Chapter VI

TECHNOLOGICAL CHANGES IN THE COIR INDUSTRY OF KERALA - THE PROCESS

In this chapter we are describing the ‘process’ of technological changes in the Coir Industry of Kerala from 1970 to 2001. The process consisted of the Research and Development related to various aspects of coir processing, training given to the people engaged in the industry, organisational changes in the industry, innovation and diffusion of innovation etc.

Analysing the process of technological changes in the Coir Industry within a concrete framework is rather complex and hence the conventional sequence of technological change such as Research and Development, invention, innovation and diffusion of innovation is adopted. As stated by Ramakrishnan Korakandy¹ “it may be prudent, however, here to point out the fundamental changes in the industry may not have always followed this sequences of R and D, invention and innovation but might have some time skipped or overlapped or over-run some of these processes or stages”. The same might have occurred in the Coir Industry also. Hence it is convenient to combine some of these stages, depending upon their nature and process.

6.1 Research and Development in the Coir Industry:-

In a broader sense, R and D is defined as investigative work carried out to acquire new scientific and technological knowledge, to devise and develop new products and process, or to apply newly acquired knowledge in making technically significant

improvements to existing products or processes. In India, the R and D expenditures are officially defined as expenditures directed towards process/products, design and engineering, testing and analysis related to these efforts, developments of new products or discovering new methods of analysis, productivity research for increased efficiency in the use of resources, capital equipment and materials, fuel efficiency, recycling of wastes etc. Cost reduction, by increased process efficiency, process improvement, product development, product diversification and product adaptation to new application etc are of vital importance in this context. It may be noted that there is an overwhelming evidence available from several studies which indicate a close positive relationship between industrial R and D and productivity.

The Coir Board has been the only agency undertaking technological research in coir. The R and D effort is being channelised through Coir Board’s establishments such as Central Coir Research Institute (CCRI), Kalavoor, Allepey, National Coir Training and Design Centre (NCTDC), Alleppey, and Central Institute of Coir Technology (CICR), Bangalore. In areas requiring multi-disciplinary action, co-operation of CSIR, Institutions with expertise in specific fields - Mechanical Engineering Research and Development Organisation (MERADO), Central Road Research Institute (CRRI), Water and Land Management Institute, Central Building Research Institute, Regional Research

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In this section we make a brief review of some of the major findings of the research institutions concerning the Coir Industry. The major findings relate to the development of improved methods of extraction of coir and processing of coir fibre and yarn, development of improved techniques for spinning coir yarn and weaving coir mats and mattings. The findings also relate to the process improvement, product betterment, diversification, design development, identification of prospective new areas for potential utilisation of coir, coir waste, and other areas which contribute to the betterment of the Coir Industry.

6.1.1. **Method of White Fibre Extraction:**

Here the process improvement in extraction of white fibre and different methods of fibre extraction were dealt in.

6.1.2. **Process improvement in Extraction of White Fibre:**

The Research and Development under this programme were aimed at:

6.1.2.1 Development of a process for reduction of the prolonged period of retting for extracting uniform and consistent quality of white fibre irrespective of the seasonal and environmental variations.

6.1.2.2 Improvements in retting to yield coir fibre of better quality.

6.1.2.3 Development of a process for suitable treatment to the unretted green husk fibre to upgrade its quality to make it comparable with retted white fibre.

6.1.2.4 Studies in pollution abatement in retting.
6.1.3 By a long period of research in laboratory and field experiment, following inventions were made by Central Coir Research Institute in the area of retting.

6.1.3.1 The optimum period of retting for extraction of coir fibre of good quality is ten months. Research and field tests have proved that crushing of husks before retting would reduce the period to three months and the crushing of husks prior to steeping does not have any adverse effect on the physical characteristics of the fibre.

6.1.3.2. Studies were undertaken on the application of biotechnology for reducing the retting period from the traditional ten months to essential minimum in collaboration with the Indian Institute of Science, Banglore. Accordingly, a new technology for the process of retting, using certain selected bacterial cultures viz. "Coir- ret" was invented for extraction of better quality coir fibre within a period of 3 months as against the period of 8 months required for extraction of fibre in to traditional methods. Field trials conducted in different coir producing centres confirmed that the retting period could be reduced to 3 months with bioinoculant treatment of husk. The investigation also proved that the fibre extracted from husk treated with bioinoculant was superior in quality and suitable for spinning fine quality yarn.

6.1.3.3 A preliminary experiment was done on the application of ‘Coir- ret’ on crushed husks in RCC tanks. The retting period of crushed coconut husk was thus reduced to 2 months only.

6.1.3.4 Speedy retting was observed with husk steeped in nets as compared to the husks subjected to pit retting. Net retting was found to be more efficient in that the fibre

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extracted from husk steeped for retting in nets was observed to have good colour and the stock of fibre was free from hard pieces of unretted husk and pith.  

6.1.3.5 Study on the quality of fibre extracted from husk of wilt-affected coconut tree was pursued in collaboration with Central Plantation Crops Research Institute, Kayamkulam. The tensile strength and elongation percentage were marginally higher in case of the fibre extracted from husks of nuts from wilt free coconut palms.

6.1.3.6 The experiments also proved that it is possible to convert the green husk fibre to the quality and colour of retted coir fibre within 3 days.

6.1.3.7 The Project entitled “Coir Retting Process Upgradation and Pollution Abatement through Environmental Bio-technology” now under way in collaboration with Cochin University of Science and Technology aims at upgradation of the retting process and abatement of pollution along the Kerala coast. Accordingly, a significant break through has been made in treating of coir fibre extracted by mechanical means treatment of effluent liquor of retted coir fibre. A cost effective method for treatment of rett liquor and recycling it for further retting has been developed. This invention has resulted in the production of white fibre without any pollution.

6.1.4. Method of Fibre Extraction:

Following experiments were conducted in this field:

6.1.4.1 Experiments were conducted to observe the performance of the De-fibering machine (Ceylone type) with particular reference to the number of husks that

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could be processed on the machine and the yield of fibre for 8 hours operation of the unit. The studies were confined to determine the period of soaking necessary to facilitate satisfactory processing of the husks on the De-fibering machine.\textsuperscript{14} Studies on this aspect revealed that the quality of the husk prior to defibering have a decisive influence on yield of fibre of different grades.\textsuperscript{15} The result indicated that by pre-conditioning, the soaking period could be reduced, with improved yield of fibre. Pre-conditioning and optimum soaking was observed to yield a higher proportion of bristle fibre and mattress fibre of grade I.\textsuperscript{16} For pre-treatment of husk, a five roller crusher with a combination of punching rollers and fluted rollers, with adjustment for release of the clearance between the rollers for passage of husks of different thickness, running at slow speed were found to be more suitable to give optimum crushing effect without damage.\textsuperscript{17}

6.1.4.2 Development of an equipment which could do away with the drudgery in extraction of coir from retted husk under more hygienic condition ensuring higher productivity and more emoluments for the operatives was explored. The mechanical contrivances already in use for processing retted husks for extraction of coir was examined, the limitations of the equipment were noted and the fault identified.\textsuperscript{18}

6.1.4.3 Identification of a suitable machine for extraction of brown fibre:-

A study of the different types of machines for extraction of coir from dry/semi-dry coconut husks was conducted with a view to assess the performance

\textsuperscript{14} Coir Board (1972-73): "19th Annual Report", Coir House, Kochi,P.49.
of the machines under field conditions. The investigations covered Japanese (SATO), Austrian (Fehrer) and Indigenous (Alltex, Ennor, Patvolk, Downs type, NSTF etc.) types of machines. In the case of defibering process of mixed or decorticated fibre, all the indigenous beater-type machines are designed more or less on the same pattern and are observed to give a higher yield of fibre. Working of the beater assembly at high speeds is observed to result in increased yields of bit fibre, reducing the proportion of fibre in the high length grades.

In regard to bristle fibre, cottage type of Defibering machine is observed to give a higher yield of bristle of medium staple and low bit fibre. For higher yield of long staple bristler, automatic feeding type machine with arrangements for a more efficient combing at the central portion of husks Maniyam Model is observed to be more satisfactory. Bristle fibre extracted on this machine is found to contain least impurity content. The lowest 'bit' fibre content in mattress fibre is observed with the ENNOR machine model. Maximum pith content is observed with the mattress fibre extracted from husks processed on the indigenous proto type of Japan machine model.

6.1.5 Spinning of Coir Yarn:-

Lab and field level investigation on development of improved techniques for spinning of coir yarn were vigorously pursued. Porto type treadle ratt/mechanised (semi-automatic and automatic) spinning unit were also actively pursued by the institute. Accordingly, research work undertaken for achieving this objective include the following:-

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21 Ibid.
22 Ibid.
23 Ibid,P.60.
6.1.5.1 The development of an improved spinning machine capable of producing coir yarn of uniform texture in continuous length with a higher per capita output. Improvement in the technique of spinning to attain higher productivity and also for realisation of increased emoluments by the operatives without unduly increasing the cost of production of yarn also formed part of the continued study in the subject. Intensive experiments conducted on the machine have indicated that while spinning yarn of 12/13 score and a runnage of 210 meters per kg., a yield of about 16 kg. of yarn could be attained on the machine for 8 hour work while processing retted coir fibre. Exploratory experiments conducted in this behalf have indicated that for centralised operation on optimum spinning unit would comprise of a fibre cleaning machine, one slivering machine and spinning heads with a capacity to yield about 150 kg. of yarn per 8 hour work, offering full time engagement to 4 workers, with part time work for an additional operation for ancillary work.

6.1.5.2 Trial experiments were conducted on the possibility of adopting the motorised coir spinning machine for spinning soft-twist yarn, for spinning hard-twist coir yarn of uniform texture in processing mechanically extracted coir from dry husk. Similarly, for spinning coir fibre obtained from green husk on processing the husk on combing machines with automatic feeding arrangement etc. were investigated by trial experiments.

6.1.5.3 Studies on Machine Spinning with Automatic Feeding Mechanism:

The motorised coir spinning machine with automatic feeding system was put to intensive trial run to observe its performance. Introduction of tongness in

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24 For more details regarding this see Chapter 3, subheading no. 3.4.3.1 and subgroups
27 Ibid, P.56.
28 Ibid.
the feeding tubes with suitable controls for optimum tension was observed to be helpful in maintaining the thickness of the yarn.\footnote{Coir Board (1970-71): “17th Annual Report”, Coir House, Kochi,P.14.}

6.1.5.4 Improvement on the Slivering Machine :-

The prototype slivering machine was tested intensively for examination of its performance. Some setbacks were observed in regard to the performance of a few of the machine components. The spikes on the combing drum of the machine were observed to get bent on continued operation and therefore, these rails were replaced with steel spikes arranged in a spiral order for efficient combing action. The conveyor belt leading the fibre to the feed tube was also observed to offer difficulties in maintaining uniform tension, resulting in overlapping of the layers of fibre before the same was taken up by the draw rollers. The necessary adjustments were made in the combing mechanism and a new endless rubber impregnated canvas belt got fabricated and fitted on to the machine.\footnote{Coir Board (1971-72): Op.cit., P.47.}

The prospects for introducing a mechanical device for controlling the feed of fibre for producing slivers of optimum size were being explored.\footnote{Coir Board (1969-70): “16th Annual Report”, Coir House, Kochi,PP.9,10.} Attempts were also made to examine the changes to be effected in the slivering machine for producing thicker slivers of uniform density. For achieving this objective, it was found desirable to control the rate of fall of fibre on the belt conveyor which was connected by a chute of suitable design.\footnote{Coir Board (1970-71): Op.cit., P.13.}

The setting on the slivering machine were revised for realisation of a higher output in keeping with the requirements of the spinning unit comprising of 9
spinning heads. A higher output was realised by increasing the speed of combing and drawing system.\textsuperscript{33}

6.1.5.5 **Studies in Motorised Coir Spinning Machine:-**

Modification in feeding and improvements for reduced wear of nozzle controls were conducted.\textsuperscript{34} Studies were also made on the realignment of worn wheel assembly, balancing of the spinning frame, easier positioning of lead thread, reduced wear and tear of driving mechanism, improvements in drive of traverse motion, modification for elimination of flattering of yarn.\textsuperscript{35} Similarly, improvements in spindle tube for reduced strand breakage, performance with roller grip control in feed tubes,\textsuperscript{36} improvement in winding mechanism etc. are studied. With all these changes, intensive trial on the eight spinning unit were conducted with a view to observe the production capacity and also the performance of the unit for any mechanised defects. A maximum production of 26,085 meters of yarn weighing 111 kg. was realised on the eight machine unit in 8 hour work.. The score of the yarn was 12/13 and the average runnage 233 meters per. kg. The average output in this unit was 100 kg.\textsuperscript{37}

6.1.5.6 **Studies in the Development of Treadle Spinning Ratts:-**

With a view to evolve a simple contrivance for spinning yarn of uniform quality for adoption in the cottage sector, scope for the development of the treadle spinning rats was examined. The settings were suitably adjusted for better performance.\textsuperscript{38} With a view to spin Carnatic Yarn and Quilandy type

\textsuperscript{34} Coir Board (1981-82): "28\textsuperscript{th} Annual Report", Coir House, Kochi, P.32.
\textsuperscript{35} Coir Board (1979-80): "26\textsuperscript{th} Annual Report". Coir House, Kochi, P.44.
\textsuperscript{37} Coir Board (1975-76): "22\textsuperscript{nd} Annual Repot", Coir House, Kochi, P.62.
yarn on the treadle spinning ratts, details in regard to the single and doubling twist were worked out and change gears designed. A change gear combination of 21 teeth to 31 teeth was arrived at for Carnatic Yarn and change in alignment of the shaft holding the spur gears of 26 and 30 teeth for producing Beypore/Quilandy type of yarn having a runnage of 130 m/ kg.\textsuperscript{39} The combination of gears necessary to produce coir yarns of different types such as Anjengo, Mangadan, Vycome, Beach etc. were evolved with necessary experimentation. The model ratt in use for spinning coir yarn of Anjengo and Vycome varieties have shown satisfactory performance at the field level with ease of operation and better output.\textsuperscript{40}

The scope for modification to the treadle ratt for enhancing the output and reducing the operational strain are being examined in consultation with the Mechanical Engineering Research and Development Organisation (MERADO), CSIR, Cochin.\textsuperscript{41}

For increasing the output of treadle ratt, modification were effected in the driving mechanism through sprocket and chains by fly wheel etc. The output of the machine was stepped up from 1600m/ 8 hours to 1800/ 8 hours in the case of hand twist yarn.\textsuperscript{42}

Examining the prospect of overcoming the limitation (the standard ratt evolved by the institute, the wheel actuating the spindles requires to be rotated faster, compared to the practice in force at the field level with the traditional ratt) the changes to be effected in the ratt were worked out. Use of a wheel of

longer diameter on the spindles has been observed to obviate the limitations.  

Model treadle ratt fabricated in conformity with the standard design were put to intensive test. Possibility of attaining higher output on use of superior grades of coir fibre free from over size barky portions of exocarp and of coir pith and cultivation of the proficiency of the spinner in operation of the ratt have been indicated by the preliminary experiments. Another modification made to the treadle ratt is to reduce the manual strain in operation and to achieve a higher output by replacing the pedal with single phase electrical motor unit. Efforts were continued for further improvement of the motorised ratts to achieve higher output and better quality. After intensive field trials the new motorised coir ratt developed by the Central Coir Research Institute has been put in to use. With minor modifications it was possible to spin Vycome, Beach and Quilandy varieties of yarn in the same ratt. Refinements are on hand to reduce the size, weight and cost of the motorised ratt with only 2 gears and compact size was fabricated. Satisfactory quality of yarn could be spun having a runnage of 240 to 300m/ kg.

6.1.5.7 **Development Of Automatic Spinning Machine:**

The automatic spinning unit was reconditioned and commissioned for evaluation of spinning performance in regular operation of the unit. With a view to developing suitable techniques for spinning coir yarn from different grades out of decorticated brown coir fibre, research investigations are under progress on the Japanese spinning unit. By changing of gears, the machine

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could be adjusted to produce coir yarn of different grades. \(^{48}\) The automatic spinning machines procured for field use were tuned for smooth and efficient operations. The output realisable on the automatic spinning machines using pulleys with diameter of 80m. and 95m. respectively are under intensive investigations. \(^{49}\) During the same period, the industry was afforded opportunity to develop indigenous models of the imported Japanese spinning machine. Modification were effected to the automatic spinning machine as a result of which it was possible to produce improved quality yarn of uniform twist, scorage and tensil strength. \(^{50}\)

6.1.5.8 **Motorisation of Traditional Ratt:**

Three sets of traditional ratt used to spin Anjengo, Mangadan, and Aratory Yarn respectively were modified and fixed with electric motor to increase the productivity and quality. The attachment of motor on the stationary ratt eliminates the worker engaged for rotating the wheel. \(^{51}\)

6.1.6. **Improvement to the Coir Handloom:**

6.1.6.1 **Semi-mechanised Coir handloom**

The scope for research for effecting improvements on the coir hand loom to reduce the physical strain in operation of the loom motions and higher productivity was reviewed and the areas for experimental work were identified as follows:

6.1.6.1.1 Improved beaming with direct feed of warp ends from spools positioned on the creel.

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6.1.6.1.2 Reducing the efforts in shedding on use of freely rotating wheels in pulley systems/ 
pulleys with axles set in ball bearing for raising and lowering heald frames, 
adopter coir rope and wire rope for linking of heald frames and the treadles.

6.1.6.1.3 Use of compound lever mechanism for lifting the heald frames by simple 
operation of the treadles.

6.1.6.1.4. Linking of the let-off, shedding and take-up with beat up through suitable cranks 
co-ordinated with manual picking, using power for driving the crank, if necessary.

With a view to evolve a semi-mechanised loom with co-ordinated let-off, take-
up, shedding and beat-up achieved by a crank shaft, the particulars for 
designing the loom were evolved by examination of various factors. Components 
like take-up rollers, main bearings crank shaft, etc. were got fabricated.

The improved lever system and pulley arrangements for easier treadling for 
shedding was successfully developed for coir matting looms of the capacity. 
The semi-automatic loom with co-ordinated loom motions was assembled. 
The different drives by sprockets and chain, linking the beat-up with take-
up, let off and shedding were aligned successfully on the loom frame and 
loom put to trials. Changes in gear wheels required for increasing number of 
picks for meter were also got fabricated and sprockets of different combination 
procured. This semi-mechanised coir hand loom was put to field test. The 
loom as originally designed was observed to have some limitations for 
accommodating the rolls of standard length of 50 meters. To overcome this 
limitation, the settings were redesigned and suitable revision effected.

53 Ibid.
A revised arrangements for preparation of warp chain for mats and beams for mattings with uniform tension on the warp and case of operation was successfully evolved. Details of the design for an improved creel mat loom and doby mechanism for fitting to standard matting looms were worked out for fabrication of prototype.\(^{56}\)

The 2 m. matting loom with improved lever system for treadling and improved lifting system for treadle frames was tuned for field trails. A central bracket to avoid buckling of the main bracket of the levers while treadling was designed for fabrication.\(^{57}\)

Adjustment to contain the roll of matting of ‘SK’ type in the full length of 50 to 60 meters were affected in the 100 m. Action for development of a loom with arrangements for co-ordinated loom motions linked to let off and take up was pursued. The framework of the matting loom was assembled. The drive motor was positioned on the main frame and synchronised with crank shaft and the sley for the beat up of the loom.\(^{58}\)

For further improvement to the coir handloom a model loom with co-ordinated loom motions and hand picking arrangements was fabricated and tested. Adjustment for formulation of uniform selvedges and smooth functioning of the take up mechanism have been affected on the modern hand loom. For insertion of closer weft strands, new set of gear wheels have to be positioned on the loom. The revised gears have been fabricated to proceed further with the investigation.\(^{59}\)

\(^{56}\) Ibid.
A can with 10mm lift, lever and ratchet wheel mechanism and a new resuction gear system were designed, fabricated and fitted on to the loom. Preliminary weaving trials have indicated that with revised fittings 30 picks per foot could be inserted while weaving mattings of the width.  

The semi-automatic loom was fitted with refinements for ease of shedding and tremble free let off linked to steady take up. The loom was fortified with cross links with base channels to reduce the vibration while weaving. For a maximum power transmission a “V” pulley was fitted for the main drive, replacing the flat pulley. An out put of 5 M of matting per hour in plain weave and one meter width has been attained on the loom during the test run. A modified arrangements for beaming, using 5 H.P. motor has been evolved for field use. Adoption of mechanised beaming dispense with the undue physical exertion on the part of the workers, which is inevitable in traditional manual beaming operation.

To overcome the stoppage of the loom at frequent intervals due to failure of the loom motions, modifications were effected in the crank shaft, pulley system and clutch mechanism. Refinements were also effected on the alignment of the fittings on the loom. An hourly output of 5m. of mattings in 2 shaft weave has been attained in the loom, on the average. The design of a semi-automatic loom for weaving coir mattings in 4 shaft weave was evolved. The work on standardisation of the semi-automatic loom and the fabrication of a model loom for weaving matting being pursued with MERADO,CSIR. Madras.

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60 Coir Board (1986-87): “33rd Annual Report”, Coir House, Kochi, P.51


63 Ibid
Development of machine for weaving circular mats in collaboration with MERADO, CSIR, Cochin is also made.  

A design of an automatic beaming assembly for preparation of warp beams, dispensing with the drudgery in manual beaming operation has been evolved. The limitation of smooth drawing of yarn from the spools positioned on the spool and winding of the warp sheet under uniform tension on the shaft of the beam has been overcome by suitable arrangement of the speed. Finally, the CCRI developed and operationalised a 4 shaft semi-automatic loom in March 1991. Output of 50 sq. meters matting with 160 picks per meter could be realised per day of 8 hours.

A tappet, for weaving door matting on the semi-automatic loom was designed and fabricated.

6.1.6.2 **Indigenisation of Power loom:**

Design of 2M, 4 shaft power loom was completed and arrangements made for procuring components, real wheel etc. Fabrication of the 4 meter power loom by MERADO, Madras were made. As part of the development of 2 meter coir matting power loom components such as clutch pulley Assembly with shaft, picking stick fixing machine, sley race and sley fittings, clutch pulley assembly, pulley shaft, Gear Box with side brackets, gear shaft, support and Treadle lever fixing brackets were developed. Tuning of the loom for weaving coir matting is

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64 Ibid.
under progress. Nylon pulleys and new head frames were fabricated and fitted to the loom for trouble free operation. The take-up speed has to be suitably modified. Finally, the 2 meter fully indigenous powerloom were operationalised.  

6.1.7 Improvement in the traditional preparatory process (Softening, Bleaching, Dyeing And Finishing)

6.1.7.1 Softening:-

The sequence on the R and D in this area is as follows:

Experiments of softening coir were conducted by applying caustic soda solution bleached in Hydrogen peroxide and dyed in faster shades. With a view to examine the prospects of softening coir fibre on a commercial scale coir fibre in lots of 12.5 kg were treated in standing bath of caustic soda in cold. The softening material was treated in acid bath for elimination of the alkalinity and washed further for removal of the acid. Further experiments were conducted to examine the prospects of softening coir fibre by the action of micro-flora associated with the retting of coconut husk. The prospect of effecting saving in softening coir by use of dilute caustic soda solution in the hot as well as cold treatment was also examined.

Coir fibre in bulk lots was softened using caustic soda by the cold process to meet the raw material requirements for spinning single strand yarn from blends of softened coir and jute on the jute spinning system. Carnatic yarn in bulk lot

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was also softened by the cold process to meet the requirements of raw materials for the studies in product development.  

Softening of coir fibre using Carnatic softners in specific concentration was successfully tried and the treated coir fibre/yarn were used in the manufacture of coir products to assess the rubbing fastness. Cationic softners were also used along side polymer emulsion for getting a permanent soft feel to the treated coir materials. The laboratory scale experiments was successfully attained and the treatment on coir fibre or yarn in bulk quantities were conducted.

6.1.7.2 **Bleaching** :-

The research and development activities are conducted by the CCRI for the following objectives:

6.1.7.2.1. With a view to eliminate the dull grey shade of coir yarn commonly marketed at present.

6.1.7.2.2. With a view to evolve a method for bleaching coir yarn at reduced cost.

The laboratory experiments revealed that treatment of the yarn with oxalic acid/ sulphuric acid at a strength of 3 g/litre (1:1:12) followed by washing the treated yarn free of the acid improves the colour considerably.

For reducing the cost, bleaching experiments were conducted on a laboratory scale using suitable additives to the peroxides bath. The experiments have revealed that on use of 7.5g/litre of Hydrosol and 0.125g/litre of oxyglow in the bleach bath containing 5g/litre of hydrogen peroxide, coir yarn could be bleached a

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creamy white, conducting the bleaching at room temperature for 19 hours. On adoption of this recipe for bleaching cost could be limited to about Rs.3.50 per kg. of yarn processed, in place of Rs.4.55 in the usual cold process. A new bleaching process for coir fibre using a stabiliser in place of sodium silicate was tried and further studies on improvement of bleaching are underway.

6.1.7.3 **Dyeing and shade Matching:**

Among the different conditions of dyeing, the nature of the water, the material to liquor ratio, the nature and concentration of dye bath catalysts and the temperature and duration of dyeing are the important factors. The traditional commercial dyeing practices followed in Kerala neither did nor do ensure optimum conditions for dyeing. So Research and Development activity in this field for overcoming the existing defects have been initiated.

With a view to improve the brightness of the dyeing on coir, the prospects of incorporating suitable oil or emulsions in the dye bath was examined. Experiments were conducted in the laboratory using sulphonated fish oil. Application of acid dyes on coir involves use of sulphuric acid in specified concentration to maintain the required P.H in the dye bath. The prospects of using a less corrosive chemical, namely sulphuric acid, has been examined. The prospect of application of "Cationic" dyes such as "Malacryl" and "Synacryl" for yielding shades of improved fastness to light, water and rubbing on coir yarn was also examined.

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81 Ibid, P.53.
Laboratory studies were pursued to examine the possibilities of increasing the penetration of dye stuff in to fibre or yarn structure and brightness of the dyeing while dyeing with basic or acid dyes. In the experimental work, sodium sulphate/EDTA were used as additives to the dye bath at a concentration of one gram per litre. Coir yarn was dyed in green, blue, red, yellow, orange and black shade drawing the dye stuff as per the standard recipe for the shades and the dyeing conducted on entering the material at 50° raising the temperature to boil in half an hour continuing the dyeing at boil for an hour followed by dyeing for 15 minutes in the cooling bath.

Experiments have also been conducted to improve the fastness to water of shades with basic dyes on coir yarn. Treatment of the dyed coir yarn in a bath containing 1 g/litre formal dehyde (40%) at 60°C for one hour is observed to result in perceptible improvement in the fastness of red, brown, violet and olive green shades of coir yarn. Finally, experiments in dyeing were also conducted with natural vegetable colouring matter in coir. This was with a view to avoid or replace use of synthetic dyestuff. Use of sulphuric acid as dye bath assistant during dyeing has been replaced with mild and less harmful Hydro Choleric acid for easy handling.

Experimental investigations were also conducted to fix up on the dye-stuff formulation for obtaining standard fancy shades on coir yarn were continued. About 365 dye stuff samples submitted for examining the suitability of the item for application to coir and the tinctorial value were tested in the lab and the test reports issued during 1969-70 to 1999-2000. A model shade card

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4 Coir Board Annual Reports of Various Years.
with a total number of 235 shades were prepared depicting samples of the different shades and detailing the recipe of dye stuff combinations, dyeing methods etc.\(^{87}\)

6.1.7.4 **Finishing:-**

A major defect of the traditional finishing activities of the coir mats and mattings has been their susceptibility to skid. So investigations were conducted to examine the effect that could be obtained by applying Polyvinyl acetate emulsion to the back side of coir door mats.\(^{88}\) Investigations regarding non-skid backing of flexible nature on the reverse side of the pile structure of carnatic mats reveal that polyvinyl acetate Terpolymer dispersion incorporating saw dust as a filler give satisfactory finishing.\(^{89}\) Laboratory experiments in the prospects of using latex based and PVC based adhesive for bonding the cut edges of mats and mattings also give satisfactory result. Similarly, to improve the non-skid characteristics of rubber backed coir mats, formation of embossed designs on the rubber backing with the use of suitably engraved plates was examined with successful results.\(^{90}\)

6.1.8. **Product Diversification , Product Development And New Uses of Coir:-**

6.1.8.1 **Use of Coir matting for sand stowing:-**

Studies in regard to the use of coir mattings as a barricading material for sand stowing operations in coal mines were successfully pursued with the Central Mining Research Station, Dhanbad.\(^{91}\)

6.1.8.2 Development of light weight fabrics of simple construction:-

Preliminary experiments were undertaken to explore the prospects of weaving light-weight fabric having coir pile structure has indicated that on use of thinner yarn for the base fabrics and soft spun thin coir yarn for the pile structure, there are prospects for evolving novel pile carpets, having a weight considerably lower than the traditional carnatic carpets of the industry. Simple pile carpets with polypropylene filament yarn as the base fabric was woven and the experiments have given very encouraging results. 92

6.1.8.3 Development of “Kayarool Druggets” :-

Studies have been conducted to explore the prospects of weaving fabrics of 4 shafts woven out of softened coir fibre of ordinary loom. As an outcome of this experiment, it has been possible to evolve “Kayarool rug”, having a supple feel and much smoother texture than the usual coir rugs made out of 2-ply coir yarn. 93

In view of the low output in spinning single strand coir yarn the possibility of finding a coir based substitute raw material for weaving the druggets was investigated. Softened, bleached and dyed carnatic yarn could be used as the raw material for the manufacture of druggets of similar texture. 94

The prospects of weaving novel type of carpets presenting different design configuration on the two sides by 4 shaft weave was examined with positive results. About 20 different patterns were evolved in the 4 shaft carpet weave for preparing sample carpet. To improve the appearance of 4 shaft Kayarool Twill Carpet, Japanese designs were attempted with success. 95

6.1.8.4 **Uncut Pile Fabrics:**

Possibilities of making uncut pile fabrics out of single strand coir yarn spun out of blends containing 80% softened coir and 20% Jute Fibre on processing the blends on Jute spinning system were examined by trial experiments. 96

6.1.8.5 **Resilient loop carpets:**

With a view to develop pile carpets with a springy feel and improved texture prospects of evolving loop pile fabrics out of softened, bleached and dyed coir yarn was examined. 97

6.1.8.6 **Use of Coir Filter Points:**

The prospects of using tabular coir mattings as filter points in tube well was investigated in collaboration with the Agriculture Department of Tamil Nadu Government. 98 Experiments on the use of coir tube as filter on tube well have been successfully attempted. 99

Enquiries with Highway / Consultant Engineers have revealed that coir needled felts can be used with advantage as filter for underground drain pipes. 100 Experiments conducted at Water and Land Management Institute, Anand, Gujrat have indicated that coir needled felt function as an efficient filter material in underground drains. 101

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6.1.8.7 **Rope Wedding Matting Mat:**

This consisted of plain wooven coir matting over the surface of which the coir rope is made to interweave as extra weft.\(^{102}\)

6.1.8.8 **Wall facings from coir shearing waste:**

Exploratory investigation were conducted for evolving elegant wall facing for fancy appeal with improved acoustic and insulation characteristics. In the experimental work, different base materials comprising of hard board, ply-wood and cotton fabrics were coated with Polyvinyl acetate paste. Coir shearing dust was uniformly spread on the coated fabric dressed with the spray of the adhesive hot pressed for effective bonding of the coir fibre bits with base materials. The resultant panels shows promise of being selected for decorative purposes as well as indoor ceiling facings for use in building construction.\(^{103}\)

6.1.8.9 **Development And Diversification of Coir Pith Products And Their Uses:**

6.1.8.9.1 **Utilisation of Coir Pith In Agricultural Farm:**

Research on the scope for utilisation of coir pith, the by product of coir industry, as additive to soil for increase in the yield in agricultural crop and a study of the physico chemical properties of farm soil in the long term on use of coir pith was pursued in collaboration with the Agricultural University, Coimbatore.\(^{104}\)

A successful method of composting coir pith using the fungus *Pleurotus Soja Caju* (mushroom), now it is known as “pith plus” was developed at the

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laboratory level. The composting of the coir pith using pith plus increases NPK content of coir pith. This methodology was test verified on a large scale in the field of various places. A hand out elucidating the method of decomposing the coir pith for circulation among the farmer is under issue.\(^{105}\) The field studies were conducted with different crops using new and composted coir pith shows that the output would be augmented in test crops viz. groundnut, ragi, paddy, and sorghum.\(^{106}\) Addition of pith to the soil in dry areas with low rainfall was found to be useful in retention of moisture of the soil for longer periods and a receptacle for nutrients for uptake of the same by the crop in the normal span of the growth cycle.\(^{107}\) The long term effect of using coir pith in raising the farm output for cultivation of selected cash crops was investigated under the continuing research on the subject. Research investigation is also undertaken on growing the fungal culture in coir pith itself instead of a media.\(^{108}\)

### 6.1.8.10 Other Uses:

Pilot scale studies on extraction of sodium lignosulphonate from coir pith were undertaken during 1993-94. A laboratory spray drier was installed at the institute for spray drying organic compound from coir pith and ret liquor.\(^{109}\) The chrome lignosulphonate extracted from coir pith was sent to the Institute of Drilling Technology at Dehradun for assessing its properties as a drilling mud additive. A sample of sodium lignosulphonate was submitted to Jadavapur University of Kolkata. Efforts are on to identify battery manufacturers so as to fabricated batteries to evaluate their performance in practical trials.\(^{110}\) Samples of sodium

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lignosulphonate extracted from coir pith were tested for application in lead acetate batteries by M/S. Business Universal Incorporation, Pune and reported that the sample could withstand 26 charge and discharge cycles on two different types of batteries. Sample was also sent to Gumbro limited, Bombay for testing as the party has shown interest in the technology transfer of the process of producing sodium lignosulphonate from the coir pith.  

6.1.8.11 Studies On Use of Coir Needled Felt:-

With a view to diversify the use of brown coir fibre, the scope for utilisation of coir needled felt as a packaging material was explored in co-operation with prospective user industries. Rubberised coir needled felts have been found to be suitable for packaging delicate and fragile electronic components. Preliminary observation have revealed that rubberised coir felt is eminently suited for packaging fragile items such as valves and T.V tubes withstanding the rigours in handling and transport of the item. Sample cushioning blocks were made available to major industrial establishments to examine the scope for using the laminated coir needled felt pads as packaging material for transport of delicate electronic items. The performance of this is under examination.

To facilitate the use of coir needled felts as padding for spring reinforced bed mattress and upholstery, cushioning, the scope for use of HDFE gauge as the sterim was attempted. The scope for the use of coir needle felt as seat cushions and back rests for passenger buses is under investigation.

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Scope for utilisation of rubberised coir needled felts as carpet underlays and also in the preparation of Janatha mattresses is also under investigation. Preliminary indications are that coir needled felt covered with cotton cloth meet with response of consumers for use as Janatha mattress. The performance of rubberised coir needled felts as carpet underlay is also reported satisfactory. Exploratory studies have also revealed that rubberised coir needled felts could meet with satisfactory service with suitable tapestry cover. Could also serve as low cost mattress for use in house of farm labourers in hill ranges, where in insulation against transmission of cold by construction is an essential requirements.

Experiments were also conducted to explore the prospects of using coir needled felt of specific density grade as a base material for preparation of corrugated cement roofing sheets.

Experimental trials were attempted to evolve composites of coir/resin from coir needled felt and a few samples were prepared giving successful results.

A new project to develop rubber coated coir needled felt tile board was undertaken and sample produced.

6.1.8.12 Utilisation of Coir For Thermal Insulation And Acoustic Control:-

Thermal insulation in normal temperature range and acoustic control are areas where in coir needled felts could find intensive area of use. Such use of the material necessitates flame retardance coupled with rigidity and pliability of

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119 Ibid
the product. A few flame retardant (FR) additives were used in imparting flame retardancy to coir products and tested for flammability characteristics and results were encouraging. Samples of rubberised coir were treated with a mixture of FR additives for imparting retardancy and the specimen tested and revealed the perceptible improvement in fire retarding.¹²¹

6.1.8.13 **Use of Coir in road construction:-**

Investigation on the prospects of using coir mesh mattings for preparation of pre-fabricated bitumenous surfacing for road construction were conducted in collaboration with the Central Road Research Institute.¹²² A project for construction of an experimental road was evolved in consultation with the National Highway Division. Detailed specification of the road construction incorporating coir mesh matting as the reinforcing material was evolved.¹²³

6.1.8.14 **Use of Coir In Erosion Control In Soil Slopes (coir geo-textile):-**

The capacity of coir netting (coir geo-textile) to effectively check erosion of the slopes and establishing over the denuded soil slopes are pursued with the Central Road Research Institute, New Delhi.¹²⁴ The exploratory studies on the use of coir retting for arresting erosion of soil slopes of highway pursued in section of Almora in U.P and Western Ghats has given encouraging results.¹²⁵ The experiments conducted in the highway ranges of Nilgiris District of Tamil Nadu, has revealed that coir netting can effectively contain the hazards of erosion, by proper application of the netting over the surface which are erosion prone.¹²⁶

As part of field experiments on use of coir geo-textile for erosion control, mesh mattings were laid on the banks of irrigation canals and road slopes planted with grass for soil stabilisation. The field experiments were continued at Moovattupuzha Valley Irrigation Project. An experimental field study on the application of coir geo-textile in soil stabilisation of bunds for control of irrigation in paddy field has been initiated at the field site at Mancombu in Kuttanad by laying coir geo-textile of basket weave for reinforcing the mud wall.

Coir Board along with Rice research station Mankombu conducted an experiment on the reinforcement of mudwall with coir matting of 3/3 Vycome type for a length of 50 meters. The matting was fixed to the bamboo and coconut poles at a distance of half meter to give it a stable structure.

6.1.8.14.1 Use of coir in sea-erosion control:-

One of the prospective areas offering scope for increased utilisation of coir appears to be the areas affected by sea erosion. The technical aspect of using coir as a medium for sea erosion control have been examined in consultation with the Kerala Engineering Institute.

With a view to explore the possibilities of using coir to new application the scope for use of sand filled rubber backed matting bag as armour for sea wall in coastal protection work was examined on a lab: scale in collaboration with the Central Water And Power Research Station. The effect of wave action on placement of the bags was studied. The wave run up on sand filled rubber bags...
backed coir matting bags as armour for sea wall is observed to be about 70 to 80% higher compared to the sea wall made out of stones of rough surface.\footnote{Coir Board (1985-86): Op.cit., P.78.}

6.1.8.15 **Use of Coir in Building Construction:**

The prospect of using coir as a reinforcing materials in the preparation of roofing/panalling boards was investigated in collaboration with the Central Building Research Institute, Rourkee. The research covered three parts:-

6.1.8.15.1. use of coir fibre along with rice straw in the preparation of composite panel boards. 6.1.8.15.2 Use of coir fibre and coconut pith in the preparation of composite panel, and 6.1.8.15.3 Use of coir in the preparation of corrugated sheets.\footnote{Coir Board (1973-74): Op.cit., P.65.}

The panels were found to be suitable for partitions and walling in building construction. Use of coir reinforced boards indicated the possibility of considerable saving in the cost of expensive timber in construction work.\footnote{Ibid, P.67.}

The possibility of evolving a design for a model building with coir reinforced panels and roofing sheets was pursued with the Central Building Research Institute.\footnote{Coir Board(1975-76): Op.cit., P.110.}

6.1.8.16 **Use of Coir Matting For Cooling Buildings By Roof Surface Evaporation Techniques:**

The experiments conducted in Central Building Research Institute, Roorkee reveals that coir matting can be used with R.C.C roof by the roof surface evaporation technique. The use of coir matting for this new application is
being popularised by demonstration of the technique in selected regions susceptible to extreme heat in north India.\footnote{135}

6.1.8.17 **Coir reinforced pre-cast concrete slabs for drains:**

With a view to examine the prospects of using coir reinforced pre-cast slabs in civil works, the technical details of fabrication of the slabs were evolved.\footnote{136}

6.1.8.18 **Coir Tiles:**

With a view to facilitate case of handling, installation and maintenance and improved serviceability exploratory experiments were conducted for developments of coir tiles using compounded rubber as backing material.\footnote{137} Rubber compound with some chemicals observed to give more satisfactory backing, to coir matting and yield tiles of a firm structure.\footnote{138}

6.1.8.19 **Development of an Equipment for tufting coir in PVC Base:**

Efforts for fabrication of model machine for tufting of coir in PVC base was pursued in collaboration with MERADO,\footnote{139} CSIR, Madras. The model machine for tufting coir in PVC base was assembled and put to test run. A model unit of the tufting plant is under fabrication and development.

6.1.8.20 **Development of coir polymer composites:**

The project, in collaboration with Regional Research Laboratory, CSIR, Thiruvananthapuram, is aimed at development of techniques for production of

composites using coir needled felt and phenol formaldehyde resin. The process involves impregnation of coir needled felt in sheet form in the phenol formaldehyde composition in an impregnation unit and curing of the prepeg to the desired shape in a hydraulic press. Composite samples of good strength and appearance have been obtained from the preliminary experimental work. The composites board have been observed to warp on release from the hydraulic press and exposure to ambient conditions. The initial warping defects observed in the particle boards have been rectified.

Pilot experiments on the development of polymer composite boards using PF resin were conducted and a new samples of the boards of poly coir were evolved. Experiments were continued to develop coir polymer composite boards of improved appearance and finish by vapour cure coating. The wood veneered particle boards were tested at Indian Plywood Industries Research Institute, Bangalore.

Trials were successfully conducted for production of various types of polymer composite boards using different parameters. Bigger size poly coir board in 7x4' size were produced. Boards with lamination papers and fancy design papers were also produced.

6.1.8.21 Development of Coir Gypsum Composites:

The project for development of gypsum coir composite panel in collaboration with Regional Research Laboratory, Jammu Tawi was successfully completed at
the laboratory level. Boards from gypsum and coir/ cement combination have also been developed in collaboration with RRL, Jammu Tawi for use in panelling and false ceiling.\textsuperscript{144} The institute developed gypsum boards by sandwiching layers of coir needled felt with layers of gypsum which have properties like low thermal and sound conductivity, smooth finish and easy machinability.\textsuperscript{145}

6.1.8.22 Use of Coir Fibre For Producing Paper Pulp And Paper:-

Bench scale trials on manufacture of paper from coir fibre has rendered high grade paper pulp and paper confirming the potentials of coir bit fibre for a new end use.\textsuperscript{146}

6.2. Training and Technical Assistance:-

The role of learning, education and training in technological change was accepted by all economists. Effective application of new technologies to traditional activities must entail improved human capabilities that keep pace with the process of upgrading technology. This requirement encompasses the need for learning how to perform well defined technologically oriented tasks better, as well as the mastery of a much greater variety of new task that will inevitably proliferate.\textsuperscript{147} Shultz argues that unless human capabilities stay "abreast of physical capital", they become limiting factor in economic growth. It is not possible to have ——— the abundance of modern industry without making large investment in human being.\textsuperscript{148} A lot

of empirical studies on the relationship between education, training and economic growth have been undertaken in economic literature. Important among them are by Shultz, Becker, Denison, Blaug etc. Economists agree that people's education and training and with these their ability to come to terms with technological changes are keys to improvement in real output.  

Skilled manpower development is an essential requirement of the coir industry. Coir processing can be undertaken by skilled workers only. For that the workers have acquired some degree of specialisation and cultivated skill and techniques which render them suitable to undertake coir based activities. The National Coir Training And Design Centre (NCTDC) had been engaged in providing adequately trained personnel to the coir industry. The NCTDC implements a variety of training programme to provide trained manpower to meet the needs of the growing coir industry. Requirements of skilled manpower is on the increase with the development of the coir industry. The NCTDC, Kalavoor, engaged in imparting intensive training in advanced methods of various process of manufacture like spinning, dyeing, bleaching, weaving etc. Moreover, the training centre conduct the refresher course for executives in coir industry, organising orientation training for government officials, technical officers, business managers of coir co-operatives societies, providing technical consultancy and extension service to the trade, organising field training in rural areas to trained local candidates, organising special training to women in spinning coir yarn on motorised ratt under Mahila Coir Yojana, short term training in the application of 'coirret' and pith plus and popularising new pattern, designs and products.

The following table shows the details of Training course conducted by NTDC.

Table 6.1
Details of Training Course conducted by NCTDC from 1965 to 2001

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Name of the course</th>
<th>Duration</th>
<th>No.of Trainees Participating the course</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Advanced Training Course</td>
<td>1 year</td>
<td>614</td>
</tr>
<tr>
<td>2</td>
<td>Artisans Training Course</td>
<td>6 months</td>
<td>471</td>
</tr>
<tr>
<td>3</td>
<td>Coir Craft Training Course</td>
<td>6 months</td>
<td>270</td>
</tr>
<tr>
<td>4</td>
<td>Coir Technology Course</td>
<td>6 months</td>
<td>92</td>
</tr>
<tr>
<td>5</td>
<td>Training under Mahila Coir Yojana</td>
<td>3 months</td>
<td>4147</td>
</tr>
<tr>
<td>6</td>
<td>Trainer’s Training</td>
<td>—</td>
<td>59</td>
</tr>
<tr>
<td>7</td>
<td>Training on composting coir pith and treatment of coir ret</td>
<td>3 days</td>
<td>355</td>
</tr>
<tr>
<td>8</td>
<td>Candidates Trained by Co-operative societies/voluntary Organisation under field Training Programme</td>
<td>—</td>
<td>2790</td>
</tr>
<tr>
<td>9</td>
<td>Short-term Training Course</td>
<td>—</td>
<td>1019</td>
</tr>
</tbody>
</table>

Source: Coir Board, Annual Reports of Various years

The details of the above courses are given below:-

6.2.1 **Advanced Training Course**:-

Advanced Training Course is intended for middle level executives sponsored by coir manufactures / coir co-operatives societies / Government department. The trainees will have to undergo training both in theory and practical about
the production techniques of all types of coir products considering the growing importance of developing the industry on non-traditional lines, this training course has suitably been modified to cover practical training in mechanical extraction of coir fibre, mechanised process of weaving and spinning. General study on the manufacture of rubberised coir products, manufacturing techniques of coir rope etc. This course was started in 1965. Thirty batches of trainees are passing out from the institute and 614 persons are trained.

6.2.2 Artisans Training Course:-

This course is intended for workers actually engaged in the manufacture of coir products. The syllabus for the course is so drawn up as to enable the trainees to get trained in modern methods of spinning, weaving, dyeing and shade matching etc. Fifty batches are completed and 471 coir workers are trained this course.

6.2.3. Coir Craft Training Course :-

As a step to diversify the conventional use of coir, handicraft product out of coir have been developed and training course in coir craft was organised. The syllabus of the course was devised to suit the female candidate. It was started in 1979. The preparation of different types of variety bags, handbags, table mat, tea mats baskets, flower vases, net, wall hanging, coir fibre chain, mesh mat, corridor mat, chain shopping bag, chappals mats, spinning finer yarn, dyeing, bleaching softening etc. were covered by the curriculum of the course. There are 270 women got this training.

152 Ibid.
6.2.4 **Coir Technology Course:**

A training course exclusively for the utilisation of brown fibre has been organised under the name of "Coir Technology Course". The curriculum of the course cover spinning coir yarn - hard, medium and soft twist- braid making, rope making, dyeing, bleaching, weaving, mesh mat, chain mat and matting and manufacture of coir brushes. Ninety two people have been trained so far.

6.2.5 **Training under Mahila Coir Yojana:**

This scheme is intended for giving training in spinning coir yarn on motorised ratt to rural women. The institute so far trained 4147 women under this scheme. The training was started in 1994-95. The societies or institutions which were distributed motorised ratt under ITC/SIDA project are also imparting training in spinning on motorised ratt. Besides, the successful trainees can also impart training to others on their motorised ratt. This is known as trainer's training.

6.2.6 **Training In Composting Coir Pith And Treatment of Coir Ret:**

Short term training in composting coir pith and treatment of coir ret is to educate entrepreneurs in the use of coir ret in converting mechanically extracted green husk fibre into white fibre and recycling of ret liquor. The NCTDC impart training to 355 trainees so far.

6.2.7 **Short Term Training Courses:**

In addition to regular training courses, short term training courses in the form of intensive training courses to officers and supervisors, orientation and

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154 Ibid.
refresher courses, training courses in brush making, training under “TRYSEM”, training course on production of coir in co-operatives, training on coir processing design, training in carpet weaving, special training in matting stitching, training in fibre mat weaving etc. are being organised as per the requirements of the state government.

In addition to these, training in coir production to the business managers of coir co-operatives, training to secretaries of coir co-operatives and inspectors of coir development in collaboration with co-operative college, Thiruvananthapuram was also continued.

6.2.8. **Field Extension Service and Technical Assistance:**

Extension service facilities were given by both NCTDC and CCRI. For that they have an extension service wing. Rendering on the spot assistance or training to solve the problem that came across in the day to day manufacturing establishments was the main activity covered under extension service scheme.

6.2.8.1 **Extension Service in Spinning:**

A scheme drawn up to conduct demonstration-cum-training programme at different yarn producing centres of Kerala. The programme was implemented through specially trained instructors who visit the individual spinning units to give technical advice. The scheme covered the area of operation of 60 coir co-operative societies in Kerala state covering more than 33,000 spinners. 157

On the spot technical advice was extended on the precautions for maintenance of the texture of the yarn through spinning and overcoming the spinning faults. A total of 3 societies involving 412 ratt and 1236 workers were covered

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under the programme. With a view to improve the quality of coir yarn extension efforts were pursued in areas producing Vycome, Aratory and Anjengo yarns. The site selected for the field inspection were located in Perumpalam, Keerikad and Kadinamkulam villages.

Field extension programme in spinning was pursued in Model Coir Villages producing Anjengo, Aratory and Vycome coir yarn. The daily production of coir yarn in the societies was examined for defects if any, runnage, twist, etc. by drawing samples at random and the defects observed brought to the attention of spinners with suggestions for correction or preventing recurrence of the faults. Spinners whose skill require to be updated were given on the spot training for bettering the output.

Training programme of workers of co-operative societies in Cannanore, Kozhikkode, and Ponnani coir project area for spinning 2 ply coir yarn on treadle ratt/traditional ratt was conducted in the Kozhikkode region drawing the candidates for each batch of training from 5 societies out of total 99 societies, who have evinced interest for training their worker members. Training programme for artisans of co-operative societies in the Kozhikkode Coir Project area was conducted in co-ordination with the Director, Coir Development, Government of Kerala and Coir Project Officer, Kozhikkode. One hundred and sixty workers drawn from 30 coir co-operatives have already been selected for the training in batches. Ninety spinners selected from 17 coir co-operative societies of Kozhikkode coir project area were trained for

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spinning coir yarn of Anjengo and Mangadan type. Four hundred and twenty six women workers of coir co-operatives in Thiruvananthapuram project area were imparted training in spinning Anjengo Yarn. Thirty six artisans of Panathara village of Thiruvananthapuram district were imparted training in spinning of coir yarn.\(^{163}\)

Training in spinning of coir yarn in motorised ratt was given to 30 women artisans for a period of 3 months at Kodungalloor. The field staff of CCRI provided on the spot technical advice in spinning of coir yarn to 1702 women spinners.\(^{164}\)

Training in spinning coir yarn on motorised ratt and automatic spinning machine was imparted to artisans. Details of training imparted are furnished below:

**Table- 6.2**

**Field Training Programme to Artisans**

<table>
<thead>
<tr>
<th>Details of Training</th>
<th>No.of Artisans Trained</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Spinning Coir Yarn on automatic spinning machine at</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Kaniyapuram cvcs</td>
<td>46</td>
<td>4 months</td>
</tr>
<tr>
<td>(b) Kerala state coir corporation Ltd. Beypore</td>
<td>10</td>
<td>3 months</td>
</tr>
<tr>
<td>2. Spinning Coir Yarn on treadle ratt for the women sponsored by the Community Dvt: Society under the UBSP aided by UNICEF</td>
<td>40 (in two batches)</td>
<td>2 months</td>
</tr>
<tr>
<td>3. Spinning Coir Yarn on motorised ratts, Moothakunnam CVCS Ltd. No.51</td>
<td>20</td>
<td>4 months</td>
</tr>
</tbody>
</table>


Altogether 157 trainees were given training on motorised ratt during the year 1994-95. The field staff of CCRI provided on the spot technical advice in spinning of coir yarn to 1702 women spinners.\(^{165}\)

The training center also provides necessary assistance to the motorised ratt spinning units in improving the quality and productivity of yarn. To modernise the spinning sector, spinning of coir yarn on motorised ratt is being popularised among coir yarn spinners particularly among traditional yarn spinners.

6.2.8.2 Field Extension Service And Technical Advice In Bleaching, Dyeing And Shade Matching:-

The extension service wing of the Board rendering service to the industry by advising the manufactures about the correct method of dyeing, mixing of the correct dyes and combination of dye stuff for matching shades, bleaching of fibre, stenciling, adoption of improved designs, adopting the softening treatment for coir on a commercial scale etc. On the spot technical advice in bleaching, dyeing, shade matching etc was extended to coir units by repeated visits of technical staff in several times. Every year the institute provides extension service to various coir units. On the average about 32 tonnes of coir yarn/ fibre was processed in each of the societies, availing of technical guidance of the extension service.\(^{166}\) Most of the manufacturing units in Alleppey and Cherthala were visited for rendering on the spot technical advice on bleaching, shade matching and bulk dyeing. Technical guidance was given to 200 major coir processing unit (from 1982-83 to 1990-91) which included organised factory type, small scale unit and co-operatives in bleaching, shade matching, bulk dyeing and stenciling. Technical assistance in spinning,


weaving, dyeing different types of coir products and details of shades, defibering etc were given to the parties who sought for guidance in these lines.

Training was also given to the technical personnel from coir co-operatives and private sector on weaving matting on semi-automatic loom, and spinning of coir yarn in Automatic Spinning Machine. During 1993-94, CCRI conduct 3 months training for coir mats weaving to 42 trainees sponsored by Alleppey Diocese Charitable Society at west Manakodam and 2 months training to 30 trainees sponsored by Sree Chitra Poor Home, Thiruvananthapuram. It also trained 7 persons in weaving on semi-mechanised loom during 1995-96 and training was extended to 36 personnel on semi-automatic loom sponsored by various coir co-operatives societies during 1996-97.

Entrepreneurs of the brown fibre sector were provided with the technical details for fabrication of indigenous version of an Automatic Coir Spinning Unit consisting of a coir fibre cleaning (willowing) machine, slivering machine and spinning heads, as part of an effort for modernisation of the coir industry.  

6.2.9 Quality Improvement Programme:

The objective of quality improvement programme was to create quality awareness among coir workers at the grass root level who are engaged in fibre extraction, spinning, dyeing, production of coir products and to impress up on them the need and significance to maintain high quality. The table given below gives number of quality improvement camps and number of workers participated in various years.

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Quality Improvement camps conducted by Institutes and workers participated in the Camp

<table>
<thead>
<tr>
<th>Year</th>
<th>No: of Camps</th>
<th>Workers Participated</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990-91</td>
<td>14</td>
<td>3402</td>
</tr>
<tr>
<td>1992-93</td>
<td>14</td>
<td>3300</td>
</tr>
<tr>
<td>1993-94</td>
<td>45</td>
<td>9000</td>
</tr>
<tr>
<td>1994-95</td>
<td>44</td>
<td>8201</td>
</tr>
<tr>
<td>1995-96</td>
<td>19</td>
<td>4110</td>
</tr>
<tr>
<td>1996-97</td>
<td>15</td>
<td>1056</td>
</tr>
<tr>
<td>1997-98</td>
<td>20</td>
<td>1163</td>
</tr>
<tr>
<td>1998-99</td>
<td>19</td>
<td>1170</td>
</tr>
<tr>
<td>1999-2000</td>
<td>5</td>
<td>500</td>
</tr>
<tr>
<td>2000-2001</td>
<td>1</td>
<td>100</td>
</tr>
</tbody>
</table>

In short, it is assumed that the system of organised training which was made available to those engaged in the coir industry in Kerala have contributed to a large extent to the increase in productivity as well as total output of the industry.

6.3 Innovation And Diffusion of Innovation:-

The second stage of technological change is innovation, which covers the development of new ideas into marketable products.\(^{169}\) Innovation as a process that begins with an invention, proceeds with the development of the invention, and results in introduction of a new product, process or services to the market place.\(^{170}\) Thus Technological Innovation may be described as the process by


which knowledge on how to produce a product not available in a given market or how to improve the performance of an existing product, reduce its cost, or market and distribute the product more efficiently, is made a reality.\footnote{Stoneman, Paul (1997): "The Diffusion of Process Innovation", Cambridge University Press, P.6.}

The third stage of technological change is diffusion, which is the adoption of innovation by the actors in and across economies.\footnote{Stephen, Davies (1979): "The Diffusion of Process Innovation", Cambridge University Press, P.6.} It is the process of the spread of uses and ownership of new technology. Imitation or inter-firm diffusion refers to the spread of the new process from firm to firm with in any industry, intra-firm diffusion to the spread of the process within individual firms and over all diffusion to the spread throughout the industry as a whole. Thus inter-firm diffusion might be measured by the proportion of firms in an industry that have adopted, intra-firm diffusion by the proportion of any one firm’s output produced using the new process and over all diffusion by the proportion of the total industry output that is produced using the new process.\footnote{See. Gerhard Rosegger’s The Economics of Production and Innovation—an industrial Perspecision —Button Worth—Heinemann Ltd, 1996,P.199. In his book he remarks that the rise in the absolute value of industry’s sales as the most relevant measure of diffusion. Hence this measure is adopted in this work also.}

Most of the technological changes (both product and process innovation) developed by R and D institutions of Coir Board have been followed or imitated by the industry. Both in the process of existing production and also in the new uses of coir, much innovation and diffusion is taken place in the industry.

In retting coconut husks, a major innovational activity found in recent years is in the large scale usage of “coir ret” (the bacterial cultures for reducing the retting period of coconut husk). The increase in the sales volume is an indication of the diffusion of “coir ret”.\footnote{Technology Acquisition and Technology Strategy for Indian Industry – Ashok Parthasarathi-Technology transfer and in house R and D in Indian Industry (In the late 1990’s) Vol. I Editor – Binoy Kumar Patnaik–Allied Publishers Ltd, 1999, P.14.}
Table 6.4

Sales of coir ret in various years.

<table>
<thead>
<tr>
<th>Year</th>
<th>Quantity(kgs)</th>
<th>Value (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994-95</td>
<td>1084.0</td>
<td>41,192.00</td>
</tr>
<tr>
<td>1995-96</td>
<td>784.0</td>
<td>29,792.00</td>
</tr>
<tr>
<td>1996-97</td>
<td>556.0</td>
<td>21,128.00</td>
</tr>
<tr>
<td>1997-98</td>
<td>976.5</td>
<td>37,107.00</td>
</tr>
<tr>
<td>1998-99</td>
<td>1320.0</td>
<td>50,160.00</td>
</tr>
<tr>
<td>1999-2000</td>
<td>1600.4</td>
<td>61,749.20</td>
</tr>
<tr>
<td>2000-2001</td>
<td>1713.0</td>
<td>68,520.00</td>
</tr>
</tbody>
</table>

Source: Coir Board, Annual Reports of Various Years.

The table reveals that the sales of coir ret increases from 1084 kgs to 1713 kgs in terms of quantity and from Rs. 41,192 to Rs. 68520 in terms of value. This clearly indicate the diffusion of this product.

Another notable innovation is in the field of fibre extraction. Here the use of defibering machines in making coir fibre is in operation. In spinning sector major innovation was the introduction of treadle / motorised ratt and also the motorised traditional ratt. Another is the adoption of automatic spinning machine.

Coming to the manufacturing sector, innovation is in the form of improvements in the traditional preparatory process through softening, bleaching, dyeing, and shade matching. In softening the coir, caustic soda solution bleached in hydrogen peroxide, cationic softeners, polymer emulsion etc. are used. For bleaching, oxalic and acid and sulphuric acid and hydrogen peroxide are widely used. Synthetic dye stuff are also widely used by the firms. Now the trend is towards natural dyes. The diffusion of these innovation in softening, bleaching etc were made possible through the Common Facility Centre.

\[^{175}\text{More details regarding this see chapter VII.}\]

\[^{176}\text{More details regarding this see chapter VII.}\]
Hindustan Coir, Dye House, Raw material Bank and Field extension service conducted by Coir Board. Other major innovational activity in this sector is in the application of new designs. The following table shows the year wise use of new designs by the manufacturers.

**Table 6.5**

**Year-wise application of Modern, Novel and New Designs by the Manufacturers.**

<table>
<thead>
<tr>
<th>Year</th>
<th>New Designs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970-71</td>
<td>112</td>
</tr>
<tr>
<td>1971-72</td>
<td>106</td>
</tr>
<tr>
<td>1972-73</td>
<td>83</td>
</tr>
<tr>
<td>1973-74</td>
<td>99</td>
</tr>
<tr>
<td>1974-75</td>
<td>83</td>
</tr>
<tr>
<td>1975-76</td>
<td>79</td>
</tr>
<tr>
<td>1976-77</td>
<td>77</td>
</tr>
<tr>
<td>1977-78</td>
<td>42</td>
</tr>
<tr>
<td>1978-79</td>
<td>51</td>
</tr>
<tr>
<td>1979-80</td>
<td>24</td>
</tr>
<tr>
<td>1980-81</td>
<td>24</td>
</tr>
<tr>
<td>1990-91</td>
<td>57</td>
</tr>
<tr>
<td>1981-82</td>
<td>40</td>
</tr>
<tr>
<td>1982-83</td>
<td>49</td>
</tr>
<tr>
<td>1983-84</td>
<td>35</td>
</tr>
<tr>
<td>1984-85</td>
<td>53</td>
</tr>
<tr>
<td>1985-86</td>
<td>71</td>
</tr>
<tr>
<td>1986-87</td>
<td>66</td>
</tr>
<tr>
<td>1987-88</td>
<td>70</td>
</tr>
<tr>
<td>1988-89</td>
<td>51</td>
</tr>
<tr>
<td>1989-90</td>
<td>64</td>
</tr>
<tr>
<td>1991-92</td>
<td>82</td>
</tr>
<tr>
<td>1992-93</td>
<td>103</td>
</tr>
<tr>
<td>1993-94</td>
<td>90</td>
</tr>
<tr>
<td>1994-95</td>
<td>82</td>
</tr>
<tr>
<td>1995-96</td>
<td>57</td>
</tr>
<tr>
<td>1996-97</td>
<td>68</td>
</tr>
<tr>
<td>1997-98</td>
<td>108</td>
</tr>
<tr>
<td>1998-99</td>
<td>72</td>
</tr>
<tr>
<td>1999-2000</td>
<td>48</td>
</tr>
<tr>
<td>2000-2001</td>
<td>54</td>
</tr>
</tbody>
</table>

*Source: Coir Board, Annual Reports of Various Years.*
The introduction of semi-automatic loom and Automatic power looms in mats and mattings is another major innovational activity in the manufacturing sector. The diffusion of this also started.

Coming to the product innovation side, “Pith plus” which is essential for composting of coir pith, earlier considered as a waste and hurdle for the industry is a major innovational activity in the industry. The following table shows sales of coir pith during various years, which is an indication of diffusion of this product.

Table 6.6
Sales of Coir Pith in Various Years

<table>
<thead>
<tr>
<th>Year</th>
<th>Quantity (kgs)</th>
<th>Value (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994-95</td>
<td>14,702.00</td>
<td>816.80</td>
</tr>
<tr>
<td>1995-96</td>
<td>11,340.00</td>
<td>2,57,040.00</td>
</tr>
<tr>
<td>1996-97</td>
<td>7,524.80</td>
<td>1,35,446.40</td>
</tr>
<tr>
<td>1997-98</td>
<td>17,197.00</td>
<td>3,09,546.00</td>
</tr>
<tr>
<td>1998-99</td>
<td>11,696.40</td>
<td>2,10,571.20</td>
</tr>
<tr>
<td>1999-00</td>
<td>13,244.80</td>
<td>2,68,041.60</td>
</tr>
<tr>
<td>2000-01</td>
<td>12,754.00</td>
<td>3,18,850.00</td>
</tr>
</tbody>
</table>

Source: Coir Board, Annual Reports of Various Years.

A large number of entrepreneurs had started production of coir pith manure on commercial scale and marketing in Kerala. More than 15 units for production of an organic manure of coir pith have started functioning in different producing centres of coir.

177 More details see chapter VII
Another product innovation is the introduction of 'coir geo-textile'. Geo-textile was earlier known as Geo-synthetics. Synthetic products were extensively used in the world market for various applications. The introduction of coir as a geo-textile is easily catching up. Geo-textile materials are used for erosion control purpose on slopes, re-vegetation, road and bridge construction, drainage filters, reinforcing the retaining wall in high ranges, reforestation, sound control, track stabilisation land scaping, silt fencing, waste land development, good for application in embarkment protection etc.

To create wide awareness of the geo-textile and its varied application, Government of Kerala declared 2000-2001 as the “Geo-textile Year”.\(^{179}\)

As production and sales figures of geo-textiles are not available from any official sources export figures are taken as an indicator of the diffusion of coir textile.

**Table- 6.7**

<table>
<thead>
<tr>
<th>Year</th>
<th>Quantity(kgs)</th>
<th>Value (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994-95</td>
<td>442</td>
<td>151.35</td>
</tr>
<tr>
<td>1995-96</td>
<td>474</td>
<td>167.30</td>
</tr>
<tr>
<td>1996-97</td>
<td>361</td>
<td>149.46</td>
</tr>
<tr>
<td>1997-98</td>
<td>739</td>
<td>313.31</td>
</tr>
<tr>
<td>1998-99</td>
<td>1208</td>
<td>546.91</td>
</tr>
<tr>
<td>1999-00</td>
<td>1711</td>
<td>808.41</td>
</tr>
<tr>
<td>2000-01</td>
<td>1402</td>
<td>625.38</td>
</tr>
</tbody>
</table>

Source: Coir Board, Annual Reports of Various Years.

\(^{179}\) Hindu daily, June 8, 2000
Another major innovation is the production of rubberised coir products. The export trend from 1985-86 shows the increased application and diffusion of these products.\textsuperscript{180}

Transfer of technology relating to manufacture of 'coir ply'/ 'coir matting Decorate Board' (Poly coir is a fibre polymer composite material using coir as the reinforcement and phenol-formaldehyde polymer as the matrix or binder) to M/S Duroflex coir Industries Ltd during 1974-75 clearly shows another product innovation in coir industry.\textsuperscript{181} For the last 10 years coir ply has been accepted as an alternative to tropical timber products.\textsuperscript{182} Central P.W.D. uses the 'Coir Ply Board' (Final Board) as an experimental basis. This will increase the industrial opportunity of this product.

The technology developed at Regional Research Laboratory, Thiruvananthapuram based on coconut pith as the pore introducing material in the manufacture of light weight bricks/ low density bricks which can be used for multi-storeyed building with structural frame work for reducing the load on the load bearing members and also for thermal and acoustic application was experimented in the construction of more than 20 houses in Thiruvananthapuram. The process has been scaled up to 2 lakhs bricks made under factory conditions as a joint programme of R.R.L Thiruvananthapuram, N.B.O and Kerala Government\textsuperscript{183}. This points out another innovational activity in the field.

\textsuperscript{180} See chapter 3, Table No. 3.40
\textsuperscript{183} Coir Board and Directorate of Coir Development, 'Poly Coir Light Weight Bricks- Technologies for diversification of coir products and utilisation of coconut pith,' Damodaran A.D, Pavithran C and Warrier K.G.K, Regional Research Laboratory ( CSIR ), Thiruvananthapuram, (edited) Smaranika (Malayalam), Thiruvananthapuram, P.161.
6.4 Organisational Changes:-

Existence of suitable organisational (institutional) set up to encourage the process of technological change is an essential condition for technological progress. The changes that took place in organisational set up in the coir industry was as follows:-

Up to the second world war the growth of the industry was closely related to the activities of the European trading firms in the West Coast. Another important aspect of industrial organisation during this period was the existence of large scale coir manufactures. Since 1940's, we find the growth of smaller manufactories in the rural areas accompanied by a parallel reduction in the scale of large manufactories. Thus the coir goods came to be produced in small units where workers were relatively less organised and factory laws either did not apply or were difficult to enforce. The end of 1980's shows the decline of the medium and small manufacturers and the proliferation of domestic manufacturing units. Similar organisational changes were taking place in the coir yarn sector also. In the retting sector the retted husk market was controlled by a few large scale commercial retters.

The fragmented nature of production structure necessitated a large net work of middlemen in the raw material market of husks and the product market of yarn. This organisational set up was unconducive to technological improvement. The small and house hold (cottage) producers have no urge for development of new skill, enterprise or technology.

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The most efficient method of protecting the small producers from exploitation is by the state government sponsoring a scheme to organise the producers on a regional co-operative basis. Then these societies were provided with adequate facilities for marketing and warehousing, so that producers may get a fair and reasonable value for the goods supplied. In other words, the co-operative reorganisation of industry has been promoted as solution to the fragmentation of the production structure and the exploitation of the middlemen and to ensure the decent level of living for the producers and workers in the industry. Moreover, the introduction of new technology demand new organisations and institutions.

As per the recommendations of the Special Task Force (headed by T.M. Thomas Isaac) and High Power Committee (headed by Ashim Chatterji) Reports, the modernisation (through Integrated Coir Development Project) of the coir industry is being implemented through the A grade coir co-operatives. The co-operative industrial structure is an institution that could facilitate a careful regulation and monitoring of the social consequences of technological change, and thus ensure their social acceptability. A brief analysis of coir co-operatives will be given below.

6.4.1. Development and Performance of Coir Co-operatives:-

The origin of Coir Co-operatives date back as early as 1935 when the first society registered as an Industrial Labour Co-operative Society at Eriyad in Trichur District. It was later on changed into Primary Coir Vyavasaya Co-operative Society, under the Coir Development Scheme. There was no widespread and organised effort to stabilise and strengthen the coir industry on co-operative basis till the coir development scheme was initiated by the

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166 Bureau of Economic and Studies (1961): Survey of Primary Coir Co-operatives in Kerala, Government of Kerala, Thiruvananthapuram, P.2
Government of Travancore – Cochin in 1950-51.\(^\text{187}\) The then government was particularly moved by the disorganised state of affairs that existed in the Coir Industry and the state in general and resultant disasters on the labour class in particular. The ‘Panel of Coir, Rope, Cordage, and Other Fibre Industrials’ constituted by the Government of India in 1945 with Shri. K.C. Karunakaran as the chairman, had in their report stressed the necessity of organising the coir industry on a co-operative basis. The ‘Unemployment Enquiry Committee’ constituted by the Government of Travancore in 1949 with Mr. Smith as chairman had also recommended the reorganisation of the Coir Industry on a co-operative basis. The erstwhile Government of Cochin also recognised the feasibility of organising the Coir Industry on a co-operative basis by organising a few societies on live. With a view to organise the industry on a sound basis and to eliminate the middlemen and capitalists who knock off all profits out of the industry, and after a very careful consideration of the various recommendations of the above mentioned committees the present schemes for the development of the Coir Industry on a co-operative basis was launched by Government \(^\text{188}\) The scheme is mainly intended to standardise the quality of the coir produced, to discourage the adulteration prevalent, to attract foreign markets for the coir produces, to eliminate the middlemen engaged in the various stages of the industry to swallow up the profits and to ensure reasonable wages and regular work to the labour class. \(^\text{189}\) Accordingly three types of co-operatives emerged, viz.

6.4.1.1 The Thondu Vyavasaya Co-operative Societies for the collection and supply of green husk to the primary producer societies.

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\(^{187}\) Planning commission (1970): Report of the study group on Coir Industry, Government of India, New Delhi, P.1

\(^{188}\) Menon, Theyunni, C.A(1959): “Report of the Special officer for Enquiries on the working of the coir co-operatives in Kerala state under the Coir Development Scheme,” Thiruvananthapuram, PP. 4,5

\(^{189}\) Ibid, P.5.
6.4.1.2. The Coir Vyavasaya co-operative societies to ret the husk purchased, to

distribute the retted husk among members for the production of coir yarn

produced by the member and arrange for its marketing and

6.4.1.3. The Coir Marketing Societies to market the yarn produced by the members of

the primary societies were organised.

A provision of Rs. 64 lakhs was made in the First Five Year Plan in the

allocation for the state of Travancore – Cochin. The scheme was intended to

organise 120 coir vyavasaya co-operatives societies, 25 Thondu Vyavasaya

co-operative societies, 2 Central Marketing Societies- one at Cochin and the

other at Alleppey, during the plan period. Thanks to the enthusiasm created

by the scheme, 40 more coir co-operatives were also set up in excess of the

target of 120 during the First Five Year Plan. 190

During the second plan Rs.150 lakhs was earmarked for the entire Coir

Development Scheme. The total number of societies under the scheme at the end

of the year 1957-58 was 320.

Table 6.8

Various Types and Number of Coir Co-operatives at the end of 1957-58.

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Type of Societies</th>
<th>In Travancore Cochin Area</th>
<th>In Malabar–Kasargod area</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Thondu Vyavasaya Co-operative Societies</td>
<td>32</td>
<td>--</td>
<td>32</td>
</tr>
<tr>
<td>2</td>
<td>Primary Coir Co-operative Societies</td>
<td>207</td>
<td>61</td>
<td>268</td>
</tr>
<tr>
<td>3</td>
<td>Central Marketing Societies</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Co-operative Coir Union</td>
<td>15</td>
<td>--</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>Mats and Matting Manufacturing Societies</td>
<td>2</td>
<td>--</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>258</td>
<td>62</td>
<td>320</td>
</tr>
</tbody>
</table>

Source: Menon.C.A.Theyunni (1959): “Report of the Special Officer for Enquiries on the working of
the coir co-operatives in Kerala state under the coir development scheme”, Thiruvananthapuram,
P.9.

190 Ibid, P.7.
At the end of the Second Five Year Plan the physical achievements were the formation of 360 Primary Coir Vyavasaya Co-Operatives, 31 Husks Societies, 3 Marketing Societies, 2 Mats and Matting Manufacturing Societies and 15 Coir Co-operative Unions in Kerala. The Third Five Year Plan saw further expansion in the scope and comprehension of the co-operative movement. The allocation in the Third Plan was Rs.195 lakhs. During the 4th Plan period, an amount of Rs.300 lakhs was allocated to the coir co-operatives. At the end of the 4th Five Year Plan there were 457 Coir Yarn Societies, 30 Husks Societies, 15 Coir Co-operative Unions, 13 Mats And Matting Co-operative Societies, 4 Marketing societies, 3 Rope marketing societies, 19 Husk retting unions and 2 Bristle and Mattress Fibre societies in Kerala. Up to the end of the 4th Five Year Plan period, it was estimated that about 1125 lakhs of coir workers have been brought under the co-operative fold as a result of these measures. The progress of the coir co-operatives during 1964-65 to 1973-74 is shown in the Table 6.9.

Table- 6.9

Progress of Coir Co-operatives, 1964-74

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No. of Societies</td>
<td>542</td>
<td>543</td>
<td>333</td>
</tr>
<tr>
<td>2</td>
<td>Percentage of Dormant Societies</td>
<td>25 %</td>
<td>32 %</td>
<td>29 %</td>
</tr>
<tr>
<td>3</td>
<td>Members of Active Societies</td>
<td>88786</td>
<td>93258</td>
<td>80082</td>
</tr>
<tr>
<td>4</td>
<td>Percentage increase /decrease over the previous period (+increase,-decrease)</td>
<td>+3.6 %</td>
<td>+5 %</td>
<td>-14 %</td>
</tr>
<tr>
<td>5</td>
<td>Average membership per society</td>
<td>218</td>
<td>253</td>
<td>341</td>
</tr>
<tr>
<td>6</td>
<td>Total working capital(Rs in lakhs)</td>
<td>113.42</td>
<td>220.97</td>
<td>420.51</td>
</tr>
<tr>
<td>7</td>
<td>Total Sales (Rs in lakhs)</td>
<td>169.32</td>
<td>231.18</td>
<td>346.40</td>
</tr>
<tr>
<td>8</td>
<td>Average per active society</td>
<td>0.42</td>
<td>0.63</td>
<td>1.47</td>
</tr>
<tr>
<td>9</td>
<td>Percentage of Societies in Profit to total Active Societies</td>
<td>19 %</td>
<td>27 %</td>
<td>15 %</td>
</tr>
</tbody>
</table>

Source: Varkey V.O. (1989), Development and Working of Coir Co-operatives in Kerala, Poona, P.69

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Inspite of the massive financial assistance and other support, the coir co-operatives could not make much headway and their progress was very tardy. They failed to achieve the objectives of the coir co-operatives. The report of the special officer on coir co-operatives and the report on the Coir Enquiry Committee throw light on this. Such a situation became increasingly untenable as the trade union movement gained momentum from mid sixties. The reorganisation of the industry under a comprehensive scheme covering all sectors became the main slogan of worker’s movement. So, under severe pressure from the trade union and indictment from enquiry commission a new scheme for the reorganisation of the industry was formulated. The new scheme was started in 1972. After a prolonged discussion with central planning authorities, the scheme was partially approved with respect to a programme for revitalising the existing coir co-operatives as a part of the Fifth Five Year Plan Programme. It envisaged the complete co-operativisation of the spinning sector in a phased manner. The basic aim of the scheme was that the new co-operatives were, to be worker’s co-operatives rather than producer’s co-operatives. In the manufacturing sector also, co-operativisation was to be encouraged. Under this scheme, the societies were classified on the basis of their past performance in to 3 categories, viz viable, potentially viable, and others. The scheme included financing of non-viable societies by the government to become viable, so that they could draw working capital requirements from financial institutions. The Directorate of Coir Development had drawn up a plan to finance coir co-operatives in a phased manner to make all the co-operatives viable. However the progress was very slow and a large number of societies still require financial assistance.

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Even after the implementation of the reorganisation scheme, the performance of coir co-operatives become dismal. The following table 6. 10 shows the growth of spinning co-operatives since the reorganisation. The number of co-operatives increased from 196 in 1974-75 to 577 in 1987-88 and the number of members from 81000 to 222000. But the co-operative have been able to give employment only to 30-40% of this members. The average days of employment of their workers are declining. The yarn output per worker has also declined during these periods.
**Table- 6.10**

**Performance of Coir Co-operatives from 1974-75 to 1987-88**

<table>
<thead>
<tr>
<th>Year</th>
<th>No of Societies</th>
<th>No of members (1000)</th>
<th>No of workers (1000)</th>
<th>Husks Procured (lakhs)</th>
<th>Yarn produced (tonnes)</th>
<th>Wages distributed (lakhs)</th>
<th>Yarn output per worker (Qty.)</th>
<th>% of workers in membership</th>
<th>Husk procured/ workers</th>
<th>Wage/ worker</th>
</tr>
</thead>
<tbody>
<tr>
<td>74-75</td>
<td>196</td>
<td>81</td>
<td>23</td>
<td>1123</td>
<td>5516</td>
<td>66</td>
<td>0.5</td>
<td>28.13</td>
<td>4883</td>
<td>23.91</td>
</tr>
<tr>
<td>75-76</td>
<td>211</td>
<td>106</td>
<td>33</td>
<td>1879</td>
<td>12729</td>
<td>222</td>
<td>3.91</td>
<td>30.71</td>
<td>5706</td>
<td>56.06</td>
</tr>
<tr>
<td>76-77</td>
<td>243</td>
<td>125</td>
<td>59</td>
<td>1542</td>
<td>14743</td>
<td>237</td>
<td>2.52</td>
<td>46.93</td>
<td>2631</td>
<td>33.47</td>
</tr>
<tr>
<td>77-78</td>
<td>354</td>
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The details of Coir Co-operatives in Kerala from 1980-81 to 1999-2000 is indicated in the table 6.11.
Table 6.11
Coir Co-operative Societies in Kerala, 1980-81 to 1999-2000

<table>
<thead>
<tr>
<th>Year</th>
<th>Primary Co-Operative Societies</th>
<th>Manufacturing Societies</th>
<th>Marketing Federation</th>
<th>Small Scale Society</th>
<th>Husk Procurement and distribution Societies</th>
<th>Fibre Society/Defibering mill Co-operative society</th>
<th>Dormant Society</th>
<th>Society under liquidation</th>
<th>Total</th>
<th>Quantity Of Output (Rs. in lakhs)</th>
<th>Value of output (Rs. in lakhs)</th>
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From the table 6.11, it is clear that the total number of Coir Co-operative Societies increases from 653 in 1980-81 to 949 in 1998-99. Along with increases in the number of societies, the number of dormant societies and societies under liquidation also increases. Another notable thing is that the number of defibering mill societies increases from 55 to 73 in 1994-95 to 98-99.

Activities of the Coir Co-operative Societies in the last nine years (1990-91 to 98-99) will be given in the table 6.12 and 6.13.
### Table 6.12

**Activities of Coir Co-operative Societies**

**A. Primary Coir Co-operative Societies:**

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of working societies</th>
<th>No. of members (1000)</th>
<th>Husk purchased</th>
<th>Fibre purchased</th>
<th>*Yarn produced</th>
<th>Fibre produced</th>
<th>No. of workers (1000)</th>
<th>Wages paid (Rs. in lakhs)</th>
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<td>4635.70</td>
<td>590.10</td>
<td>9361.70</td>
<td>1978.40</td>
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* Yarn Produced from 1990-91 to 1997-98 include both Yarn and Fibre Produced.


### Table 6.13

**Activities of the Coir Co-operative Societies**

**B. Manufacturing Societies**

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Working Societies</th>
<th>No. of Members (1000)</th>
<th>Value of Production (Rs lakhs)</th>
<th>No. of Workers (1000)</th>
<th>Wages Paid (Rs. Lakhs)</th>
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<td>1555.30</td>
<td>2.35</td>
<td>198.41</td>
</tr>
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<td>5.23</td>
<td>1652.00</td>
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<td>193.00</td>
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<td>34</td>
<td>7.07</td>
<td>2388.83</td>
<td>4.90</td>
<td>255.33</td>
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</table>

Another organisational set up which leads the modernisation of Coir Industry in Kerala is ‘Coir-fed.’ The coir-fed was formed in 1979 by amalgamating the four Central Marketing Societies at Kollam, Alleppey, Kochi and Kozhikkode, as the single apex body for coir yarn primaries. The Coir-fed is an apex co-operative society of more than 600 primary coir co-operatives. From the affiliated societies they procure their products and market them through their regional depot, show rooms and agencies. The federation has network of 99 sales outlets throughout the country including 44 agency showrooms.

For promoting modernisation and rapid technological change in Coir Industry the coir-fed introduces various schemes and measures. The coir-fed has started its own rubberised coir product units, rubber backing units, rubber backed coir car mats/ Tile unit etc. The only Rubberised coir products units under co-operative sector in Kerala is in Coir-fed.

Coir-fed has set up Coir Geo-textile Division and implement Coir Geo-textile project for research and development in the field.

Government selected Coir-fed as the Nodal agency in implementing the ‘Integrated Coir Development Project’. The machinery required for

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194 The Kerala co-operative societies Act 1969, PP 8,9,10- vide section 3 to 8 of the Co-operative Societies Act, 1969.
implementing the ICDP for Defibring and spinning unit were purchased and supplied by Coir-fed. Moreover, Coir-fed started five numbers of defibering units of their own.

From the analysis of the process of technological change in the Coir Industry of Kerala, it is clear that there is a spectacular progress taken place in Research and Development, training, innovation and diffusion of modern technology. Similarly, the organisational change viz. co-operativisation is also now conducive to initiate the process of the Technological change in the industry.

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