF) and the result is expressed in Table 4.32.

Table 4.32 VIF –Firm Specific Determinants of MI

Explanatory Variables	VIF
Firm size	1.62
Awareness status of the manufacturer	1.20
Education of the manufacturer	1.62
Provision/ participation in promotional programmes	1.26
Average years of schooling of the labour force	1.27
Average age of the labour force	1.27
Presence of the labour union	1.33

Source: Estimated from primary data

Since the Minimum possible value of VIF = 1.0 and Values > 10.0 may indicate a collinearity problem, it is clear that, no such collinearity exists between the explanatory variables of regression model 7.1 (See Table 4.32). Thus Table 4.32 shows that no variables are highly collinear since the value of VIF of all explanatory variables is near to 1.

Another assumption of Tobit regression model is the normality of residual, which is important in hypothesis testing. This is checked using Chi- Square test of normality. The value of the test statistic is 24.17 with a p-value 0.00. This shows that the residuals of the regression model 4.5 are normally distributed. Since these two assumptions are satisfied, the study used the regression model to elicit the firm specific determinants of the Mechanisation Index.

4.5.1.2 Regression Results and Interpretations

Tobit model uses the method of Maximum Likelihood for estimating the regression parameters. The overall significance of the regression model is examined in terms of Chi-

Square in this model. Instead of R square, in Tobit regression model, log-likelihood ratio is taken as the explanatory power of the model. The result of the Tobit regression model 4.5 is exhibited in Table 4.33.

Table 4.33 Regression Results – Firm Specific Determinants of MI

Explanatory Variables	Coefficient	Std. Error	z	p
Constant	−1.18	0.48	−2.41	0.01
Firm size	0.22	0.09	2.25	0.02
Awareness status of the manufacturer	−0.06	0.10	−0.60	0.55
Education of the manufacturer	0.02	0.02	1.26	0.21
Provision/ participation in promotional programmes	0.25	0.12	2.05	0.04
Average years of schooling of the labour force	0.05	0.03	2.08	0.03
Average age of the labour force	0.006	0.006	0.92	0.36
Presence of the labour union	−0.35	0.13	−2.76	0.005
Log- Likelihood ratio = -64.92		Chi-Square = 22.71		

Source: Estimated from primary data

It is clear from the Table 4.33 that, the regression model is significant with Chi Square value 22.71 at 1 % level. Therefore it is a good model and can be used to draw inferences about the factors determining the MI. The individual influences of the explanatory variables of the model on the MI are examined with the individual beta coefficients. It was clear that the variables firm size, provision/ participation in promotional programmes, average education of the employees and presence of labour union are the factors determining the MI. The estimated β's from the Tobit regression model do not directly measures the changes in the dependent variable per unit changes in the explanatory variables. For having the individual influences of each independent variable on the dependent, the marginal effects are estimated. The marginal effects (dp/dx) from the Tobit regression model shows how much variations in the dependent variable (Yi = mechanisation index) can be explained by the independent variables. The marginal effects of the model 4.5 are shown in the Table 4.34.

Table 4.34 Marginal Effects – Firm Specific Determinants of MI

Explanatory Variables	dp/dx	Std. Error	z	p
Firm size	0.10	0.04	2.28	0.02
Awareness status of the manufacturer	-0.01	0.02	-0.59	0.60
Education of the manufacturer	0.01	0.01	1.26	0.20
Provision/ participation in promotional programmes	0.13	0.07	1.83	0.07
Average years of schooling of the labour force	0.02	0.01	2.08	0.03
Average age of the labour force	0.003	0.003	0.92	0.35
Presence of the labour union	-0.14	0.04	-3.34	0.00

Source: Estimated from primary data

Table 4.34 reveals that, the variables firm size, provision/ participation in promotional programmes, average education of the labour and presence of labour union are the variables significantly determines the MI of the coir units. The result shows that, firm size, average education of the labour and presence of labour union are significant at 5% level where as provision / participation in promotional programmes is significant at 10% level. From it, it can also be deduced that the firm size, participation in promotional programmes and the average education of the labour are positively influenced the MI (coincides with the results of Koundouri et al., 2006; Adewuyi et al., 2006; Gosh, 2010 Okello et al., 2014 and Oladeji et al., 2015) whereas, the presence of labour union inversely influence the mechanisation index which is significant at 1% level. It can also be noted that the other variables like awareness about available machines for manufacturing, education of the manufacturer and average age of the labour are turned to be not significant to influence MI of the coir manufacturing firms.

4.5.2 Determinants of Mechanisation Level: Multi-nominal Logit Regression Model

Here the study uses an alternative method for the sensitivity analysis. The sensitivity analysis determines how different values of an independent variable affect a particular dependent variable under a given set of assumptions. Here the dependent variable is the mechanisation level and the firm specific factors explained in model 4.5 are used as the explanatory variables. Since the dependent variable is a categorical variable with four levels of

mechanisation, the multi-nominal Logit regression model is employed for the sensitivity analysis as shown in Model 4.6.

$$Yi = \beta_1 + \beta_2 X_1 + \beta_3 X_2 + \beta_4 X_3 + \beta_5 X_4 + \beta_6 X_5 + \beta_7 X_6 + \beta_8 X_7 + Ui \text{.....(4.6)}$$

Where;

Yi = Mechanisation Levels (Y_i =0 for traditional firms, =1 for low mechanised firms, =2 for medium mechanised firms and =3 for high mechanised firms)

X_1 = Firm size

X_2 = Awareness status of the manufacturer (X_2=1 for aware and =0 for not aware)

X_3 = Education of the manufacturer

X_4 = Provision / participation in promotional programmes (X_4=1 for provided/ participated and = 0 for not provided/ not participated)

X_5 = Average years of schooling of the labour force

X_6 = Average age of the labour force

X_7 = Presence of labour union (X_7 = 1 present and =0 for not present)

and

Ui = Stochastic random variable

The basic assumption of no perfect multi-collineariry is already checked and satisfied in Model 4.5 using VIF (Table 4.32) and thus the model is employed to regress the mechanisation levels with the above specified regressors (Model 4.6). The results of the regression model 4.6 are described in Table 4.35.

Table 4.35 Regression Results: Firm Specific Determinants of Mechanisation Levels

Mechanisation Levels	Explanatory Variables	β	S.E	z	p	dp/dx	p
Low mechanised firms	Constant	−5.16	2.26	−2.29	**0.02**	-	-
	Firm size	0.06	0.08	0.75	0.45	-0.28	**0.02**
	Awareness status	0.05	0.03	1.55	0.12	0.16	0.15
	Education of the manufacturer	0.12	0.13	0.89	0.37	-0.01	0.45
	Provision/ participation in promotional programmes	−1.83	0.64	−2.85	0.004	-0.04	0.79
	Average years of schooling of the labour force	−0.68	0.47	−1.43	0.15	-0.03	0.37
	Average age of the labour force	0.17	0.65	0.26	0.79	-0.01	0.11
	Presence of the labour union	1.19	0.51	2.32	0.02	0.36	**0.00**
Medium mechanised firms	Constant	−3.56	16429.6	−0.0002	0.99	-	-
	Firm size	0.78	0.61	1.29	0.19	6.28	**0.02**
	Awareness status	−0.99	0.84	−1.17	0.24	-0.16	0.15
	Education of the manufacturer	−1.83	1.64	−1.11	0.26	0.01	0.45
	Provision/ participation in promotional programmes	−6.09	6.36	−0.96	0.34	0.04	0.79
	Average years of schooling of the labour force	3.92	16429.6	0.0002	0.99	0.03	0.37
	Average age of the labour force	−0.54	2.27	−0.24	0.81	0.01	0.11
	Presence of the labour union	18.47	16.16	1.14	0.25	-0.36	**0.00**
High mechanised firms	Constant	−43.19	24413	−0.002	0.99	-	-
	Firm size	0.89	0.48	1.86	0.06	2.15	0.99
	Awareness status	−0.08	0.14	−0.54	0.58	5.78	0.99
	Education of the manufacturer	1.82	0.96	1.89	0.05	9.07	0.99
	Provision/ participation in promotional programmes	−3.81	2.68	−1.42	0.15	-6.13	0.99
	Average years of schooling of the labour force	22.38	24413.5	0.0009	0.99	-2.24	0.99
	Average age of the labour force	4.71	2.55	1.85	0.06	-1.20	0.99
	Presence of the labour union	−3.78	2.48	−1.52	0.13	-5.18	0.99
Number of cases 'correctly predicted' = 71 (61.7%)				Chi-square = 67.99 [0.00]			

Source: Estimated from primary data

The regression results of multi-nominal Logit regression results shown in Table 4.33 reveals that, in high level of mechanisation, none of the explanatory variables are significant (based on dp/dx and p values) to influence the level of mechanisation. It is due to the fact that only 5 firms are there in this category. Thus the number of parameters to be estimated is greater than the number of observations. In the case of low and medium mechanised firms, both the firm size and presence of labour union significantly influences the mechanisation levels. The influence of firm size is positive in medium mechanised firms where as it is negative in low mechanised firms comparing to traditional firms. But the presence of labour union has a positive impact in low mechanised firms and negative in medium mechanised firms. Thus it can be concluded from the results that, the two variables, firm size and presence of labour union significantly influences the mechanisation levels as in the case of MI, the direction of its influence varies in different levels of mechanisation.

To conclude, we can say that the MI is influenced by the firm size, provision/participation in promotional programmes and the average education of the labour force positively whereas the presence of labour union has a negative influence on. Considering the mechanisation levels, the firm size and the presence of labour union have positive influences in low and medium mechanised firms. . It can also be infer that the variables like awareness about available machines for manufacturing, education of the manufacturer and average age of the labour are not significant to influence either MI or the mechanisation levels of the coir manufacturing firms.

4.6 Conclusion

From the analysis of degree of mechanisation of the coir industry of Kerala, we can conclude that, the degree of mechanisation of the coir manufacturing units is very low. Majority of them remains traditional in this modern era of technological explosion. It may due to the inherent traditional features of the industry. The analysis of the Mechanisation Index across various firm characteristics shows that the extent of mechanisation differs accordingly. The Mechanisation index is high in urban coir firms comparing to its rural counterpart, in spinning firms comparing to de-fibering and product manufacturing firms, in factory sector firms comparing to household sector firms, in partnership firms comparing to sole proprietorship, in government owned firms comparing to the firms under co-operative and private sector, in medium firms comparing to small and micro firms, in aware group than not

aware group of manufacturers, in firms where labour union is absent than present and in firms who participated promotional programmes than not participated. The firm size, the education of the manufacturer and the average years of schooling of the labour force are positively associated with the Mechanisation Index where as the age of these two are negatively associated with MI. It is also noted that the year of starting the coir unit is not influences the MI. An analysis of the determinants of the MI (firm specific factors) reveals that the firm size, the participation in promotional programmes and the average education of the labour force are positively influences the MI whereas, the presence of labour union inversely influence it. All the other firm specific factors analysed (socio-economic, geographic and demographic) have no significant influence on MI.

CHAPTER 5

MECHANISATION AND THE PERFORMANCE OF COIR INDUSTRY: Micro-Level Evidences

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- ***Introduction***
- ***Impact on Production***
- ***Impact on Efficiency***
- ***Impact on Productivity***
- ***Impact on Number of diversified Products***
- ***Impact on the Extent of market***
- ***Conclusion***

CHAPTER 5

MECHANISATION AND THE PERFORMANCE OF COIR INDUSTRY: Micro-Level Evidences

5.1 Introduction

State of technology is a key determinant of growth (Wellisz 1966; Mehta 1980; Stoneman 1983; Greenwood et al., 1997; Malecki 1997; Helpman 1998 and Verspagen 2006) and performance (Zahra & Covin 1993). Though the concept of technology is broader in definition and difficult to bring in the analytical ambience of a traditional industry such as coir in its fuller sense, the present study considers mechanisation of coir industry as advancements in production technology. Thus, this chapter examines the impact of this technical advancements on the performance of the industry. For evaluating the impact of mechanisation on the performance of coir industry the major variables used are;

- Production,
- Efficiency of the production process,
- Productivity,
- Number of products produced and
- Extent of Market of the products

Out of these variables, the productivities and efficiencies were taken as the key variables indicating the performance since the first measures the average and marginal productivities of the various inputs and the later measures the efficiency of the production technique or the efficiency of the process of production. These two variables directly measure the impact of the production techniques on the performance of the industry. Each variable is analysed in detail and examined across mechanisation levels. The detailed analysis is presented in following sections.

5.2 Impact on Production

Production is the primary variable used to evaluate the performance of an industry. It is because; the impact of production technique is first reflected in the volume of production. Production is analysed both product wise and firm wise across different mechanisation levels.

5.2.1 Mechanisation and Daily Production of Coir Products

Firstly the daily production of different products and their corresponding EM scores are taken in to consideration. Since the volume of different products is measured in various units, their value in rupees is taken in to account for the analysis. This is summarised in Table 5.1.

Table 5.1 EM Scores and Average Daily Production

Products	Average EM scores	Average Daily Production (in Rupees)	Std.Deviation of average production
Hand Loom Mat	0.15	43124.73	309231.50
Geo-textiles	0.02	75422.22	221517.50
Power Loom Matting	0.21	180667.27	308042.03
Hand Loom Matting	0.12	222990.43	331808.38
PVC Tufted mat	0.96	1015924.00	751492.09
Yarn and Fibre	0.42	14536.25	8123.30
Total	0.17	112656.50	364278.30

Source: Computed from primary data

PVC tufted mat is the highest mechanised product and its average daily production is also the highest as shown in Table 5.1. Geo-textile is the least mechanised product but its daily production is higher than that of handloom mat and yarn and fibre. This may be due to the largest demand from the Local Self Governments (LSGs) for the product after the 6th edition of 'Coir Kerala' (2018). During the time of data collection, geo-textile is the mostly demanded product due to the intervention of government in coir industry through 'Coir Kerala'. LSGs demanded geo-textiles in huge quantities for their construction of roads and canals. This demand is created by the creative intervention of Coir Minister, Dr. Thomas Isaac, during Coir Kerala 2018. Therefore the production of geo-textiles reached in its heights at the time of primary data collection.

Coir yarn and fibre has the least daily production but have a high (0.42) EM score next to PVC tufted mat (0.96). This is because, for the production of fibre and yarn, mechanical means are available in plenty and at low cost comparing to machines for manufacturing coir products but, the raw materials (both husk and fibre) are scarce. Husk collection became a

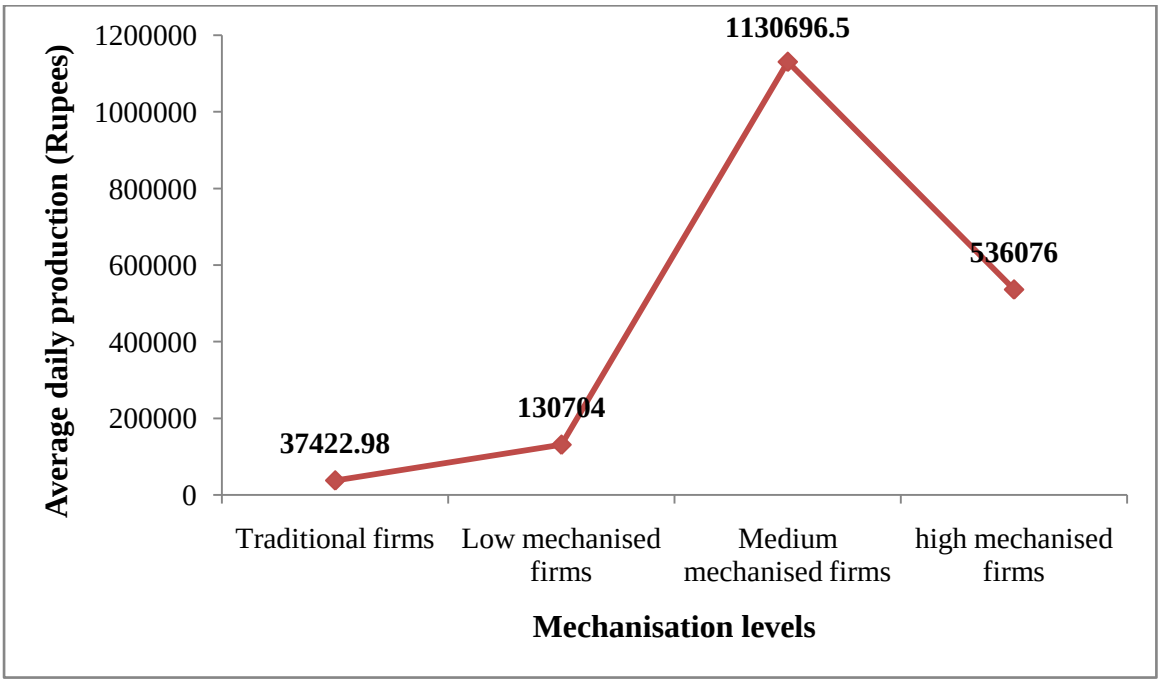
failure in Kerala. For mechanised fibre extraction, green husk is required in huge quantity. But in Kerala, coconut is not a plantation crop now. Most of the coconut plants are in the homesteads and so the harvesting of coconut is not fully in commercial manner (Coir Board, 2008). Thus green husks are not available in bulk quantities which are essential for mechanical fibre extraction. Instead, in neighbouring States, especially in Tamil Nadu, coconut is a plantation crop and huge quantities of coconuts are harvested at one time and so green husk is plenty available at a point of time and at one destination. There is no need of collection at all. This led to the speedy mechanisation in de-fibering and spinning activities in Tamil Nadu and fibre and yarn are extensively produced using less time and resources. This is not happened in Kerala. The machines for de-fibering and spinning are available but the raw materials are not. Thus the production of fibre and yarn is low even with high levels of mechanisation.

In order to check the association between EM scores and daily production of different coir products, the Karl Pearson's coefficient of correlation is computed and it is 0.31 and is significant at 1% level. Thus we can infer that as the Extend of Mechanisation goes up, the daily production of different coir products also increases. This section analysed the production of different products against corresponding EM scores whereas, the production of each firm is examined against their MI scores in the following section.

5.2.2 Mechanisation and Daily Production of Firms

The average daily production of various firms that belongs to different levels of mechanisation is examined in this section. This can be better explained in the Figure 5.1. It is clear that, the average daily production increases with the levels of mechanisation up to the medium mechanised firms. It is also noted that, the average daily production is highest in medium mechanised firms. But comparing to traditional and low mechanised firms, the average daily production is high in the higher mechanised firms (medium and high mechanised). Therefore we can infer that, as the mechanisation levels goes up, the average daily production increases. But it is noted that, the daily production is influenced not only by the level of mechanisation but also by various firm characteristics, especially, firms size. So when analysing the impact of mechanisation on the daily production of firms, it is better to consider the per capita production and this is analysed in section 5.2.3.

Figure 5.1 Mechanisation Levels and Average Daily Production



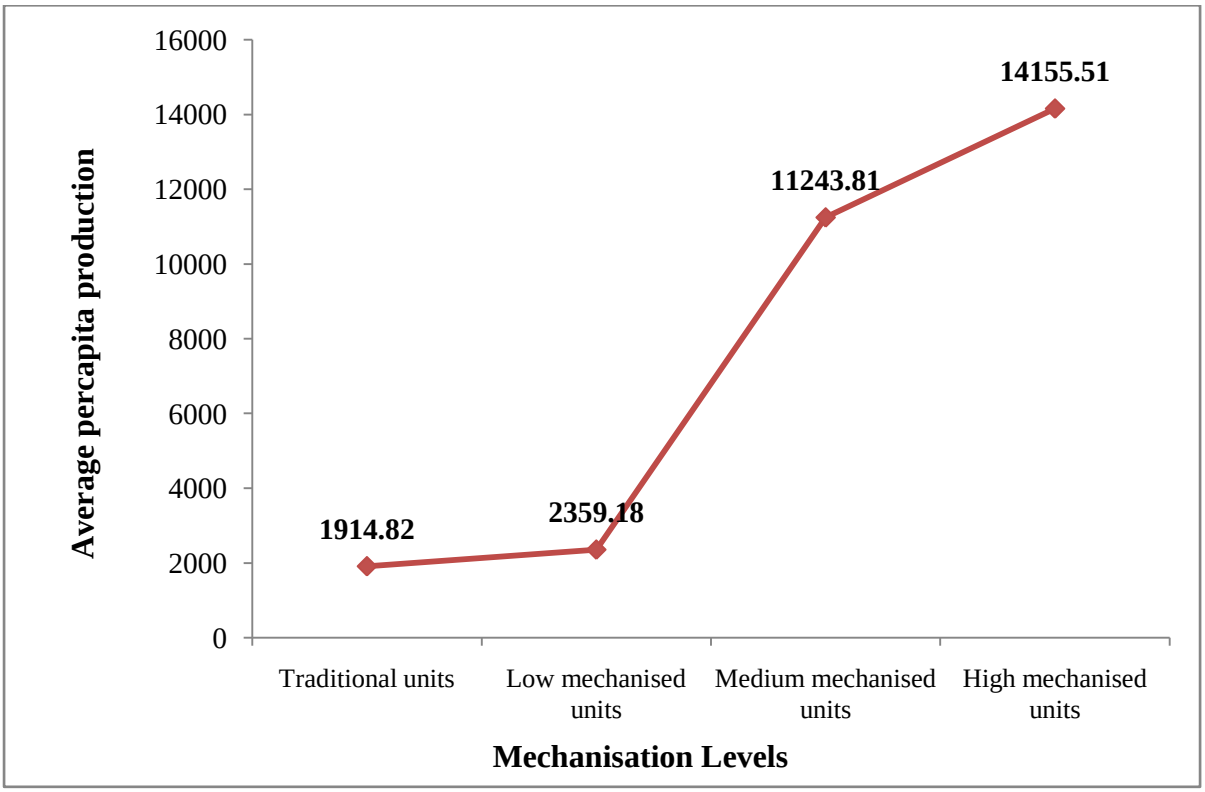
Source: Computed from primary data

5.2.3 Mechanisation and Per Capita Production

To nullify the effect of firm size on production, the per capita production is computed, by dividing the daily production by the number of workers. After that, the impact of mechanisation is analysed on the per capita production. This per capita production also shows the productivity per worker or simply the average productivity of labour per day. The average per capita daily production of the coir units belongs to different mechanisation levels better indicates the impact of mechanisation on production. This is depicted in Figure 5.2.

Figure 5.2 shows that the average per capita production raises with mechanisation level. Not only that, the rate of increase of per capita production at higher mechanised levels is very high compared to that of lower levels of mechanisation. So it is evident that mechanisation level influences the per capita production positively and in order to verify the significance of the association between the mechanisation level and per capita production, statistical testing of comparing significant mean differences, Analysis Of Variance, (ANOVA) is used. Before performing the ANOVA, the normality of the distribution of the per capita production is tested using Kolmogorov- Smirnov test.

Figure 5.2 Mechanisation Levels and Average Per Capita Production



Source: Computed from primary data

The results of the normality test reveals that the distribution of the per capita production is not normal and so the parametric ANOVA cannot be used to check the significant differences in group means of per capita production across the mechanisation levels. So the non parametric ANOVA test, Kruskal- Wallis test, is used to test this. Since the variation of per capita production among various levels of mechanisation is high, another average (median) of per capita production is also tested using independent sample median test. The results of these two statistical tests are summarised in Table 5.2.

The test results presented in Table 5.2 shows that both the averages, mean and median, of per capita production are different across mechanisation levels. Since the hypothesis of equality of mean is rejected, we can infer that the mechanisation level influences the per capita production positively. As the level of mechanisation increases, the per capita production also increases and vice versa.

Table 5.2 ANOVA Results- Mechanisation Levels and Per Capita Production

	Null Hypothesis	Test	Test Statistic	p
1	The medians of per capita production are the same across categories of mechanisation level.	Independent-samples median test	10.19	.017
2	The distribution of per capita production is the same across categories of mechanisation level.	Independent-samples Kruskal-Wallis test	14.07	.003

Source: Computed from primary data

Since the hypothesis of equality of averages of per capita production across different mechanisation level is rejected, we have to check between which levels of mechanisation, the averages are different. Pair wise comparison of average is analysed as the post hoc analysis (Table 5.3).

Table 5.3 Pair-wise Comparison - Average Per Capita Production & Mechanisation Levels

Sample 1- Sample 2	Test statistic	Std. error	Sig
Low mechanised firms – Traditional firms	3.36	6.65	0.61
Low mechanised firms – Medium mechanised firms	-29.02	17.46	0.09
Low mechanised firms – High mechanised firms	-54.27	15.79	**0.001**
Traditional firms – Medium mechanised firms	-25.66	17.17	0.14
Traditional firms – High mechanised firms	-50.91	15.47	**0.001**
Medium mechanised firms – High mechanised firms	-25.25	22.36	0.26

Source: Computed from Primary data

Table 5.3 reveals that the average per capita production is significantly different between only two levels of mechanisation at 5% level. These are traditional firms with high mechanised firms and low mechanised firms with high mechanised firms. That is, the two lower levels mechanisation are performing significantly low compared to the high mechanised firms in terms of per capita production. The average MI is significantly different between low mechanised and medium mechanised firms at 10% level. There were no significant differences between the lower mechanisation levels (traditional firms and low mechanised firms) and between higher mechanisation levels (medium and highly mechanised firms). Therefore it can be concluded that, the high per capita production in the highly mechanised firms is the positive impact of mechanisation.

5.3 Impact on Efficiency

The production function approach to study the impact of technology on the performance was employed by Brada (1989) and Goldar (2012). To study the impact of technology, TFP is used as the key indicator of the performance by Pall (2011), Goldar (2015) and Singh (2016). The present study also uses TFP as one of the key indicators of performance to study the impact of mechanisation. Therefore, for measuring the efficiency of the production process or the efficiency in combining inputs in the production process, the Total Factor Productivity (TFP) is computed using the neo-classical framework of production function, the Cobb-Douglas production function. TFP is calculated explicitly in the Cobb-Douglas production function and can be expressed as;

$$Q = AL^{\alpha}K^{\beta} \quad \text{..... (5.1)}$$

Where,

Q = output

A= Total Factor Productivity

L= Labour input

K= Capital input

α, β =Respective output elasticities

Using natural logarithm, the Cobb- Douglas Production function can be converted to a linear regression model as equation 5.2 for the purpose of OLS estimation.

$$\ln Q = \ln A + \alpha \ln L + \beta \ln K \quad \text{..... (5.2)}$$

The α and β in the Cobb- Douglas Production function also represents the respective factor shares in the total output. Not only that, the sum of these parameters (α and β) measures the returns to scale. So the TFP, factor shares and returns to scale are analysed across mechanisation levels. For this, the study firstly examined the regression results and then the TFP, factor shares and returns to scale are analysed among mechanisation levels. Since a log-linear model is used for, it is not necessary to check the basic assumptions of OLS.

5.3.1 Regression Results and Interpretations

The results of the regression model 5.2 are used to examine the TFP, factor shares and returns to scale in coir industry across mechanisation levels. For this, firstly run the regression of the

log linear model (Equation 5.2) for each levels of mechanisation and measure the parameters of the models, A, α and β using OLS. These results are presented in Table 5.4.

The results presented in Table 5.4 revealed that the regression models of all levels of mechanisation are significant at 5% level except the medium mechanised firms using the F statistic. The regression model of medium mechanised firms is significant at 10% level. Since the regression models of all levels of mechanisation are significant, we can proceed with the model 5.2 for measuring the parameters of the production function 5.1. The R square values of all regression models are high. Thus the fitted regression models for all levels of mechanisation are good and thus are able to explain the variations in the output through the variables included in the model 5.1, labour and capital. The details of the parameters of the model 5.2, TFP and factor shares are examined in detail in the sections 5.3.2 and 5.3.3. The returns to scale is analysed in section 5.3.4.

Table 5.4 Results of Log- linear Regression Models

Traditional firms	Variables	Standardized Coefficients	S. E	t	p
	Ln A	2.41	.65	3.70	.000
	Ln L	.81	.12	10.30	.000
	Ln K	.11	.07	1.44	.15
	$R^2 = 0.80$			F = 125.84	
Low mechanised firms	Variables	Standardized Coefficients	S.E	t	p
	Ln A	1.94	1.02	1.91	.06
	Ln L	.93	.21	7.33	.000
	Ln K	-.09	.13	-.68	.49
	$R^2 = 0.75$		F = 57.25		
Medium mechanised firms	Variables	Standardized Coefficients	S.E	t	p
	Ln A	-3.69	4.19	-.88	.54
	Ln L	.25	.46	2.33	.26
	Ln K	.89	.12	8.13	.08
	$R^2 = 0.99$		F = 45.98		
High mechanised firms	Variables	Standardized Coefficients	S.E	t	p
	Ln A	7.26	1.43	5.09	.04
	Ln L	.34	.24	1.54	.26
	Ln K	.70	.17	3.15	.09
	$R^2 = 0.95$		F = 19.52		

Source: Estimated from primary data

5.3.2 Total Factor Productivity (TFP)

Total-factor productivity (TFP) is the portion of output not explained by the traditionally measured inputs of labour and capital. So it measures the efficiency of the production, how efficiently the inputs are combined in the process of production. It is defined also in terms of residual of output after paying to traditional inputs labour and capital, and thus indicates the profitability (Solow residual). Total factor productivity is a measure of economic efficiency and thus can be used as a measure of firm's performance. TFP is measured from Cobb-Douglas production function using OLS as explained in section 5.3.

Table 5.4 shows the values of the parameters of the model 5.2, log of total factor productivity (LnA) as the constant of the regression function, the output elasticity of labour (α) and the output elasticity of capital (β) as the coefficients oh Ln L and Ln K respectively. But for a better understanding of these parameters, we are examining them separately. Then only we can derive conclusions easily. In this section TFP is examined. From the fitted regression model 5.2, the TFP is calculated as;

Total Factor Productivity (A) = Antilog (LnA).....5.3

The TFP calculated from the log linear regression model 5.2 is illustrated in Table 5.5.

Table 5.5 Total Factor Productivity

Mechanisation Levels	Ln A	TFP	p
Traditional firms	2.407	11.1	.00
Low mechanised firms	1.939	6.95	.06
Medium mechanised firms	-3.695	0.025	.54
High mechanised firms	7.262	1425.1	.03

Source: Estimated from primary data

TFP presented in Table 5.5 reveals that it is highest in the high mechanised firms. It is also noted that TFP do not exhibits any clear pattern as the mechanisation level increases. But it is evident that the efficiency is far higher in the high level of mechanisation comparing to the lower levels of mechanisation. Thus it can be concluded that, the TFP increases as mechanisation increases and thus mechanisation positively influences the efficiency of the production. TFP can be considered as Solow residual since it is the residual after accounting

the contributions to labour and capital. Thus it can be inferred that, the labour and capital is better combined in high levels of mechanisation and thus improves the efficiency of the activity.

5.3.3 Factor Shares

After analysing the TFP, the output elasticities of labour and capital, derived from the regression results (Table 5.4), are examined. These are also defined as the factor shares in Cobb Douglas production function. The factor shares are important when analysing the impact of mechanisation. As per the Marxian theory of distributive shares, when OCC increases, the share of profits (share of constant capital) in total products increases and the share of wages (share of variable capital) decreases. Therefore, an analysis of the factor shares of the coir industry as mechanisation increases is quiet relevant. The factor shares in coir industry across the mechanisation levels are shown in Table 5.6.

Table 5.6 Factor Shares

Mechanisation Levels	Share of Labour (α)	p	Share of capital (β)	p
Traditional firms	0.81	.00	0.11	.16
Low mechanised firms	0.93	.00	-0.09	.49
Medium mechanised firms	0.25	.26	0.89	.08
High mechanised firms	0.34	.26	0.70	.09

Source: Estimated from primary data

Both the factor shares (Table 5.6) do not exhibit any patterns with the mechanisation levels. It is clear that the share of labour is significant at 5% level in traditional firms and low mechanised firms and the share of labour is higher in lower mechanised firms (traditional and low mechanised firms) comparing to higher mechanised firms (medium and high mechanised firms). In the case of share of capital, no value is significant at 5% level but at 10% level it is significant in both medium mechanised firms and high mechanised firms. It is noted that the share of capital is higher in higher mechanised firms comparing to lower mechanised firms.

Thus, it can be concluded that, as mechanisation increases, the share of labour decreases and the share of capital increases in the selected coir producing firms of Kerala. The findings of the present study relating to factor shares coincide with the Marxian theory of distributive share. Thus the results of the study follow theoretical consistency.

5.3.4 Returns to Scale

Returns to scale refers to the changes in output as all inputs change by the same proportion. Returns to scale are examined in the study for analysing the changes in output of the firms belongs to different levels of mechanisation due to the changes in inputs for evaluating the impact of the mechanisation on the returns to scale. The study makes use of the Cobb-Douglas production function framework for estimating the returns to scale of firms with different levels of mechanisation. According to Cobb- Douglas production function, the returns to scale is the sum of the powers of labour and capital in the production function[1] expressed in the Model 5.1. By using the regression results of model 5.2 (Table 5.4), the returns to scale is estimated and is exhibited in Table 5.7.

Table 5.7 Returns to Scale

Mechanisation levels	Returns to scale
Traditional firms	0.81
Low mechanised firms	0.93
Medium mechanised firms	0.89
High mechanised firms	0.70

Source: Estimated from primary data

The returns to scale shows that, decreasing returns to scale ($\alpha + \beta < 1$) operates in all levels of mechanisation. It can be inferred that, in coir industry, the output raised only at a lesser rate than the increase in inputs. Scale of operation of coir industry in Kerala is poor at all levels of mechanisation.

[1] The values of parameters α and β estimated from the regression model 5.2 is used for computing returns to scale. For this, the significant values are added. For those insignificant values of $\alpha + \beta$, their value is taken as zero (H_0: $\alpha = \beta = 0$)

5.4 Impact on Productivity

Improvement in the production techniques and resulted shift of the production function is partly due to the rise in the productivity of the inputs used and partly due to the increased efficiency of the process of production. By using the same quantity of inputs one can produce more output or can produce same output with lesser quantities of inputs. This is due the rise in productivity and efficiency. So these two crucial measures are used to evaluate the impact of mechanisation. Technology has considerable impacts on factor productivities (Kumari 2010; Bedi 2003; Trivedi et al., 2011; Pall 2011; Apiors et al., 2016 and Singh 2016). So the present study examined the factor productivities in terms of average and marginal productivities across the mechanisation levels of the coir manufacturing firms. The major inputs used in coir manufacturing are classified in to labour, capital and materials. The average productivity is measured for these inputs (see section 5.4.1). The marginal productivity is measured from the production function 5.1, and so it is computed for labour and capital alone and explained in section 5.4.2.

5.4.1 Average Factor Productivities

Average productivity is defined as the ratio of output to an input. Here three inputs are taken in to account namely labour, capital and materials. Therefore we have three average productivity ratios namely, Average Productivity of Labour (AP_L), Average Productivity of Capital (AP_K) and Average Productivity of Materials (AP_M). Average productivity is defined as the ratio of output to an input. The study considers three categories of inputs namely labour, capital and materials. Therefore, there are three measures of average productivities namely, average productivity of labour (AP_L), average productivity of capital (AP_K) and average productivity of materials (AP_M). The computation of these three partial productivities is described in equations 5.4, 5.5 and 5.6.

Average Productivity of Labour (AP_L) = Total output / Labour input used

That is,

$$AP_L = Q/L \quad \text{.....(5.4)}$$

Average Productivity of Capital (AP_K) = Total output / Capital input used

That is,

$$AP_K = Q/K \quad \text{.....(5.5)}$$

Average Productivity of Materials (AP_M) = Total output / Material Input used

That is,

$$AP_M = Q/M \quad \text{.....(5.6)}$$

Out of these productivity measures the AP_L is calculated both in terms of labour hour and in terms of labour cost (Rupees). AP_L can be better measured in labour hour. But the productivities of other two inputs (labour and capital) are measured in rupees. So for the purpose of comparison, AP_L is also measured in rupees. The average productivities of labour, capital and materials across mechanisation levels are presented in Table 5.8.

Table 5.8 Average Factor Productivities

Mechanisation Level	AP_L(Hour)	AP_L(Rs)	AP_K(Rs)	AP_M(Rs)
Traditional firms	252.01	3.70	628.75	2.51
Low mechanised firms	343.17	2.60	897.62	3.01
Medium mechanised firms	1405.48	3.49	592.87	8.04
High mechanised firms	1769.44	17.94	394.29	2.12
Total	390.61	3.92	713.17	2.87

Source: Computed from primary data

Average productivities of inputs in coir product manufacturing are shown in Table 5.8. It is clear that, AP_L/hour increases as the degree of mechanisation increases. In a traditional firm, one labour hour produces rupees 252 worth of products where as it is rupees 1769 worth product in high mechanised firms. This shows that as mechanisation increases, labour can produce more. Average productivity of labour in rupees is not much different between first three levels of mechanisation but it is highest in the high mechanised firms. In high mechanised firms, a rupee spends on labour produces 17.94 rupees of output. This clearly indicates that as the mechanisation goes up labour produces more but they were not paid according to their productivity. Thus one can clearly conclude that as the expenditure on machines (Capital Equipments) increases, the productivity and the exploitation of labour increases and thus the manufacturer tries to extract the surplus value to increase their share (Profit). That is the result of analysis coincides with the Marxian theory of distribution. Degree of mechanisation and Organic Composition of Capital (OCC) is one and same. Mechanisation is in the form of use of modern machines. So as the degree of mechanisation goes up OCC also increases. Hence one can say that the degree of mechanisation increases not only the productivity but also the exploitation of the labourer by the coir manufacturers.

In order to test the significant differences in the labour productivity across the mechanisation levels, AP_L/hour is considered. For this, the statistical technique of testing the equality of means among different groups, that is, Analysis of Variance (ANOVA) is used. Before using the ANOVA the normality of the distribution of the AP_L/hour is checked using Kolmogorov-Smirnov test. The result of the normality test of the AP_L/ hour reveals that, the distribution of the AP_L/hour is not normal and therefore the non parametric test of ANOVA, Kruskal-Wallis test, is used to test the mean difference of AP_L / hour across mechanisation levels. The result is summarised in Table 5.9.

Table 5.9 ANOVA Results - AP_L/hour across Mechanisation Levels

Null Hypothesis	Test	Test statistic	P
The distribution of AP_L/hour is the same across categories of mechanisation levels.	Independent-samples Kruskal-Wallis test	13.44	.004

Source: Computed from primary data

The test results (Table 5.9) reveals that the AP_L/hour is different across the mechanisation levels and so it can be concluded that the mechanisation levels significantly influences the productivity of labour/ hour. That is, it is highest in higher mechanised firms (medium and high mechanised) comparing to lower mechanised firms (traditional and low mechanised). In order to know among which levels of mechanisation, the AP_L/hour is different, the post-hoc analysis in terms of the pair wise comparison of the variable is performed and the results are shown in Table 5.10.

Table 5.10 Pair-wise Comparison – AP_L/hour & Mechanisation Levels

Sample 1- Sample 2	Test statistic	S.E	Sig
Low mechanised firms – Traditional firms	3.52	6.65	0.59
Low mechanised firms – Medium mechanised firms	-28.54	17.46	0.10
Low mechanised firms – High mechanised firms	-53.09	16.79	**0.001**
Traditional firms – Medium mechanised firms	-25.02	17.17	0.15
Traditional firms – High mechanised firms	-49.57	15.47	**0.001**
Medium mechanised firms – High mechanised firms	-24.55	22.36	0.27

Source: Computed from primary data

Table 5.10 reveals that the average AP_L/hour is significantly different only between two groups. It is between the lower mechanisation levels (Traditional firms and low mechanised firms) with the high mechanised firms. All other groups of mechanisation are not different in terms of average AP_L /hour. Hence we can conclude that the productivity of labour goes up with mechanisation. For drawing the degree of association between average APL/hour and MI, the Karl Pearson's coefficient of correlation is calculated. This value is 0.265 and is significant at 1% level. This shows the positive association between MI and average AP_L/ hour. Then it can be infer that the labour productivity is positively influenced by the use of mechanised techniques and so it can be advocated for the improvement of coir industry of Kerala.

There are fluctuations in the average productivities of capital and materials across mechanisation levels. The productivity of capital is highest in low mechanised firms where as that of material in medium mechanised firms. Considering the AP_K, it steeply declines when we move from low mechanised to high mechanised firms, and lowest in high mechanised firms. That is, as mechanisation level increases, the AP_K declines continuously. It may be an indication of under-capacity utilization (caused for X- ineffieciency). The reasons for this could be: i) the scarcity of raw materials (fibre and yarn) and ii) lack of demand of their product. There is high demand for the natural fibre products in international markets due to great environmental concerns. But majority of the sample firms are small sized and they cannot access the foreign markets directly. So there exists lack of competitiveness among the coir producing firms, which may directly lead to the under capacity utilization. Thus, if the full capacity is utilized, more labour force will be employed and thus can reduce the labour displacement, if at all happens by way of mechanisation. This will enable mechanisation and productivity further. This chain of actions and reactions continues and may be ends up with better performance of the coir industry in Kerala.

5.4.2 Marginal Factor Productivities

Marginal productivities are a better measure of productivity of an input. It is the change in output resulting from employing one more unit of a particular input, labour, capital etc, assuming that the quantities of other inputs are kept constant. Present study uses the Cobb-Douglas production function (Model 5.1) for measuring the marginal productivities and hence it is computed for both labour and capital.

After measuring the parameters of 5.1 (A,α and β) using OLS (details are described in section 5.3) the marginal productivities of labour and capital are computed using the property of Cobb-Douglas production function that expressed in equations 5.7 and 5.8.

Marginal Productivity of Labour (MP_L) = α (AP_L) .....5.7. and

Marginal Productivity of Capital (MP_K) = β (AP_K) .....5.8.

Using the above equations (5.7 and 5.8), the marginal productivities of labour and capital are estimated. This is shown in Table 5.11

Table 5.11 Marginal Factor Productivities

Mechanisation Levels	MP_L / Rupee	MP_L/ hour	MP_K
Traditional firms	3.01	204.88	0
Low mechanised firms	2.42	319.83	0
Medium mechanised firms	0	0	525.28
High mechanised firms	0	0	276.39

Source: estimated from primary data

Since the AP_L is measured both in terms of labour hour and in terms of labour cost, MP_L is also calculated in these two units. Since the values of α is not significant in higher mechanised firms, MP_L becomes zero. Similarly, the values β and MP_K in lower mechanised firms. This reveals that, lower mechanised firms can perform better only if the production techniques updates and high mechanised firms by more capacity utilisation.

5.5 Impact on Number of Diversified Products

Number of diversified products produced by a firm is used as another variable indicating the performance. The production of diversified products in many ways promotes the industrial performance. This practice enables an industry or a firm to face market risks like fluctuations in demand and price of the products. A firm with diversified products can adjust its production on the line of advantageous products instead of the risky products. Thus it can

overcome the market risks and perform well even during crises. Moreover that, the manufacturing techniques itself has some role in product diversification. All products cannot use the same production techniques or machinery and so how the practice of product diversification varies across mechanisation levels are needed an enquiry. For analysing this, we are looking in to the extent of product diversification among the surveyed coir units first. This is shown in Table 5.12.

Table 5.12 Number of Diversified products

Number of Products	Firms (%)
1	86.1
2	9.6
3	4.3
Total	100

Source: Primary data

It is clear from Table 5.12 that, majority (86.1%) of the sample firms produce only one product. Only 13.9% of the units producing more than one product and the maximum number of products among the sample firm is three. The average of the number of products produced by the firm is below 2. This may be due to various reasons. One of the important reasons is that, the location specific feature of the coir products. The coir producing firms are located in specific locations and they produce more or less uniform products. The chance for product diversification is limited because of this. Apart from this majority of the firms are micro and small firms and are starving for working capital due to high priced and scarce raw materials and lack of proper demand for their product. Amidst of these problems, they are not thinking about producing one more product.

It is also noted that, Coir industry is one of the skill needed industry and the labourers acquired these skill through their experience. Therefore, it is not easy to shift from one product to another and from one method to other. Because of this also, there are fewer chances for product diversification. But the introduction of new machines may overcome these limitations and therefore, as the mechanisation varies positively, there may be chances for product diversification. This view is examined among the firms and the results are summarised in Table 5.13 and Figure 5.3.

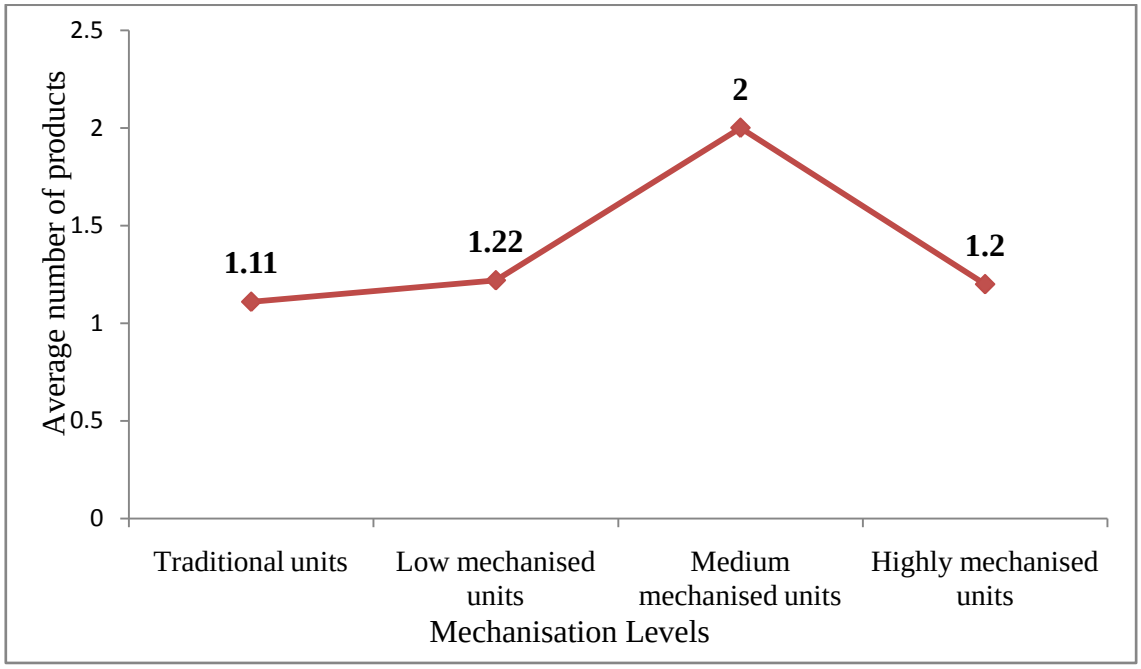
Table 5.13 Mechanisation Level and Number of Products

Mechanisation Levels		Number of Products			Total
		1	2	3	
Traditional firms	within mechanisation Level	92.3	4.6	3.1	100
	within Number of Products	60.6	27.3	40	56.5
Low mechanised firms	within mechanisation Level	82.9	12.2	4.9	100
	within Number of Products	34.3	45.5	40	35.7
Medium mechanised firms	within mechanisation Level	25	50	25	100
	within Number of Products	1	18.2	20	3.5
High mechanised firms	within mechanisation Level	80	20	0	100
	within Number of Products	4	9.1	0	4.3

Source: Computed from primary data

Majority of the traditional firms, low mechanised firms and high mechanised firms are producing a single coir product (Table 5.13). It was also clear from the Table 5.13 that, 50% of the medium mechanised firms are producing two coir products. Therefore we can conclude that the practice of product diversification is limited in coir industry even with high levels of mechanisation. The average number of products among different levels of mechanisation is checked and the results are summarised in Figure 5.3.

Figure 5.3 Mechanisation Levels and Average Number of Products



Source: Computed from primary data

It is evident from Figure 5.3 that, only medium mechanised firms producing 2 varieties of coir products on an average. At all other levels of mechanisation, the average number of products is less than two. Even with high levels of mechanisation, the coir producing firms are not attempted to produce different varieties of the product. This is due to the fact that, high mechanised firms mainly produces one product, PVC tufted mat. This is almost (96%) a fully mechanised product and the machine used for producing PVC Tufted mat is not suitable to produce any other coir product. The PVC tufted machine is costly also. Therefore, they are not trying to produce more products by using another means. Thus lower number of products exists in high mechanised firms. So it can be concluded that, there is limit to diversification in coir industry in general and product manufacturing sector in particular, even with high levels of mechanisation.

5.6 Impact on the Extent of Market

Varakolu (2007) opined that technology adoption has emerged as an important determinant of competitiveness in recent global trade. For the efficient working of an industrial unit, proper marketing of the products is essential. Prices of the products may vary from markets to markets. The higher the accessibility of the market by the product, better the price they received. The middlemen in the markets have some negative impacts on price and this inversely affected the profits of the manufacturer. Well established and experienced firms have better markets comparing others. The present study examined the marketing of the products of sample firms. They were enquired about the buyer of their products firstly. These buyers are categorised into domestic market and foreign market further. After that, the extent of market is examined across the mechanisation levels. This is done to examine the influence of mechanisation on the marketability of products. The buyer of the products of each sample firm is examined and summarised in Table 5.14.

It is clear from Table 5.14 that, the primary coir cooperative societies are the major players of the market of coir products. This is because, majority of the sample firms are the members of the primary coir cooperative societies. Other than coir co-operative societies, coir-fed directly buys products from the coir manufacturers. These two government agencies together purchase the products from 59.1% of the sample firms. That is, the support received from the government in marketing of the coir products is remarkable.

Table 5.14 Marketing of Coir Products

Buyer of the products	Firms (%)
Co-operative society	47.8
Coir-fed	11.3
Retailers	13.9
Supply to exporters	19.1
Direct export	7.8
Total	100.0

Source: Primary data

It is clear from the Table (5.14) that, only 7.8% of the manufacturers directly export their products. About 19.1% sells their products to the exporters who are the middlemen in marketing coir products.

It is the strong interventions by the government, by stopping the depot system, reduced the interference of middlemen in coir marketing. Instead of depot systems, government introduced direct procurement of the coir products from the manufacturers through, primary coir cooperatives and coir-fed. These interventions helped the coir manufacturers not only for getting faire prices but also for creating proper demand for their products. Even though, it is noted that, 13.9% of the coir manufacturers sells their product to the retailers (Table 5.14). Government procurement helps the coir units to work smoothly even during the periods of market downs but majority do not avail this facility. The reason they pointed out that is the discrimination in product selection while procurement by the coir-fed or Coir Corporation. They choose only those products with high finishing quality and a major portion of the output is rejected by them due to inferior and low quality. The delay in payment is also another problem. Within the shortage of capital, they cannot afford the delays in payment. These causes huge lose to the manufacturers and this is the main reason for depending others for marketing the products. When selling to exporters and retailers also they face the same problem of selection. But they purchased the entire products by differentiating to prime quality (high price) and as second quality (lower price) and paid instantly. Thus the firms are ready to sell their products to retailers and exporters even at low prices.

Now the extent of market is examined across the mechanisation levels to draw the conclusions. This result is presented in Table 5.15.

Table 5.15 Mechanisation Levels and Extent of Market

Mechanisation Level		Firms (%)		Total
		Domestic market	Direct Export	
Traditional firms	within mechanisation Level	95.4	4.6	100
	within Extent of Market	58.5	33.3	56.5
Low mechanised firms	within mechanisation Level	95.1	4.9	100
	within Extent of Market	36.8	22.2	35.7
Medium mechanised firms	within mechanisation Level	50	50	100
	within Extent of Market	1.9	22.2	3.5
High mechanised firms	within mechanisation Level	60	40	100
	within Extent of Market	2.8	22.2	4.3

Source: Computed from primary data

It was interesting to note that, majority of the traditional firms and low mechanised firms sell their products in domestic markets whereas 50% of the medium mechanised firms and 40% of the high mechanised firms directly exported their products. This reveals that the higher mechanised firms have better marketing avenues compared to lower mechanised firms.

5.7 Conclusion

The impact of mechanisation on the performance of Coir Industry of Kerala is analysed in this chapter. For this purpose, production, process efficiency, factor productivities, number of diversified products produced and the extent of market are examined as the major criteria of performance. The extent of mechanisation scores of the individual products and its daily production are examined and found that they associated positively. In the case of daily production and mechanisation index of the various firms also exhibits positive association. The analysis of per capita production and mechanisation reveals that as the mechanisation scores of the coir manufacturing units goes up, the per capita production increases. In short, the mechanisation index has a positive impact on the production of the selected firms.

AP_L/hour increases with mechanisation. But it is evident that, the labours are not paid according to their productivity at higher levels of mechanisation. This finding coincides with the Marxian theory of exploitation of labour force at higher levels of mechanisation. But the AP_K shows that it is not increased as mechanisation increases due to under capacity

utilisation of the firms and thus can be infer that X-inefficiency is existed in the selected firms. As far the returns to scale concerned, decreasing returns to scale operates in all levels of mechanisation.

As far as efficiency is concerned, it is highest in high mechanised firms and can infer that as mechanisation increases, the efficiency also increases. The mechanisation in coir industry limits the chances of product diversification. It can be clearly pointed out that, the higher mechanised firms have greater extent of markets. So we can conclude that, the mechanisation influences positively the performance of the coir industry in general and the production, AP_L/hour, efficiency and the extent of market in particular. It can also be noted that, X-inefficiency existed in coir industry of Kerala and this proper market interventions are inevitable. Then only, the full capacity can be tapped. For this, the role of the government in coir industry need to be examined (Chapter 6). Then only the proper channels of interventions can be identified.

CHAPTER 6

GOVERNMENT AND THE COIR INDUSTRY

- ➢ *Introduction*
- ➢ *State and the coir industry*
- ➢ *The financial and non-financial assistance by government*
- ➢ *Thrust areas of interventions*
- ➢ *Conclusion*

CHAPTER 6

GOVERNMENT AND THE COIR INDUSTRY

6.1 Introduction

Growth and development cannot happen in an institutional vacuum. Economic maturity and the growth of markets requires a system that allows transactions to take place in an orderly manner and the agents know that the decisions they take and the contracts they made will be protected by law and enforced. Savers, investors, consumers, entrepreneurs, workers and risk takers of all kinds need a framework of rules if rational, optimising decisions are to be made (Mishra et al., 2014.). For the smooth working of any economic activity, a well structured and properly functioned system is required. Industrial development requires voluntary and pre-planned institutional actions. An industrial friendly atmosphere accelerates not only the industrial growth but also the overall growth of the economy. Therefore, through this chapter, the study aims to explain the role of government as a promoter of coir industry. In the first section of this chapter, the researcher is trying to describe the various government institutions working in the industry with their functions and various schemes, programmes and policies implemented by different layers of governments for renovating the industry. This will provide a background for analysing the role of government in the form of financial and nonfinancial assistances in the selected firms in later section.

6.2 State and the Coir Sector

In coir industry, both Centre and State governments have played dominant roles. These roles are exercised through its various institutions and schemes. Firstly, the government institutions, both Centre and State, working in coir industry are examined with their roles. Secondly, the policies and the programmes undertaken by the governments through these institutions for promoting coir industry are examined. This gave an overall picture of the role of government in one of the major traditional industries of the country, coir.

6.2.1 Central Government Institutions

The major central government institutions working in the coir industry are Coir Board, National Coir Research and Management Institute (NCRMI) and Hindustan coir. These institutions with their roles are described under this head.

- **Coir Board**

Coir Board is a statutory body established by the Government of India under a legislation enacted by the parliament namely Coir Industry Act 1953 (45 of 1953) for the promotion and development of coir industry as well as export market of coir and coir products in India as a whole. The main functions of the Board as laid down in Section-10 of the coir industry act are, to promote the development of the coir industry by promoting exports of coir yarn and coir products, regulating the production of husks, coir yarn and coir products by registering the coir producing equipments and manufacturers of coir products, licensing exporters of coir yarn and coir products, undertaking, assisting or encouraging scientific, technological and economic research and research institutes, collecting and publishing statistics from manufacturers of, and dealers in, coir products, fixing grade standards and arranging when necessary for inspection of coir fibre, coir yarn and coir products, improving the marketing of coconut husk, coir fibre, coir yarn and coir products in India and elsewhere and preventing unfair competition, setting up or assisting in the setting up of factories for the producers of coir products, ensuring remunerative returns to producers of husks, coir fibre and coir yarn and manufacturers of coir products, licensing of retting places and warehouses and otherwise regulating the stocking and sale of coir fibre, coir yarn and coir products both for the internal market and for exports and advising on all matters relating to the development of the coir industry.

The head quarters of the Board is located at M.G. road, Kochi, Kerala. The Board is running 47 establishments including 30 showroom and sales depots and 2 sub depots set up in various parts of India. The Central Coir Research Institute (CCRI) Kalavoor, Alleppey, and Central Institute of Coir Technology (CICT) Bengaluru, are the two research centres under Coir Board for undertaking, assisting or encouraging scientific and technological research in the field of coir. The CCRI, Kalavoor was established in the year 1959 for carrying out research all aspects of coir including extraction, processing, product development and diversification,

waste management and utilization. The CICT, Bangaluru was established in 1978 for economic utilisation of coir fibre produced in non-traditional coir producing states.

- **National Coir Research & Management Institute (NCRMI)**

NCRMI is an organization spearheading various R&D projects in the traditional segment of Coir was established in 1994, under the name C-DOCT to cater the varied needs of coir sector of Kerala. NCRMI have been conducting studies for the development of new coir technologies in collaboration with similar research organizations across the country and even at the International level. Later in 2003, Govt. decided to elevate C-DOCT to the standard of the national institute viz. "National Coir Research & Management Institute (NCRMI)" to facilitate comprehensive research on coconut fibre and allied products. This Institute would eventually become a centre of excellence for R&D, consultancy and knowledge propagation on coir sector. Besides the Governing body, the State Level R& D advisory Committee of NCRMI engaged in conceiving, formulating and implementing different projects in the respective field.

This institution works with the objectives of ensuring assured level of basic services to the people working in the coconut fiber sector, building and enabling environment for growth for the sector, achieving fiscal sustainability of the sector enabling continuous development, optimum utilization of available quality husks for the production of high valued products, undertake consulting for improvement of the industry in terms of product value additions, diversification in coconut fibers in the lines of other natural fiber industries and evolving marketing strategies for export/domestic (rural) markets etc, undertake transfer of technology for POC and acceptance amongst the industry about new generation value added products, act as a knowledge centre for all information relating to policy directions, sharing of ideas, new product developments, market intelligence, improvements in the industry, technology innovations, product trends, trade practices and all other areas in coconut fiber through interaction, co-ordination and networking with other institutions of national and international repute and not to duplicate efforts, extension activities for people working in coconut fiber sector at panchayat level on technology development, current trends etc, exposure and extending management training for the societies in export arena, act as a nodal agency for sourcing funds for research programme undertake capacity building in industry to all types of stakeholders in various areas like technology, management, marketing etc. and, identify new talents and skills in research for development and impart training to equip the industry and

create awareness amongst coconut-fiber industry on new intellectual property rights, contractual obligations and international trade related issues.

- **Hindustan Coir**

The Indian coir industry has been traditionally a cottage industry confined to handloom sector. In order to meet the challenge from the competing countries in the world market, the government of India has decided to introduce mechanization in the coir industry in phased manner. Accordingly it was decided to mechanize one third portion of the production of coir mattings. As a part of this decision, the Hindustan Coir was established in the year 1969 with 5 imported power looms. Hindustan Coir produces and supplies quality power loom mattings to the Coir Board showrooms.

6.2.2 State Government Institutions

The State government institutions working in coir industry includes coir directorate, coir-fed, coir corporation, Kerala Coir Workers Welfare Fund Board (KCWWFB), Kerala state coir machinery manufacturing company (KSCMMC) and foam Mattings (India) Limited (FOMIL).

- **Coir Directorate**

Directorate of coir development is the agency for implementing all policy decisions of the Government of Kerala regarding coir industry. The Directorate is the controlling authority of the ten coir project offices at Chirayinkeezhu, Kollam, Kayamkulam, Alappuzha, Vaikom, North Paravur, Thrissur, Ponnani, Kozhikode and Kannur in the state. The programme of action of the Directorate is anchored on the concept of functioning as a facilitator for the promotion and sustainability of the coir sector in Kerala's economy. This institution caters to the needs of co-operative societies in the ways of giving facilities for marketing their products, to improve the quality of products by providing technical guidance and provides financial assistance.

The major schemes provided by this institutions includes, integrated coir development projects (for the modernisation and mechanisation of the industries to improve quality and quantity, to provide better environment to workers and for better wages), revitalisation of

sick and dormant societies (to increase production by reviving sick and dormant societies, to improve production and to provide more employment), market development assistance (to sell the products of primaries, government provides incentives by way of market development assistance as rebate, discount etc) and the welfare schemes (government contributes to coir workers welfare fund board for providing the welfare measures like pension of coir workers, educational assistance to the worker's children, marriage assistance geriatric centres etc).

- **Coir-fed**

Kerala State Coir Co-operative Coir Marketing Federation Limited is the apex federation of coir co-operatives of Kerala popularly known as Coir-fed. It has a string of regional offices and national network of over 100 showrooms. Coir-fed plays a stellar role in finding markets world range of products including geo-textiles and promoting new business opportunities in the coir sector. It has two divisions namely yarn division and product division. In product divisions they are manufacturing and marketing many diversified products such as mats & mattings, rubberised coir products and mattresses. Coir-fed is an apex federation of 833 primary coir co-operative societies. It is a non profit organization in the coir co-operative sector. The main objective of the federation is procurement of the entire products of the member societies and marketing the same throughout the country and thereby providing fair wages and subsistence to the coir workers.

- **Coir Corporation**

The Kerala State Coir Corporation Limited is a fully owned government company in the public sector, for the systematic development of coir industry in the State. Its main focus is on to find out market for the coir products of small scale producers in the state of Kerala in addition to their own products. The Corporation has its administrative wings and manufacturing units in the premises of its office complex. Its diversified operations include curled coir manufacturing and allied products sectors. The Corporation has the status of being the largest and the most diversified manufacturing plant in the count.

- **Kerala Coir Workers Welfare Fund Board (KCWWFB)**

Kerala Coir Workers Welfare Fund Board is a statutory body undertaken by government of Kerala, constituted under the Kerala Coir Workers Welfare Fund Act 1987 passed by the

Kerala state legislature for the welfare of poor and down trodden coir workers in coir industry which is one of the leading traditional industries in Kerala, with the sole intention of improving their social and economic, living conditions. Grasping the deplorable situation in which the coir workers toiled and contributed their might to the betterment of the State's economy, the government of Kerala enacted the Kerala coir workers welfare fund act 1987 which provided for the constitution of a fund to grant relief to, promote the welfare of, and pay pension to the coir workers and self employed persons in coir industry in the state of Kerala and for certain other matters incidental to it.

- **Kerala State Coir Machinery Manufacturing Company (KSCMMC)**

Kerala State Coir Machinery Manufacturing Company (KSCMMC) is a Kerala government initiative which is committed for ensuring development & growth of coir based industries in Kerala. KSCMMC is situated in Alappuzha and focus upon the development of coir manufacturing equipments & machineries in order to boost the growth of coir industry in India.

- **Foam Mattings (India) Limited (FOMIL)**

It is a government of Kerala undertaking engaged in the production of rubberised coir products, marketing and export under the brand name FOMIL. It's focal point is to tap the domestic and international markets with a wide range of products including coir geo-textiles and a host of other environment friendly products made from natural fibres like coir, jute, sisal, cotton, sea grass, flax, paper, and hemp etc. FOMIL's wide range of products is well complimented by its accent on technology, infrastructure and machinery to make world class products with specially trained and skilled personnel.

6.2.3 Centre Sector Schemes for Coir Industry

The schemes sponsored by the Centre government for the improvement of the coir industry are explained here. This gives some picture about the intervention that the Central government taken for the coir industry over years. These schemes and their focus are summarised in Table 6.1. Apart from these schemes, the Central government through the Coir Board provides trainings through its regional and sub regional offices. These programmes include, quality improvement programmes, entrepreneurship development programme, exposure tour and awareness programmes and conducting national seminars and workshops.

Coir Board also conducts advanced training course (one year duration) and artisans training course (six month duration) at NCT&DC, Kalavoor.

Table 6.1 Centre Sector Schemes

Schemes	Purposes
Scheme of Fund for Regeneration of Traditional Industries (SFURTI)	Regeneration of traditional industries by enhancing productivity, competitiveness, employability and technical support by providing local support.
Coir Udyami Yojana (CUY)	A credit linked subsidy scheme for setting up of coir units with project cost up to Rs.10 lakhs plus one cycle of working capital (40% of the project cost as government of India subsidy, 55% as loan from bank and 5% as beneficiary contribution).
Export Market Promotion Scheme	Delegation, consultancy & information sourcing, participation in seminars and conferences, participation in international fairs/buyer seller meets, publicity abroad, external market development assistance (EMDA) scheme and coir industry awards.
Domestic Market Promotion Scheme	The establishment and maintenance of showrooms & sales depots, participation in domestic exhibitions, to promote the sail of coir and coir products and thereby encouraging sustained production and better employment opportunities.
Development of Production Infrastructure Scheme for Coir Units	Provision of financial assistance for setup of coir units or to modernize existing units by extending subsidy to 25 percentage of the cost of equipments and other infrastructural facilities
Skill up gradation and quality improvement scheme	Creation of a skilled man power base by giving proper training. It consists of three distinct components viz, skill up-gradation, quality improvement and mahila coir yojana (MCY).
Rejuvenation, Modernisation and Technology Up-gradation Scheme (REMOT)	A credit linked subsidy scheme to facilitate sustainable development of the coir industry by creating more employment opportunities in rural area especially for women.
Science and Technology Scheme	For the conduct of research at the laboratory level for application at the field level and extension at CCRI and CICT.
Pradhan Mantri Suraksha Bima Yojana (PMSBY)	Provides accident insurance scheme offering accidental death and disability cover for death or disability on account of an accident.
Trade and Industry Related Functional Support Services Scheme	Initiates the collection of statistical data required for providing feedback to the trade and industry and for formulating appropriate policy for the systematic development

Source: Authors compilation

6.2.3 Schemes Implemented by State Government – Plan Schemes

The various schemes implemented by the State, Kerala, for protecting its most prestigious traditional industry, coir. Mainly the plan schemes are explained here. The detailed picture of these is given in Table 6.2. Apart from these schemes provided by the State government, it initiated new heights of intervention by organising "Coir Kerala". So it should be described separately as a successful intervention.

- **"Coir Kerala" – A Special Initiative of the Kerala Government**

The Department of Coir Development, government of Kerala is organising an international event on Kerala coir and natural fibre products – "Coir Kerala". Seven editions of the annual Coir Kerala fair have completed successfully and the eighth edition is scheduled in December 2019. It is a six-day event aims at exploring and expanding the international market for coir products from Kerala and to encourage use of latest machinery and technology in the coir production sector. This will emerge as the biggest, most influential and comprehensive event on Coir and Natural Fibre products. This mega event will provide ample opportunities for domestic manufacturers and overseas buyers to meet and interact on business, trading, joint ventures, strengthening of existing markets, establishing new markets, transfer of technology and technical know-how and widening of contact base. It is a very successful event in coir with mass participation and as a venue for knowledge dissemination. It also creates awareness among the public regarding the various coir products available in the market.

The analysis of the various government institutions working in coir industry with a vision of its improvement and various schemes by which government intervenes in this traditional industry revealed that, government plays a major role in coir industry as a supporter. This support is given in the form of both in financial and non financial assistances. Hence a beneficiary based analysis is essential to know the real advantages of these supports. So the study attempted to collect and analyse the micro level evidences from the coir producing firms regarding the governmental assistances in general and regarding mechanisation in particular. These are explained in section 6.3 in detail.

Table 6.2 Schemes Implemented by State Government – Plan Schemes

Schemes	Purposes
Marketing, Publicity, Propaganda, Trade Exhibition and Assistance for Setting up of Showrooms	Popularize the activities in the coir sector and strengthening marketing for overall development of the sector by attending and organizing trade fairs at state, national & international level including 'Coir Kerala'.
Grant for Centres of Research and Development in Coir Technology	To undertake R&D activities to improve the coir sector as a whole
Coir Geo-Textiles Development Programme	The comprehensive coir geo-textiles development programme aimed at implementing model projects, inclusion of geo-textiles as a standard engineering material, creation of awareness, strengthening of R&D, and orientation on geo-textiles.
Regulated Mechanization of Coir Industry	Viable projects of co-operative societies, public sector undertakings and other government institutions in the coir sector to modernize, expand, diversify, reorganize and revive their units / factories.
Training and Management Improvement.	To provide training to the employees of the coir development department, coir-fed, Kerala coir workers welfare fund board and PSUs and other workers
Production and Marketing Incentive (PMI)	Providing assistance to promote production, marketing and exports of coir and coir products including PVC and rubberized coir products and geo-textiles to encourage sustained production and thereby generate more employment opportunities in the sector.
Price Fluctuation Fund	To stabilize the price of coir fibre, yarn and coir products. This is aimed to make the coir-fed, FOMIL and KSCC capable to produce / procure the products from co-operatives giving price at par with the production cost and compensates the loss while selling at market prices.
Market Development Assistance	The State contributes 50% of the MDA given by the Central government.
Margin Money Loan to Entrepreneurs	Small scale units in coir sector will be assisted by providing margin money loan up to 50% for establishing new industrial units or expansion /diversification /modernization of existing industrial units
Government share participation for Coir Co-operatives	Proposed to assist 50 societies under the scheme based on clear cut viable proposals for modernization / diversification with specific outcomes.
Cluster development programme in Coir sector	Part of centre scheme SFURTI for which a state share of 150 lakh is provided for the development of clusters.

Source: Authors compilation

6.3 Financial and Non-financial Assistances by the Government

Coir is one of the prominent traditional industries of Kerala with immense government support. At all stages of operation, this industry is greatly supported by both Centre and State governments (Kumar 2012 and Praveenkumar & Moorthi 2017). Infrastructural, financial, marketing and institutional supports are giving for the betterment of this industry. This section examines the government supports received by the selected coir producing firms. For this, the coir units under government and cooperative sectors are excluded because they are running with government support and is analysed in Chapter 4 under the head, nature of ownership. In addition to this, the Mechanisation Index is also examined among the different ownership categories, government, cooperative and private sectors, and these results are also presented in Chapter 4. Therefore the governmental interventions in privately owned firms[1] are examined in this section to identify the role of government in mechanisation of selected coir firms in Kerala.

The governmental assistance to coir industry are analysed under two sections. Firstly, the financial support given by government for the improvement of coir industry is analysed. Secondly, the non financial supports they received from the government in various aspects of the industrial activities are considered. This non financial assistance includes the direct benefits such as provision of subsidised raw materials, government procurements, support to access market such as provision of trade fairs and other indirect supports like trainings. After describing various government supports received by the private coir manufacturers, the influence of this support on the mechanisation of the coir units is analysed. This analysis helps to infer whether these supports promote or not the mechanisation of coir industry. This also gave directions for future interventions of government.

6.3.1 Financial Assistance

Manufacturing industries requires huge amount of capital to initiate and continue productive activities. Due to high prices of raw materials and low demand for products, coir manufacturers suffering for working capital. Apart from these, mechanisation requires huge amount of capital. Due to these vulnerabilities of the coir manufacturing firms, they will not attempt to mechanise. In these circumstances, government support plays a crucial role. This section analyses the governmental financial assistance to the private coir manufacturing

[1] The number of privately owned firms surveyed is 105.

firms. The status of receipt of the financial support, type of financial assistance received, various lairs of government providing the assistance, pattern of utilisation of the assistance, amount of assistance received, assistance for mechanisation, and repayment status of subsidised loans received are examined. After that, the mechanisation levels are examined across the status of receipt of the financial support, type of financial assistance and the amount of assistance received.

- **Status of Financial Assistance**

The private sector coir manufacturing units are categorised into those who received or not the financial assistance from government. The study shows that majority (52.4%) of the sample firms do not avail any financial assistance from government. The financial help may have different forms like government grants and subsidised loans. The awareness about the financial assistances is also important to avail it. The coir manufacturers revealed that they are aware about the subsidised loans, but hesitated to avail loans due to the fear of the defaults in the repayments and related issues due to financial shortage. Since they have only a small amount of flexible capital to play, the loans became a burden and therefore they are not attempted to avail the subsidised loans. They also witnessed the sufferings of those availed the loans regarding the repayment and the difficulties related to defaults in repayments.

The financial assistance received includes grants and subsidised loans. Therefore a categorised analysis of the financial assistance into loans and grants are carried out. Apart from this the body of government provides the assistance and the amounts of assistance they received are also examined. For this, only the 47.6% of the sample private sector coir units who received the assistance are considered.

- **Type of Financial Assistance**

The financial assistance received from government mainly classified in to grants and subsidised loans. Out of the beneficiaries of governmental financial assistance 80% avail it in the form of subsidised loans and rest (20%) as grants. Those who are availing subsidised loans will get a maximum subsidy of 40% in the loan amount if repaid correctly. Even repayable, it is a great help to the coir manufacturers who are in short of working capital. A few (20%) received financial assistance in the form of grants which is not repayable but only in smaller amounts comparing to loans.

- **Tier of Government Providing the Financial Assistance**

The source of loans and grants may differ. Loans are mainly through Central government schemes where as grants are by the schemes of the State government. Therefore the tier of the government providing various types of financial assistances are examined and the results are illustrated in Table 6.3.

Table 6.3 Sources of Financial Assistance

Type of Assistance Received	Tier of government providing the Assistance (%)		Total (%)
	State	Centre	
Grants	50	50	100
Loans	5	95	100
Total	14	86	100

Source: Primary data

Table 6.3 reveals that, only 10 out of 50 manufacturers received grants and this was from both tiers of the government in the same proportion. But in the case of loans, central government has a greater role than the State since the loans are mainly provided through schemes of Coir Board. Because of the difference in the provision of loans, Central government has the major share (86%) in the total assistance provided to the firms.

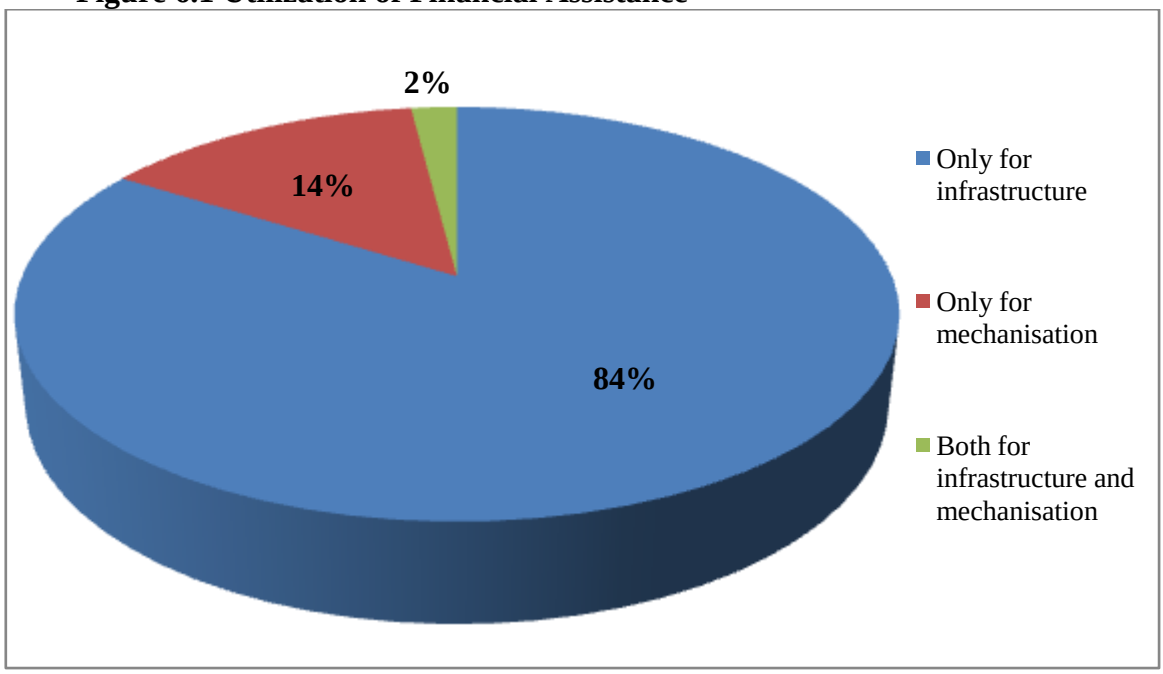
- **Utilisation of Financial Assistance**

The assistance received either in the form of loans or grants are used for the better functioning of the coir manufacturing firm. The purpose for which the financial assistance is utilised is relevant when analysing the influence of the financial assistance on the mechanisation levels of the firms. Thus, the utilisation of the financial assistance received is analysed and the results are summarised in Figure 6.1.

It was clear from the Figure 6.1 that, the major share of the governmental financial assistance received are utilised for infrastructure development. The infrastructure of firm means building and other basic infrastructure for the working of the firm. For mechanisation of the unit, only a few units (16%) utilised the financial assistance. The category-wise analysis of

financial assistance (grants and loans) and the utilisation is also examined and the results are presented in Table 6.4.

Figure 6.1 Utilization of Financial Assistance



Source: Primary data

Table 6.4 Utilisation of Grants and Loans

Utilisation		Type of Assistance Received (%)		Total
		Grants	Loans	
Only for infrastructure	within Project of Assistance	21.4	78.6	100
	within Type of Assistance Received	90	82.5	84
Only for mechanisation	within Project of Assistance	14.3	85.7	100
	within Type of Assistance Received	10	15	14
Both for infrastructure and mechanisation	within Project of Assistance	0	100	100
	within Type of Assistance Received	0	2.5	2
Total	within Project of Assistance	20	80	100
	within Type of Assistance Received	100	100	100

Source: Primary data

The financial assistance from government (both grants and loans) are mainly utilised for developing infrastructure of the firm (Table 6.4). For mechanising the firm, a meagre portion (16%) of financial assistance are used.

- **Size of Financial Assistance**

The size financial assistance received by the private sector firms is analysed in this section. The average amount of assistance (loans and grants) is examined and is presented in Table 6.5.

Table 6.5 Average Size of Financial Assistance

Type of Assistance Received	N	Average Amount of Assistance (in rupees)	S.D
Grants	10	45100	29471.08
Loans	40	496725	385911.31
Total	50	406400	389864.23

Source: Computed from primary data

It is clear from the Table 6.5 that the average amount of grants is lower than that of loans and the average amount of loans is more than ten times that of the grants. This may be because loans are repayable where as grants are not. There is great variability also in the loan amount between firms.

- **Financial Assistance and Mechanisation**

The governmental financial assistance may influence both the basic infrastructure and the production infrastructures (machines). Even though the utilisation of assistance shows that, the financial assistance are utilised mainly for promoting basic infrastructures such as building, the influence of it on the mechanisation of firms is also examined. The status of the assistance, type of assistance and the amount of assistance are examined in relation to mechanisation levels and the results are summarised in Tables 6.6, 6.7 and 6.8 and Figure 6.2.

Table 6.6 Status of Financial Assistance & Mechanisation Levels

Mechanisation Levels		Status of Governmental Financial Assistance (%)		Total (%)
		Received	Not received	
Traditional firms	within Mechanisation Level	38.7	61.3	100
	within Status of Governmental Financial Assistance	48	69.1	59.1
Low mechanised firms	within Mechanisation Level	62.2	37.8	100
	within Status of Governmental Financial Assistance	46	25.5	35.2
Medium mechanised firms	within Mechanisation Level	100	0	100
	within Status of Governmental Financial Assistance	4	0	1.9
High mechanised firms	within Mechanisation Level	25	75	100
	within Status of Governmental Financial Assistance	2	5.5	3.8
Total	within Mechanisation Level	47.6	52.4	100
	within Status of Governmental Financial Assistance	100	100	100

Source: Primary data

Table 6.6 reveals that majority of the traditional firms and high mechanised firms (61.3% and 75% respectively) are not receiving the governmental financial assistance where as majority of the low mechanised firms and medium mechanised firms(62.2% and 100% respectively) avail it. It is very interesting to note that the percentage of firms who availed the financial assistances decreases as the level of mechanisation increases. This may be due to lesser number of units in higher mechanised levels. Among the availed groups, majority are traditional firms followed by low mechanised firms. Out of the total availed units, only a few medium and high mechanised firms are there as the beneficiaries. The type of financial assistance availed may also vary among the mechanisation levels. This is examined and the results are presented in Table 6.7.

Table 6.7 Type of Assistance & Mechanisation Levels

Mechanisation Level		Type of Assistance Received (%)		Total (%)
		Grants	Loan	
Traditional firms	within Mechanisation Level	16.7	83.3	100
	within Type of Assistance Received	40	50	48
Low mechanised firms	within Mechanisation Level	26.1	73.9	100
	within Type of Assistance Received	60	42.5	46
Medium mechanised firms	within Mechanisation Level	0	100	100
	within Type of Assistance Received	0	5	4
High mechanised firms	within Mechanisation Level	0	100	100
	within Type of Assistance Received	0	2.5	2
Total	within Mechanisation Level	20	80	100
	within Type of Assistance Received	100.0%	100	100

Source: Primary data

From Table 6.7, it is evident that grants are fully availed by the lower mechanised categories (Traditional firms – 40% and Low mechanised firms – 60%). In the case of loans also, there is a marked difference in the number of beneficiaries among the mechanisation levels. Out of the beneficiaries of subsidised loans, majority are traditional firms followed by Low mechanised firms. Within the mechanisation levels, loan is the only financial assistance received by the higher mechanised groups. To conclude, in the case of both types of financial assistances, there is a clear dominance of lower mechanised groups. That is, the financial assistance from government is availed by the deserving group. Therefore, it necessitated to check the economic viability of the assistance. Whether the financial assistances by the government incentivise or not the performance of the firm need to be examined and are presented in Table 6.8.

Table 6.8 Status of Financial Assistance, Average MI & Factor Productivities

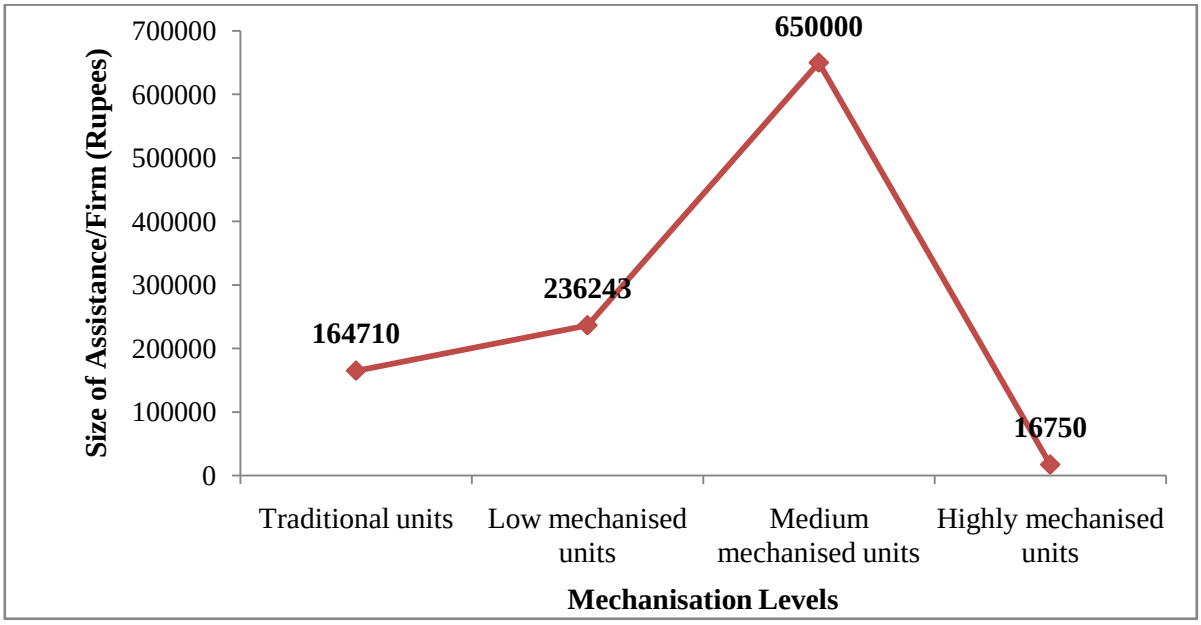
Status of financial assistance	Average MI	AP_L/ hour	AP_K
Received	0.20	314.43	363.94
Not received	0.13	427.73	1077.69
Total	0.16	373.78	737.81

Source: Computed from primary data

There are differences in average MI among those availed the governmental financial assistance and those who are not (see Table 6.8). The average MI of the availed group is higher than that of not availed. But this difference is very nominal. But it is very interesting to note that the average factor productivities (both labour and capital) are higher in the firms who are not receiving financial assistance from government than those firms avail this benefit. This is due to the fact that the small firms are more in the group of firms who receiving the financial assistance. But it can also be noted that the factor productivities are lower where average MI is higher. Therefore we can conclude that the financial assistance are aimed at bettering the infrastructure of the firm and not for mechanisation and for the resulted improvements in productivities. How the benefit of financial assistance to firms influence the MI is analysed in detail in section 6.3.3.

The size of assistance per firm across each level of mechanisation is analysed for inferring the association of mechanisation level and the size of assistance. This is depicted in Figure 6.2.

Figure 6.2 Size of Assistance/Firm and Mechanisation Levels



Source: Computed from primary data

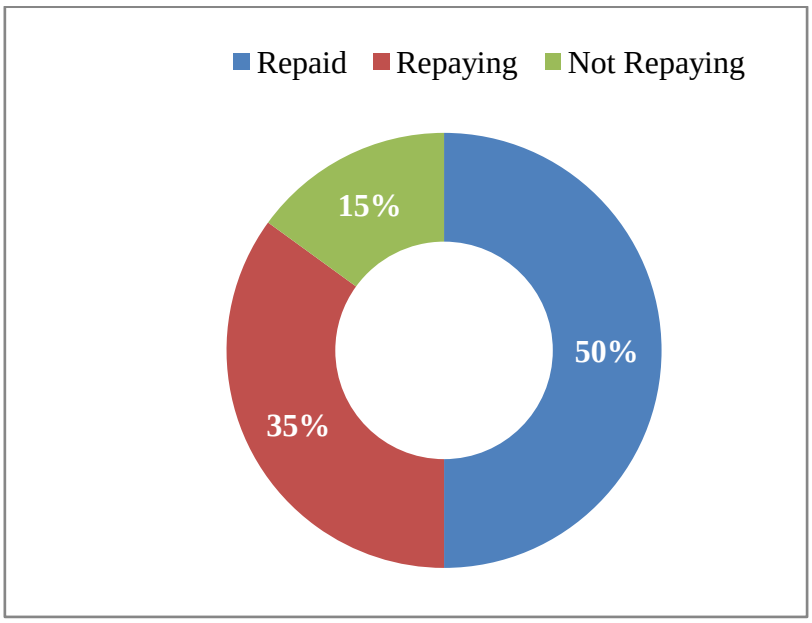
Figure 6.2 shows that, the size of assistance/firm is highest in medium mechanised firms followed by low mechanised firms. It is also noted that the size of assistance/firm increases as mechanisation levels rises up to medium mechanised level and it is lowest in high

mechanised firms. The reason for the lowest size of assistance/firm in high mechanised firm is that, out of the four high mechanised firms only one avail the financial assistance.

- **The Repayment of Financial Assistance (Loans)**

Out of the financial assistances received by the coir manufacturers, loans are repayable and they can avail a subsidy of 40% of loan amount if repaid on time. The repayment status of those availed loans reveals the financial position of the coir manufacturers of Kerala. Out of 50 beneficiaries of governmental financial assistance, 80% avail loans. The repayment status of loans is examined and the results are presented in Figure 6.3.

Figure 6.3 Repayment Status of Loans



Source: Primary data

It is clear from the Figure 6.3 that, majority of the beneficiaries repaid their loans. But 15% of the beneficiaries were not repaying their loans. They opined that the defaults are due to the vulnerable industrial situations. They cannot raise enough funds for repaying the loans mainly due to high price and scarcity of raw materials on one hand and the lack of sufficient demand for their products on the other. Those who are defaulted in the repayment of loans opined that, they are afraid of the banking procedures due to the defaults in repayments, but are helpless.

6.3.2 Non-financial Assistances

The non financial assistances availed by the firms includes government procurement, provision of subsidised raw materials, assistance to access market such as trade fairs and provision of on job trainings. Out of these, the first three belongs to the marketing support and the last one belongs to the support for human capital formation. An analysis of these kinds of non financial support by government among the sample firms with its impact on the MI and factor productivities are done in this section. The influence of each of this non-financial assistance on MI is examined in detail in section 6.3.3. Present section summarises the status, the average MI and the performance in terms of average factor productivities among firms who avail or not avail each of the non-financial assistances to coir sector (Table 6.9).

- **Government Procurement**

Government procurement of the products of the firms' is analysed as one of the non financial assistances received from the government. Government procurement policies helped to boost industrial performance (Nelson, 1982). Government procurement helps the firms to work smoothly during the periods of market sluggishness. It also helps them to get reasonable prices (procurement prices) for their product. These two benefits of government procurement help them to avoid disruptions in their production activities due to lack of demand. It also helps the coir manufacturers to provide regular works to the hired employees. Otherwise, the irregular nature of employment in coir production caused for the migration of the employees to other activities. The details of government procurement of the products of the firms are examined and the results are presented in Table 6.9.

Table 6.9 Non-financial Assistances, Average MI & Factor Productivities

Non financial assistances	Status	Firms (%)	Average MI	AP_L/ hour	AP_K / Rupee
Government procurement	Availed	47.61	0.16	156.58	368.69
	Not availed	52.39	0.17	571.24	1073.37
Subsidised raw materials	Availed	33.33	0.12	215.09	521.21
	Not availed	66.67	0.18	394.26	765.76
Participation in promotional programmes	Availed	17.14	0.31	1014.96	1888.68
	Not availed	82.86	0.13	241.12	499.70
Participation in on-job trainings	Availed	9.52	0.3	1697.23	2978.40
	Not availed	90.48	0.15	234.47	501.96

Source: Computed from primary data

It is noted from Table 6.9 that, only 47.6% of the private sector firms selling their product to coir corporation or primary coir co-operative societies at the procurement price. It is a great support for marketing the coir products but a majority do not avail this facility. The reason they pointed out is the selection procedure (purchase) the coir-fed and coir corporation follows. They choose only those products with high finishing quality and a major portion of output is rejected as inferior quality. Not only that, the delay in payments also one another reason for not availing the facility of government procurement. With the shortage of capital, they cannot afford the delay in payments too. When they sell their products to exporters also, selection is there. They graded the product into superior and inferior qualities and fix low prices to the inferior quality but purchase the whole products. There are instant payments also and hence the coir manufacturers are satisfied and preferred other modes than government procurement for marketing their products.

The mechanisation index and performance in terms of average factor productivities is also analysed among the categories of firms that availed and not availed the facility of government procurement. This is also summarised in Table 6.9. In the case of average MI not much differences exists between those who availed and not availed the facility of government procurement. The average MI of coir units who not avail the facility of government procurement is higher than those of avail by only 0.001 units. But it is important to note that the average factor productivities (both labour and capital) are higher in the group those who are not availing the facility of government procurement. These firms either directly export their products or sell to retailers or to exporters. The firms who directly export their products, the MI and factor productivities are higher. It may be because of high firm size too.

- **Support Price**

All the surveyed firms opined that, government do not fix support prices for the coir products. They fix the procurement prices at which government procures various coir products through coir cooperative societies (for coir corporation) and coir-fed. This price is revised in successive periods. Coir manufacturers opined that, the revision of product prices are not on time while the input prices (fibre and yarn) revised on time. This caused huge losses to the manufacturers. They have the opinion that both inputs and products prices should be revised together and this is to be done in such a way to promote the activities in coir.

- **Provision of Subsidised raw materials**

Subsidies are given to the coir manufacturers for the purchase of raw materials from the coir-fed and primary coir co-operative societies. At the time of primary data collection, the prices of the raw materials, especially fibre and yarn, reached its peak. Rupees 30/- 32/- is the price of fibre/ Kilogram. The price of yarn is different for different varieties and also too high for all varieties of coir yarn due to high priced fibre. So the raw material at subsidised rates is a great support for the coir manufacturers. Today, the major source of raw materials (fibre and yarn) for the coir manufacturers of Kerala is Tamil Nadu, especially Pollachi. Apart from the price hikes of raw materials, the coir manufacturers of Kerala also face scarcity of it due to the provision of direct export of fibre. So majority of the coir manufactures opined that, for easy availability of the reasonably priced raw materials, government must interfere[2].

The details of the beneficiaries of subsidised raw materials is summarised in Table 6.9. It reveals that only a few (33.33%) of the private coir manufacturers avail the facility of subsidised raw materials. Primary coir cooperatives or coir-fed provides the fibre and yarn at subsidised price only to the coir manufacturers who are the members of primary coir cooperative societies. These agencies collect the raw materials either from own production or from its member producers. But the problem is that de-fibering and spinning activities are rare in Kerala and therefore, these agencies also depend on other states for raw materials. This creates scarcity of the raw materials in coir-fed and primary coir co-operative societies. Thus the member manufacturers compelled to purchase the raw materials from the local market or from Tamil Nadu (Pollachi). The average MI of firms who availed or not the subsidised raw materials with respective factor productivities are also described in Table 6.9.

It is noted that, a nominal difference in average MI (see Table 6.9) is there between the two groups of manufacturers, those who purchased raw materials at subsidised rates and not. It is clear that the average MI of those do not availed the facility of subsidised raw materials is higher than those of availed. In the case of average factor productivities also, it is clear from Table 6.9 that, the average productivity of both labour and capital is high in those firms who does not avail the facility of subsidised raw materials. To conclude, one can said that both the

[2] Details of areas of interventions further required by the coir producing firms are analysed in Section 6.4

MI and factor productivities are higher in the firms who do not avail subsidised raw materials.

- **Participation in Government Sponsored Trade Fairs (Coir Kerala)**

Information dissemination is very important in diffusion and adoption of new production techniques. Nelson (1982) examined the role of government policy in information dissemination to influence the technology adoption levels. Promotional programmes like coir exhibitions, seminars and trade fairs are the major information dissemination programmes in coir industry. One of the most celebrated government sponsored coir trade fairs in Kerala, the 'Coir Kerala', is taken in the present study as a market support to coir and its influence in mechanisation of coir industry is examined. 'Coir Kerala' is a State government programme in which the coir manufacturers get the opportunity to participate. This is the venue where they can gain great exposure by exhibiting their products, attracting the customers, spot sale of the commodity, getting future purchase orders for products, experiencing the product varieties of other firms, experiencing and purchasing new machines for manufacturing coir and getting a chain of contacts with the personals of the same area. This may influences the level of mechanisation. All coir manufacturers have equal chance to participate in the 'Coir Kerala' but only a few (17.14) utilised this facility (Table 6.9).

The impact of participation in trade fairs on the average MI and factor productivities of firms is also presented in Table 6.9. It is a noted that, the average MI of those who participated in Coir Kerala is much higher (0.31) than those who not participated (0.13). Therefore, we can infer that the participation in government sponsored trade fairs influences the awareness, adoption and usage of mechanised production techniques. Not only the average MI, the average factor productivities of both labour and capital of firms who participated in "Coir Kerala" are much higher than those who not participated. Thus the participation in promotional programmes like exhibitions in general and "Coir Kerala" in particular positively affects both the degree of mechanisation and factor productivities.

- **Participation in On-job Trainings**

The provision and attendance of on job trainings of the employees of the coir units may enhances their productivity. Trainings are provided by the industry itself or by other agencies like government. The government policies regarding education and training is significant in adopting new production techniques (Nelson, 1982). As an analysis of the non financial

government support to the coir industry, the participation in government sponsored training programmes by the employees of the coir units are considered. The details of the participation of the employees, in government sponsored training programmes, are also depicted in Table 6.9.

It is clear that, the workers of only a few (9.52%) private sector firms are participated in the on job trainings sponsored by the government (Table 6.9). The reason, they pointed out for the lower participation in training programmes, is that training is not essential for efficient working but the experience and thus acquired skills matters in a traditional industry like coir. Therefore they are not interested in participating training programmes. Those who participated in on-job trainings opined that, the trainings are good and related to the implementation of new machines by providing on-hand experience. The operation and minor maintenance were worked out and trained to the employees during the training sessions. So to continue with the mechanisation, trainings are essential. The participation status in government sponsored on-job trainings and average MI is cross examined to infer the effect of trainings on MI. The results are presented in Table 6.9. It is noted that the average MI of those who participated in on-job trainings is twice (0.3) that of not participated (0.15) [see Table 6.9]. This reveals that the participation of employees in trainings influences the degree of mechanisation. It is also revealed from Table 6.9 that, the average factor productivities are also higher in the firms whose employees are participated in on-job trainings sponsored by government. This reveals that the trainings not only better their own productivities but also the productivities of the tools of production.

After analysing the financial and non-financial assistance of the government received by the private sector coir manufacturers, a scientific approach is attempted to derive the individual influence of these assistances on the MI of coir manufacturing firms using regression anlysis. Then only we can identify the proper channels of governmental interventions for mechanising coir industry to boost its performance. The areas of government intervention required in coir industry are enquired to the manufacturers and the results are presented in the section 6.4.

6.3.3 Government Assistance and MI: The Tobit Regression Approach

The analysis of financial and non financial assistance provided by the government to coir sector reveals that these supports have some influences on the MI of the coir industry. For drawing a cause and effect relation between government supports and the MI of the firms,

Tobit regression model[3] is used. The Tobit Regression model used for the purpose of analysing the impact of government assistance on MI of coir industry can be illustrated in Model 6.1.

$$Yi = \beta_1 + \beta_2 X_1 + \beta_3 X_2 + \beta_4 X_3 + \beta_5 X_4 + \beta_6 X_5 + Ui \text{.....(6.1)}$$

Where,

Yi = Mechanisation Index

X_1 = Amount of financial assistance

X_2 = Status of government procurement (1= avail, 0= not avail)

X_3 = Status of subsidised raw materials (1= avail, 0= not avail)

X_4 = Status of participation in government sponsored trade fairs (1= participated, 0= not participated)

X_5= Status of participation in government sponsored on-job trainings (1= participated, 0= not participated)

Ui = Random Error term

The ML method is used for estimating Model 6.1 since the OLS estimators are inconsistent.

6.3.3.1 Checking for basic assumptions

Before proceeding with the tobit regression Model (6.1) the basic assumption of no perfect multi-collinearity and normality of residuals are checked. The assumption of no perfect multi-collinearity is checked using the Variance Inflation Factors and the result is presented in Table 6.10.

Table 6.10 VIF – Governmental Assistance and MI

Explanatory Variables	VIF
Amount of financial assistance	1.008
Government procurement	1.216
Subsidised raw materials	1.247
Participation in government sponsored trade fairs	1.101
Participation in government sponsored on-job trainings	1.094

Source: Estimated from primary data

[3] The distribution of MI is censored and the reason for using Tobit model is better explained in Chapter 4

Table 6.10 shows that, no variables are highly collinear since the VIF values of all variables of the model 6.1 are nearer to 1. Thus the Tobit regression Model 6.1 can be use to elicit the influence of the explanatory variables on the explained variable. Normality of the error terms entering in to the regression model is another major assumption of Tobit regression model. For checking the normality of residuals, the Chi-Square test is used. The Chi-Square value is 57.63 with a p value of 0.00. This reveals that the assumption of normality is satisfied. Since the two basic assumptions of Tobit regression model is satisfied, this model is used to elicit the influence of the variables of government assistance of the model 6.1 on the MI.

6.3.3.2 Regression results and interpretations

The results of the regression model 6.1, which shows the influence of various forms of government support of the mechanisation of coir industry, are presented in Table 6.11.

Table 6.11 Regression Results - Government Assistance and MI

Variables	Coefficients	S.E	z	p-value
Constant	−0.18	0.099	−1.79	0.07
Financial Assistance	0.00	0.00	0.99	0.32
Government Procurement	0.19	0.12	1.66	0.09
Subsidised raw materials' availed	−0.24	0.13	−1.94	0.05
Participation in trade fairs	0.31	0.13	2.33	0.01
Participation in On-Job Training	0.15	0.17	0.86	0.39
Log-likelihood = -62.62		Chi-square = 10.13		

Source: Estimated from primary data

The overall significance of the regression model expressed in Table 6.11 in terms of Chi-square value discloses that, the model is significant at 10 percent level. Since the overall fit is significant, the influences of the regressors on the regressant are elicited. The individual influences of the explanatory variables of the model on the mechanisation index are not expressed with the individual beta coefficients given in Table 6.11. Because, in Tobit model, the beta co-efficients do not directly measures the changes in the dependent variable per unit changes in the explanatory variables. Thus, in order to draw the individual influences of the

explanatory variables on the dependent, we are depending on the marginal effects (dp/dx) of the explanatory variables. This is presented in Table 6.12.

The regression results presented in terms of marginal effects in Table 6.12 says that the financial assistances to coir manufacturing units are not significant to influence the mechanisation index since their focus is mainly on infrastructure development. Instead, the non-financial assistances like government procurement, provision of subsidised raw materials and the participation of the coir unit in government sponsored trade fairs are significant to influence the mechanisation index. Out of these non-financial assistances, government procurement and participation in government sponsored trade fairs are positively influence the mechanisation index where as the provision of subsidised raw materials is negatively influenced it.

Table 6.12 Marginal Effects - Government Assistance and MI

Variables	dp/dx	S.E	z	p-value
Financial Assistance	0.00	0.00	0.998	0.32
Government Procurement	0.095	0.05	1.67	0.09
Subsidised raw materials' availed	-0.12	0.06	-1.89	0.05
Participation in trade fairs	0.15	0.08	1.94	0.05
Participation in On-Job Training	0.096	0.12	0.798	0.42

Source: Estimated from primary data

From this, it is clear that the market supports to create demand are directly influences the mechanisation index where as the supply side supports negatively. The market expansion activities of the government prompt the manufacturers to adopt better techniques of production, which in turn improves the production capacity.

From the analysis of government support and Mechanisation Index of selected firms in coir industry of Kerala, it is clear that the government supports for creating markets for coir products are essential for better mechanisation and performance. This can be done either by government procurement or by helping them to find markets by providing opportunities to participate in trade fairs. In this sense, 'Coir Kerala' is one of such successful programme. One another important result to note that the financial supports and participation of the employees in government sponsored training programmes are not significant to influence the MI.

6.4 Thrust areas of Interventions

After analysing the various types of governmental supports that the private sector coir manufacturers received, an attempt is made to explore the thrust areas where more governmental intervention are required from the opinion of the experienced coir manufacturers. For this, the manufacturers are enquired about the need of more government intervention in their activities. If needed, the area of intervention required is also explored. The results are presented in this section. Firstly, whether they require government intervention or not are examined and result is presented in table 6.13.

Table 6.13 Need of Government Interventions

Type of Ownership	No. of Firms		Total
	Required	Not required	
Government	0	2	2
Co-operative Sector	6	2	8
Private	100	5	105
Total	106	9	115

Source: Primary data

It is clear from the Table 6.13 that, 92.17% of the surveyed firms opined that, governmental interventions are required in their activities. 86.5% of the cooperative sector firms and 95.24% of private sector firms opined that, governmental interventions are required whereas, the government sector firms opined that they are well supported by government and no more interventions are required further. The area in which government interventions required is also examined and the summary of results are presented in Table 6.14.

Table 6.14 Areas of Government Interventions Required

Areas of Intervention	Firms (%)
Regulation of raw material prices	36.79
Revision of Product Price	4.72
Provision of machinery	11.32
Raw material availability	15.20
Provision of sufficient market	16.04
Provision of working capital	15.20
Others	0.94
Total	100.0

Source: Primary data

It was already pointed out that, the raw materials prices are very high during the period of primary data collection. So, most of the respondents (36.79%) opined that the government should interfere in coir industry by regulating the raw material prices. (see Table 6.14). 16.04% of the coir units have an opinion that govt should take necessary steps to create sufficient demand for the coir products. They either procure the products which have high demand in foreign markets or help the manufacturers to find markets. The small coir units cannot export directly and so the exporters exploit them by giving low price for their product and export the same at high prices. If the government actively interfere in the market by procuring the products from the small manufacturers and export it directly, they will get fair price and sufficient demand. 11.32% of the manufacturers required government intervention by providing machinery for manufacturing the coir products.

6.5 Conclusion

This chapter analysed the role of the government in coir industry of Kerala in general, and in mechanisation in particular. From the variables of government support, it can be concluded that, the financial assistance is focused on developing the infrastructure of the firms and thus not significant to influence the MI. The non-financial assistances like government procurement, provision of subsidised raw materials and the participation of the coir units in the government sponsored trade fairs are significant to influence on the mechanisation levels. Out of these non-financial assistances, government procurement and participation in government sponsored trade fairs are positively influence the mechanisation index whereas, the provision of subsidised raw materials negatively. Thus it is noted that the activities of the government to create market for the products of coir manufacturers are more effective in mechanisation. It was also note that the coir sector required more governmental interventions for improvement. Most of the firms opined that, they required government support for regulating the prices of raw materials. Some of the manufacturers opined that the government should interfere to ensure sufficient demand for their product either by procuring or by giving help to find markets. Thus this opinion coincides with the results of the regression analysis and can derive the policy implication that the focus of the governmental interventions is market, both raw material and product markets. This in turn helps the firms to utilise their full capacity and performing better by reducing the negative effect of mechanisation, labour displacement.

CHAPTER 7

SUMMARY OF FINDINGS AND IMPLICATIONS

- ***Summary of the Procedure***
- ***Summary of Findings and Policy implications***
- ***Limitations and Areas of further research***

CHAPTER 7

SUMMARY OF FINDINGS AND IMPLICATIONS

7.1 Summary of the Procedure

The study tried to measure the degree of mechanisation in selected coir industries of Kerala and categorised the firms into different levels of mechanisation based on the value of Mechanisation Index (MI)[1]. The firm characteristics influencing MI, the channels through the diffusion and adoption of technology take place and its influence on performance of coir industry was also undertaken in relation to the levels of mechanisation. Lastly the study aimed at discussing the role of the state in coir industry in general and mechanisation in particular.

For analysing the stated objectives, the study mainly uses the primary data from 115 randomly selected coir producing firms of the Alappuzha district through direct interview. In order to draw the association of various social and demographic characteristics of the coir manufacturer and the awareness status, the Chi square test of association is performed. Thereafter, to understand the individual influence of these variables on the awareness, a Binary Logit regression model is employed.

For measuring the degree of mechanisation, two indices namely Extent of Mechanisation (EM) and Mechanisation Index (MI) were used. EM is the individual mechanisation scores of each coir product represented by the ratio of actual mechanisation scores to recommended mechanisation score. It measures the degree by which the firm uses the available machines for manufacturing each coir product. EM scores are different for different coir products and to test whether these differences are significant, one way ANOVA is used. Before running the ANOVA the assumption of normality of the distribution of EM scores is tested using Kolmogorov-Smirnov test. Since the distribution of EM scores is not normal, the non parametric ANOVA test, Kruskal-Wallis test, is used.

[1] A measure of degree of mechanisation.

After analysing the EM scores of individual coir products, the degree of mechanisation of each firm is computed. Some firms are producing more than one product and so the EM scores of the products are not capable of explaining the degree of mechanisation of firm. Hence the Mechanisation Index (MI) is computed. MI is a weighted average of EM scores. The relative share of each product in the total output of the firm is taken as the weights. Based on the value of MI, the sample coir units are categorised in to four levels of mechanisation such as, MI = 0 for traditional firms, $0 < MI < 0.5$ for low mechanised firms, $0.5 \leq MI < 0.75$ for medium mechanised firms and $0.75 \leq MI \leq 1$ for high mechanised firms. For identifying the firm specific determinants of mechanisation, the Tobit model of regression is employed since the distribution of MI is censored. In order to estimate the regression coefficients of the Tobit regression model, the Maximum Likelihood (ML) method is used since the OLS estimates are inconsistent. A multi-nominal Logit regression model is also employed to study the influence of firm characteristics on mechanisation levels.

For evaluating the impact of mechanisation on the performance of the coir industry, variables such as production, process efficiency, partial productivities, number of products produced and the extent of market of the products are used. For checking the association between MI and daily production, the Karl Pearson's coefficient of correlation is computed. For verifying the significance of the association between the mechanisation levels and per capita production non-parametric ANOVA, Kruskal- Wallis test, is used after checking the normality of the distribution of MI with Kolmogrov-Smirnov test.

For measuring performance in terms of process efficiency, the Total Factor Productivity (TFP) is computed using the framework of Cobb- Douglas production function. To estimate the production function using OLS method, the production function is converted to a linear model using natural logarithm and calculated the parameters of the model such as TFP and factor shares. The returns to scale of each levels of mechanisation are also computed from the production function using its properties. For analysing the performance in productivity, the average and marginal productivities of labour and capital are calculated. In order to test the significant differences in the labour productivity (AP_L/Hour) across the mechanisation levels, the non parametric test of ANOVA, Kruskal-Wallis Test is used after checking the normality of the distribution of MI with Kolmogrov-Smirnov test. Another variable for evaluating the firm's performance is the number of coir products produced. For examining the impact of mechanisation on the number of coir products produced by the firm, the group means are compared across the levels mechanisation.

The role of the government in coir industry is assessed both in terms of financial support and non financial supports. For eliciting the influence of various types of government assistances on the MI of the firms, the Tobit model of regression is executed since the distribution on MI is censored.

7.2 Summary of findings

There is a geographic dimension in the spread of coir industry across districts of Kerala. It is concentrated in some specific areas and the coir products have also got location specific features. Out of the sample firms, majority is located in rural areas and started functioning before 1991 since it is a traditional industry. Its traditional feature is also revealed in its method of operation. Majority of the firms use only manual power for manufacturing their product. Not only this, about half of the firms were not electrified at all. It is clear that most of the firms have less than ten workers and thus belongs to the category of micro units. The average number of workers per firm calculated as six. The average owned land area of the firm is 20 cents and that of the building area is 1500 square feet. Most of the firms have tin sheeted roof, half covered walls and concreted floors.

It is important to note that more than one third of the manufacturers are not aware of the available machines in coir production. Education of the manufacturer has significant and positive influence on the awareness status. But the years of experience in the industry and the participation in promotional programmes like seminars, exhibitions and trade fairs are not significant in influencing the awareness status of coir manufacturers. Consequently, it is found that majority of the firms produce the handloom mat with low average EM score. PVC tufted mat have the highest EM score but it is produced by only a few of the sample manufactures. Geo-textiles have the least score of EM.

Majority of the surveyed coir units belongs to the category of traditional firms with an MI equal to Zero. For majority of the firms MI is less than 0.50 and so belongs to traditional and low mechanised levels. For the rest of the coir units MI is equal and above 0.50 and belongs to medium and high mechanised levels. The MI scores and the number of units in each category exhibits low level of mechanisation in coir industry of Kerala. Majority of the lower mechanised units belongs to rural area. The average MI of urban firms is higher compared to rural firms. Old and new firms are not much different in the case of MI. The MI also differs

in different categories of the industry such as, de-fibering, spinning and product manufacturing. The spinning units have the highest MI and that of product manufacturing is the lowest. The MI is not much different between household units and factory units. It is interesting to note that, most of the partnership units belong to higher mechanised levels whereas, it is only a few in the case of units under sole proprietorship. The private sector coir units have the lowest MI comparing to the coir units under co-operative and government sectors. Majority of the micro enterprises come under the lower mechanised levels. As the firm size increases average MI also increases. It is noted that more than half of the total workers are not members of any labour union, which was very prominent historically and has experience of political movements in Kerala. The MI of the firms where labour unions are absent is slightly higher than that of the firms whose workers are the members of labour unions.

Among the firm specific determinants of mechanisation, the firm size, the participation in promotional programmes, average education of the labour and presence of labour union significantly influence the MI of the firms. Out of these, the firm size, the participation in promotional programmes and the average education of the labour are positively influences the mechanisation index whereas, the presence of labour union inversely influence it.

After measuring the degree of mechanisation in coir industry, its impact on the performance are evaluated. The results reveal that, the daily production is highest for the product with highest EM score. The lowest mechanised product is geo-textiles but its daily production is higher compared to handloom mat and yarn and fiber. This is due to the large demand from the Local Self Governments (LSG) for the geo-textiles for their various construction purposes such as roads and canals. Coir yarn and fiber occupies second highest value of EM but its daily production is the least due to the absence of de-fibering and spinning activities within the State. A positive association exists between the EM scores and the daily production of various products and thus can be concluded that, EM scores have positive impacts on the daily production. The average per capita production of coir units also rises with mechanisation level and thus can be inferred that mechanisation level influences the per capita production positively.

The efficiency of the process of production (the efficiency in combining inputs) is measured in terms of the Total Factor Productivity (TFP). It is indicates the residual left after paying to traditional inputs, labour and capital and thus measures the share of profits. The analysis of the TFP reveals that, it is highest in highly mechanised firms. Thus one can conclude that at

high level of mechanisation, the TFP is also high. The factor shares are computed at different levels of mechanization and it revealed that, as mechanisation increases, the share of labour in total output decreases whereas the share of capital increases in the selected coir producing firms. This finding is consistent with the Marxian theory of distribution. The study revealed that diminishing returns operates in the coir industry of Kerala at all levels of mechanization.

Analysis of the average factor productivities shows that, the AP_L/ hour increases as the Mechanisation Index (MI) increases. One labour hour produces rupees 252/- worth of products in traditional firms, whereas it is of rupees 1769/- worth product in high mechanised firms. But it is noted that in traditional coir units, one rupee spend on labour produces rupees 3.7/- worth of output where it is of Rupees 17.94/- in highly mechanised coir units. This indicates that, as mechanisation increases, labour contributions increase but are not paid accordingly. This result coincides with the Marxian theory of surplus value and exploitation of labour force.

Considering the AP_K, it steeply declines when we move from low mechanised to high mechanised firms, and lowest in high mechanised firms. That is, as mechanisation level increases, the AP_K declines continuously. It may be an indication of under-capacity utilization. The reasons for this could be: i) the scarcity of raw materials (fiber and yarn) and ii) lack of demand of their product. There is high demand for the natural fiber products in international markets due to great environmental concerns. But majority of the sample firms are small sized and they cannot access the foreign markets directly. So there exists lack of competitiveness among the coir producing firms, which may directly lead to the under capacity utilization. Thus, if the full capacity is utilized, more labour force will be employed and thus can reduce the labour displacement, if at all happens by way of mechanisation. It is evident that, in higher mechanised firms MP_L is zero whereas in lower mechanised firms MP_K becomes zero. This reveals that, lower mechanised firms can perform better only if the production techniques updates. Thus it can be concluded that, lower mechanized firms can perform better only by upgrading its production techniques, where as high mechanized firms by full capacity utilization. For this, effective interventions both in raw materials and product markets are the proper channels.

Since different products use different types of machines, there is a limit to product diversification with respect to mechanization. The primary coir co-operative societies and the

coir-fed together purchase the products of the majority of the firms. Only a few of the manufacturers directly export their products. It is revealed that, majority of the traditional and low mechanised firms marketed their products domestically whereas, almost half of the medium mechanised and 40% of the high mechanised firms marketed internationally. This indicates that the higher mechanised firms have better marketing opportunities compared to lower mechanised firms. Thus the mechanisation levels influences the extent of markets of the products positively.

Regarding the government support availed by the private sector coir manufacturers, only a few received grants and 38.09% of firms availed subsidized loans. Major share of the governmental financial assistance is provided for infrastructure development. For mechanising the unit, only a few received the financial assistance. The average amount of grants received is Rupees 45100/- where as for loans it is Rupees 469725/-. It is noted that, 15% of the units are not repaying their loans because of their vulnerable industrial situations.

The non financial assistance received by the coir units includes government procurement, provision of subsidized raw materials, assistance to access market such as trade fairs and provision of on job trainings. Government procurement helps the coir units to work smoothly even during the periods of market downs but majority do not avail this facility. The reason they pointed out that the procedure that the Coir-fed and Coir Corporation followed for procurement is not favorable to the manufacturers. They procure only those products with high finishing quality and a major portion of the output is rejected by them due to inferior and low quality. The delay in payment is also another problem. Within the shortage of capital, they cannot afford the delays in payment too. The subsidized raw materials are provided to the coir manufacturers through the Coir-fed and coir cooperative societies who are the members of primary coir co-operative societies. But only one-third of the private sector coir manufacturers avail this facility due to scarcity of raw materials and the MI of those availed raw material subsidies is lower than those who not availed.

Only a few private coir manufacturers participated in the government sponsored trade fairs like ‘Coir Kerala’. But it is a noted that the MI and productivities of those who participated are much higher than those who not participated. The analysis of the attendance in government sponsored on-job trainings by the employees reveal that the workers of only a few private sector coir units are participated in it. The reason they pointed for this is that, the training is not essential but the experience and thus acquired skills are more important as the

coir industry is concerned. But it is noted that the MI and productivities of those who participated in on-job trainings are higher than that of not participated.

The analysis of the influence of government assistance on MI reveals that, the financial assistances are not significant to influence the MI since they are focused mainly on infrastructure development. Instead, the non-financial assistances like government procurement, subsidized raw material provision and the participation of the unit in the government sponsored trade fairs are significant to influence the MI. Out of these non-financial assistances, government procurement and participation in government sponsored trade fairs are positively influence the MI whereas, the provision of subsidized raw materials negatively. From this, it is clear that the market supports directly influences the mechanisation where as the supply side supports negatively. In this respect, it can be inferred that, 'Coir Kerala' is a successful programme. It can also noted that, the participation of the employees in the government sponsored training programmes is not significant to influence MI. Majority of the firms opined that they need more governmental intervention by regulating the price of raw materials.

From the above findings the study concludes that, the degree of mechanisation is low in coir industry of Kerala. Majority of them remains traditional. The education of the manufacturer positively influences his awareness about the available machines for manufacturing coir. The firm characteristics such as the firm size, the participation in promotional programmes and the average education of the labour positively influences the mechanisation index whereas, the presence of labour union inversely. The high mechanised firms perform better in terms of production, labour productivity, efficiency and extent of markets. The share of labour in total product decreases as the mechanisation increases and thus consistent with the Marxian theory of distributive shares. There exists X-inefficiency in coir production in higher mechanised firms and the fear of labour displacement in higher mechanised firms can be offset by full-capacity utilisation. This can be possible by ensuring proper interventions of the government in both the input and output markets. At the same time, the lower mechanised firms can perform better only if the production techniques updates.

Among the government supports, the participation in government sponsored trade fairs and government procurement positively influence the mechanisation whereas, the provision of subsidised raw materials negatively. The governmental financial assistance is mainly used for infrastructure development and hence not significant to influence the mechanisation level of

coir industry. Thus the study points out the channels of intervention in the industry for mechanisation by the promoting general education and state-initiated market supports. If the products have sufficient demand and raw materials are easily available, the firms can utilise their full capacity and this could boost mechanisation and thus the performance of the industry in Kerala.

7.3 Limitations and areas of further research

Variables used in analyzing the performance of the firm are limited in the present study. The important dimensions such as profitability and cost efficiency can also be used as variables of performance, which were not considered in the study for wan of time. As it widely understood the performance of a firm is not only influenced by the level of mechanization, but by so many other factors including human capital and extent of market. These aspects can be considered as important analytical additions in future. The scope of the study could have been broadened by incorporating the concept of technology rather than limiting to the concept of mechanization as the present study has done.

Annexure 2.1

Review of Literature at a Glance

Annexure 2.1

Review of Literature at a Glance

Empirical Works	Area of the Study	Outcome of the Study
Kannan (1976), Prakash (1977), Issac (1982), Isaac (1983), Isaac et al., (1992), Rammohan (1999), Sabarinath (2000), Rammohan (2000), Jose (2002), Menon (2002), Rajan & Kumar (2004), Menon (2005), Coir Board (2008), Amutha (2013), Indu (2014). Titty (2015), Mohanasundaram (2015), Isaac & Mathai (2017), Ashik (2018) and Sujay (2018).	Coir industry and its modernisation	Traditional coir industry faced a variety of problems like unavailability of labour, low wage rate, health issues, obsolete production technology, absence of an effective marketing system, production in only sunny days, environmental problems and unhealthy competition between mechanised and non-mechanised units. Modernisation of coir industry through mechanisation is recommended for its better performance. The fear of labour displacement and huge unemployment with the existence of low wages is the major reason for resistance of mechanisation among the coir workers at earlier periods. The impact of mechanisation on the performance in terms of productivity (both partial and total factor productivity) is analysed and found positive.
(Skorov, 1978), Langley & Truax (1994), (Gale, 1998), Comin & Hobijn (2004), Antonioli & Mazzanti (2009), Spencer et al., (2012)and Kamath (2014).	Technology diffusion and adoption	The speed of diffusion and adoption of technology is determined by human capital endowment, type of government, proximity to city, degree of openness to trade, competition from foreign goods and the demands of the world market. Training and organisational innovations are the main "non environmental" significant drivers of technology adoption in MSMEs.

Atanu et al., (1994), Gale (1998), Burton et al., (1999), Daberkow et al., (2003), Adewuyi et al., (2006), Lippert & Davis (2006), Varukolu (2007), Katungi (2007), Lin & Zhang (2009) Gosh (2010), Kuriakose et al., (2011), Okello et al., (2014), Narayanamoorthy et al., (2014), and Oladeji et al., (2015),	Determinants of technology adoption	The age of the manufacturer, education and computer literacy of the operator, full-time farming, farm size and exposure to extension agents are the factors determining the awareness of technology, whereas, social capital, market incentives, household factor endowments, human and financial capital, characteristics of the plant such as plant size, the nature of the production process, area of the plant (rural urban), export orientation, output varieties, access to credit and the plant's industry and the demographic features of the labour force and manufacturers are the key determinants of technology adoption.
Wellisz (1966), Mehta (1980), Stoneman (1983), Malecki (1997) Greenwood et al., (1997), Berman et al., (1998), Helpman (1998), Acevedo (2002), Bedi (2003), Verspagen (2006), Varakolu (2007), Kumari (2010), Trivedi et al., (2011), Pall (2011) , Sun (2011), Goldar (2012) Apiors et al., (2016) and Sing (2016),	Impact of technology adoption	Technology is the key driver of economic growth. It influences positively on output growth, competitiveness, wages, net employment growth and productivity. Technological developments also enable the skills of the workforce and thus change the pattern of labour supply. Total Factor Productivity (TFP) is used as the key indicator of the impact of technology on the performance of a firm.

Nelson (1982), Isaac & Raghavan (1990), Lall (1992), Kalamani (2006), Jahanshahi et al., (2011), Aswati (2011), Kumar (2012) Barbieri et al., (2012), Stephen (2013), Misra (2014), Narendran (2014), Wei & Liu (2015), Singaravelu & Kavitha (2015) and Praveenkumar & Moorthi (2017)	Government and Industrialisation	Good business environment enriched the performance of industrial sector. Government is the most responsible and suitable agency that can provide this business friendly environment by its interventions. A corruption free and stable government by its strong support for industrial development by providing good infrastructure, Research and Development (R&D) support, pro-industrial and entrepreneurship development policies and programmes can create wonders. Coir is one of the most supported industries by government through R&D, modernisation and training, market promotion and welfare measures to coir workers. But they were not achieved the desired results.

Source: Authors compilation

Appendix - I

Interview Schedule for "Mechanisation and Coir Industry in Kerala:

Impact, Determinants and the Role of Government"

Introduction

This interview schedule is designed to facilitate the assessment of the impact of mechanisation on the performance of coir industry. The information collected by this interview schedule is indented **to measure the extent of mechanisation in coir industry of Kerala, to identify the firm specific factors determining the mechanisation of coir industry to analyse the impact of the mechanisation on the performance of coir industry and to examine the role of the government in modernising the coir industry.** To enable an accurate assessment, it is important that the information requested in the interview schedule may be provided as completely and accurately as possible. The information will be used for research purpose.

[BLOCK 1] Descriptive identification of the sample unit

Descriptive identification of the sample unit				
1. Register No.		6. Year of starting		
2. Sub district / town		7. Details of the owner/ secretary	Name	
3.Panchayath			Educational qualification	
4.Cluster/ Ward			Age	
5. Name of the Unit		8.Name of the informant		

[BLOCK 2] Characteristics of the sample unit

Characteristics of the sample unit			
1.Type of the industrial unit (code)		9.Area of building	
2.Type of ownership (code)		10.Category of region(code)	
3.Category of unit (code)		11.Category of work place (code)	
4. Type of industrial settlement(code)		12. Method of operation (code)	
5.Initial capital outlay		13. Number of working days in a week	
6.Working capital		14. Status of electricity connection(Yes-1, No-2)	
7.Type of building (code)		15. If yes, the connected load	
8. Owned land area		16. Total No. of workers	

Codes for Block- 2

Item1: Type of the industrial unit: Government-1, Quasi- government-2, co-operative sector-3, private-4.

Item2: Type of ownership: sole properitership-1, partnership-2

Item3: Category of unit: defibering-1, spinning-2, manufacturing-3, defibering and spinning-4, spinning and product manufacturing-5, all the four processes-9

Item 4: household unit-1, factory unit-2

Item7: Type of building: owned-1, rented-2, others-9

Item10: Category of region: urban-1, rural-2

Item11: Category of work place: under a roof-1, open place-2, both-3, others-9

Item12: method of production: manual-1, mechanical-2, both -3.

Production and production techniques of the units

A: Details of raw material collection

1. Year of starting production activity:

A) Defibering: ☐ B) Spinning: ☐ C)Manufacturing: ☐

2. Source of raw material

A) Defibering (husk):☐ B) Spinning (Fibre): ☐ C) Manufacturing (yarn): ☐

1.Own production 2. Local source 3. Cooperative society 4. Coir fed

5. Outside the district 6. Outside the state 7. others

3. Method of raw material collection ☐ 1. Self collection 2. For contract 3. Others

4. Price paid for raw material / unit: A) Husk ☐ B) Fibre ☐ C) Yarn ☐

5. Frequency of raw material collection: A) Husk ☐ B) Fibre ☐ C) Yarn ☐

1. Daily 2. Twice or thrice in a week 3. Weekly 4. Once in two weeks 5.Monthly

6. Quantity of raw material used in a month:

A) Husk: Quantity ☐ Value ☐ B) Fibre: Quantity ☐ Value ☐

C) Yarn: Quantity ☐ Value ☐

7. Do you face any shortage in availability of raw material? ☐ 1. Yes 2. No

8. Whether there is wastage of raw material? ☐ 1. Yes 2. No

9. If yes the wastage: Quantity ☐ value ☐

B: Details of production

10. Details various stages of production (defibering and spinning)

Stages in Production		Method of operation (code)	If mechanical, the name of machine used	Type of energy source used for operation (code)	Number of machines	Number of employees engaged	Frequency of operation (code)	Daily production (value)
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)
Defibring	1.							
	2.							
	3.							
Spinning	1.							
	2.							
	3.							
Manufacturing- P1	1.							
	2.							
	3.							
P2	1.							
	2.							
	3.							

Codes for 10: Details of various stages of production

Item 2: mechanical -1, manual-2

Item 4: Electric energy -1, manual energy-2

Item 7: Daily -1, Twice or thrice in a week -2, Weekly-3, once in two weeks-4, Monthly-5

11. Details of products produced

Varieties of products produced		Method of operation (code)	Production (daily)		No. of machine hours used (daily)	Average machine cost for operation (daily)	No. of man hours used (daily)	Average labour cost for operation (daily)
			quantity	value				
(1)		(2)						
Fibre								
Yarn								
Produ								

Codes for 11: Details of products produced Item 2: mechanical -1, manual-2

12. Details of machines used

Stages in Production		Name of the machine used	Number	Need of training(1yes, 2.no)	Year of installation	Year of getting Information	Source of information	Reasons for installation delay	Source of purchase	Assured Life span	Installation cost	Maintenance cost (monthly)	Working cost (monthly)	Reason for using
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(12)	(13)	(14)	(15)
defibring														
spinning														
Manufacturing														

13. Did you start producing new products after mechanisation? 1. Yes ☐ 2. No ☐

14. Is there any unused machines? 1. Yes ☐ 2. No ☐

15. If yes, the details of the unused machines

Sl no	Name of the unused machine	Number of machines	Purpose for which it used	Year of installation	Life span	Reason for not using
1						
2						
3						

Extent of Market

16. If yes, to whom you sell the product

1. Cooperative society 2. Local market 3. Outside the district

4. Outside the State 5. Export companies

17. Do you have the marketing department 1. Yes ☐ 2. No ☐

18. If yes, the details,

Staff detailes	Number	Monthly expense
Permenant staffs		
Contract workers		
Daily wagers		

19. Details of the marketing of products

Sectors	Products	Buyer of the product(codes)	Price / Unit	Quantity sold (monthly)
(1)	(2)	(3)	(4)	(5)
Defibering				
Spinning				
Weaving and manufacturing				

Codes for 19. Details of the marketing of products

Item 3: 1. Cooperative society 2. Local traders 3. Exporters 4.Others

20. Details of marketing cost

Products	Packaging cost/ unit	Transportation cost/unit	Cost of publicity and advertising/ month	Cost of storage

21.Do you export directly? 1. Yes ☐ 2. No ☐

22. If yes, Details of export

Products exported	Country of export	Price received /unit	Average monthly export (quantity)	Channel of export(codes)	Place of export
(1)	(2)	(3)	(4)	(5)	(6)

Codes for 22. Details of export

Item 5: 1. Road 2. Water 3. Air

23. Is there any unsold stock of your product? 1. Yes ☐ 2. No ☐

24. If yes the reasons

1. Lack of demand 2. Less price 3. Inferior quality 4.Other reasons

25. Do you have any storage facility for your product 1. Yes ☐ 2. No ☐

26. Is there any wastage of the product 1. Yes ☐ 2. No ☐

27. If yes the wastage in quantity ☐ in value ☐

28. Do you participate in product promotional activities 1. Yes ☐ 2. No ☐

29. If Yes,

- the type of the promotional activity

1.Advertisements ☐ 2. Trade Fairs ☐ 3. Exhibitions ☐

4. Seminars ☐ 5. Others ☐

- Sponsor of the promotional activity

A) advertisement ☐ B)Trade fairs ☐ C)Exhibitions ☐

D)Seminars ☐ E)Others ☐

1. Self 2. Government 3. Cooperative Society 4. Others

30. If No, the reasons.....

31. Do you have the R&D department? 1. Yes ☐ 2. No ☐

32. If yes, the details

Staff details	Number	Monthly expense
Permanent staffs		
Contract workers		
Daily wagers		

33. Areas of R&D ☐

1. Marketing 2. Technology development 3. Product diversification 4. Others

Nature of labour employed

34. Nature of labour used ☐

1. Family labour only 2. Hired labour only 3. Both

35. Type of Labour used ☐

1. Trained 2. Un trained 3. Both

36. Details regarding age and educational attainment of workers

Age category	Number of workers	Education attainment	Number of workers
Below 20		Illiterate	
20- 40		Up to Upper primary	
40-60		Up to SSLC	
60+		Plus Two	
		Graduation+	

37.Detailes of remuneration to workers/ day

Category of workers	Male	Female
Salaried		
1.Managerial staff		
2.Clerical staff		
3.Others		
Contract staff		
Daily wagers		

38. Whether the employees are attending any on job training? 1. Yes ☐ 2. No ☐

39. if yes,

- Type of training ☐ 1.Technical 2. Non technical
- The authority that provides the training ☐
  1. Self 2. Government 3. Cooperative society 4. Others
- Number of employees attended the training ☐

40. If no, give the reason....

41. Do you face the problems in availability of labour ☐

42. Is there any interstate migrant labours? ☐

43. The details of social security measures offered to workers

☐ PF	☐ Written contract
☐ Pension	☐ Insurance
☐ Paid leave	☐ Others,specify.....

44. Provision of Health and safety measures (gloves, mask.....)

Governmental Assistance

44. Whether you received any governmental assistance 1. Yes ☐ 2. No ☐

46. If yes, the details of assistance received

Type of assistance	Body of Govt. Providing the assistance	Amount of assistance	Project for which the assistance received(codes)
(1)		(2)	(3)
Grants			
Subsidies			
Others			

Codes for 46: details of governmental assistance received

Item 3: building and infrastructure-1, mechanisation-2,

promotional activities-3, others-4

47. If no, whether required? 1. Yes ☐ 2. No ☐

48. Details of assistance for mechanisation

Type of machines purchased by using the assistance	Purpose of using the machine	Amount of assistance received	Nature of assistance (1.grant, 2.loan)	Body of Govt. Providing the assistance

49. Repayment status of loans? ☐ 1. Closed 2. Repaying 3. Not repaying

50. Details of non- financial assistance received

Govt. Procurement ☐ Support Price ☐ Subsidies ☐ Others, specify ☐

51. Do you require more governmental intervention? ☐ 1. Yes 2. No

52. If yes, in which areas .....

53. Are you a member of any association? ☐ 1.Yes 2. No

54. Whether the workers are the members of any trade union? ☐ 1.Yes 2. No

55. Do you think that any blocks exist for mechanising your firm? ☐ 1.Yes 2. No

56. If yes, specify.....

57. Your suggestions for improving the condition of the industry.....

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