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Technological Modernization and its Challenges in Coir Industry in Alappuzha

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Abstract: On the international market, India is the biggest producer and exporter of coir and coir-related items. Kerala holds a significant portion of the nation's production and exports. Despite having great potential and high ambitions, the coir business in the state is not progressing as much as other industries. Reluctance to implement automation on time was the main cause of the industry's backwardness. Towards the end of the 20th century, Kerala's coir sector began to modernize with the introduction of innovative technologies. However, there are still numerous reasons why the procedure is ongoing and not finished. The implementation of technological modernization has ramifications for disempowered workers in the industry. In addition, the prosperity or downfall of technical advancements holds great importance when considering the expansion of both the sector and the economy. This study examines the many plans and strategies for the development of coir and evaluates the overall application of the technical modernization scenario. It also highlights the automation issues with contemporary coir units. Additionally, the federal and state governments offer a variety of programs to advance the coir business, but the manufacturers were unaware of these initiatives. This report discusses Kerala's coir industry's opportunities and problems.
Keywords: Coir, Technological Up-gradation, Modernization, Coir Board, Geotextiles, Coir Pith

1. Introduction:

Kerala covers 39,000 square kilometers (Heller, 1996), of which 7,704.73 square kilometers are used for coconut cultivation (Kerala Planning Board, 2013). About 375,000 people in Kerala, mostly women, depend on the coir business, one of the state's most important rural industries, for their livelihood (Kerala Planning Board, 2013). The coir industry has historically expanded in areas with a large number of coconut crops and easily available coconut husks. Therefore, it should come as no surprise that Kerala's old city of Alappuzha is the birthplace of the nation's coir industry. When Alappuzha is portrayed in literature or Malayalam films, the coir and coir workers are frequently seen in rural settings. The picturesque sights of peasants working to make coir would not have been missed by anybody who has taken a trip along Alappuzha's backwaters. In 1859, Mr. James Darragh, an American of Irish descent, and Henry Smail established the first coir factory in India, known as "The Darragh Smail & Co." Nearly 25 significant coir manufacturers, including William Goodacre & Sons (1862), Aspinwall & Co (1867), Volkart Brothers Company (1869), Bombay & Co, and Madura & Co., were subsequently established in the town of Alappuzha. Fundamentally labor-intensive and conventional, the sector had a long time to adapt to modernization, which hurt its expansion and advancement. The structural changes that have taken place in the coir business over the final ten years of the 20th century are attempted to be described and explained in this article.

By 1990, Alappuzha district had 29 significant coir factories, each operating over 200 looms. Additionally, 450 registered coir units and 690 unregistered ones were active, primarily following small-scale or household-based production models. When compared to other industries in the state, the coir industry fails to achieve progress even though its potential and hopes are very high. The prime factor behind the backwardness of the industry was the reluctance to adopt mechanization. Technological change is not merely a matter of finding new machines for old; but it involves several other important social questions also (K. T. Rammohan, 1999). Though

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the trade union movement was successful in defending mechanization till 1991, the total consciousness of the industry was gradually changed due to the liberalization policies adopted by the central government. The coir industry was chosen for study because of its socio-cultural and politico-economic importance. The industry employs the majority from the disempowered social sections, mostly of 'lower' and 'out' castes, and an overwhelming majority is women. The ongoing technological change has thus important implications for the marginalized sections of society.

2. Literature Review

The study on 'the problems and prospects of the Coir Industry in Kerala' conducted by Dr. M.V. Pylee in 1976 gives a clear picture of the problems faced by the industry at that time. The basic facts regarding the production of coconut, the process of fiber extraction, the production of coir, internal consumption of coir, and the world trade in coir were examined. Shortage of coir fire was the basic cause of the crisis that developed in the Coir Industry in India during 1974. The reduced operation in the spinning and manufacturing sectors left a large number of workers unemployed, especially in the spinning sector many exporters were unable to execute not only export orders but were also finding it risky to accept foreign orders.

The true nature of Kerala's historic coir business is revealed by T. M. Thomas Isaac (1991) in his paper "Evolution of Organization of Production in Coir Yarn Spinning Industry." He noted that the conventional coir business had a very different organization and a much longer production process. He promoted the quick industrialization of the coir sector as a strategy of survival to cope with the shifting global landscape. In 1992, another article 'Class Struggle and Structural Changes: Coir Mat and Matting Industry in Kerala, 1950-80' analyzed the need and pattern of modernization in the industry in detail.

K. T. Rammohan (1999) in his paper 'Technological Change in Kerala Industry: Lessons from Coir Yarn Spinning' points out that technological backwardness is a crucial fact of Kerala's industrial life. The major industries in the State, coir processing, handloom weaving, and beedi-making are marked by the use of low-productive technologies. Technological change is not merely a matter of finding new machines for old, but it involves several other important social questions also. The new techniques could be ideal from the efficiency point of view but could be inappropriate for the social economy where these are applied. The article concludes that the new technology might increase the workers' income but jeopardize the employment. In another work (2008) 'Coir in India: History of Technology', he explains the history of coir production and its technology in detail.

Kumarasamy Pillai (2005) in his article 'Towards Self-Reliance in Coir Fiber Production, stated that it might not be possible e to utilize the entire coconut husks produced in the country for coir production due to a variety of reasons such as lack of a well-defined mechanism for collection of husks, increased cost of transportation, lack of awareness among the coconut producers, dealers, and domestic households about the economic value of husk. Another article by Soundariya Preetha (2017) about coir pith export "Coir Board Focuses on Value Added Products", analyzes that the future performance of the coir products chain especially in coir pith, will be dominant in the future.

Sudarshana Brodoloi (2020) in 'Productive Forces in the Coir Industry' examines the constraints and contradictions faced in the development of productive forces in the Coir industry. The study describes the simple labor process in the coir industry, including the nature of the means of production and the types of labor used. It also speaks about the spatial organization of productive forces across Kerala and the coir belt; and the production and export trends of coir in/from India and Kerala. It also looks at the levels of productivity, the state-initiated technological changes promoting productivity, and the contradictions surrounding the technological changes in the coir industry.

3. Methodology

In this conceptual study, both primary and secondary sources are used for data collection and analysis. The sources consist of articles, published press reports of the coir board, coir news, and reviews from the research journals, data collected from the web sources of the coir industry, ministry of MSME reports, and daily newspapers and magazines. The primary objective of the study is to analyze the present status of technological modernization and its challenges in the coir industry.

4. Kerala and its Coir Industry

Keram, which means coconut palm, is said to be the source of Kerala's name (Jeffry, 1984). Products like carpets and mats are manufactured using coir, a fiber derived from coconut husk (Dictionary.com, 2014). According to

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KITCO (2009), the coir sector is Kerala's second-largest employment and a substantial source of income, particularly for those with lower incomes. It is unclear when exactly coir was first produced, although evidence suggests that it increased dramatically in the 16th and 19th centuries (Rammohan, 1999). The present coir industry began operations in 1859 and underwent significant changes in structure and character throughout time. The coir industry's workforce and employment have shifted from traditional to mechanized periods, and it is now lucrative in terms of both labor and time. Machines are taking over tasks like extracting coir fiber and creating mats, which reduces the need for human labor and interventions. The traditional coir workers and industry have left behind the memories of a bygone period since the next generation of workers with technological abilities may fit into this sector presently.

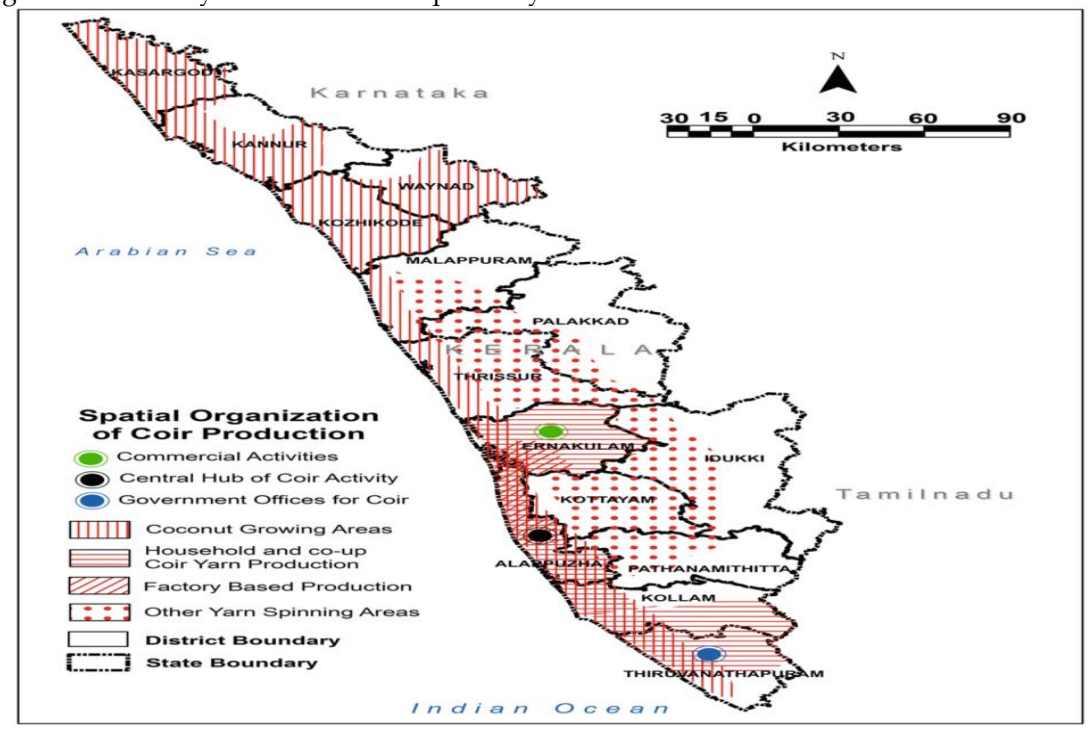

Figure 1: Coir Production Centers in Kerala

The coir industry in the country has registered a steep growth in exports in the last three years before COVID-19 spread. In 2019 the country achieved Rs. 2,282 crores, a record of export growth whereas, in 2018, it was 2,090 crores by value and 5, 37, 050 metric tons in terms of quantity. In this phenomenal growth, Kerala accounts for 74% of exports and 85% of production. Subsequently, measures have been taken by the government for the Export Market Development Assistance to assist the coir exporters in the marketing and sale of their products. According to the Coir Board's report, 76.6% of coir production units operate on a small scale, while 18.1% function as medium-scale and 5.3% as large-scale industries. In terms of ownership, 57.3% of these units belong to the private organized sector, followed by 15.8% in the private unorganized sector, 3.5% under cooperatives, and 1.8% operated by self-help groups (SHGs). Household industries connected to cooperatives make up 1.2%, and those not linked with cooperatives account for 6.4% of the total units.

Regarding production activities, 33.3% of the units focus on fiber extraction or defibering, 23.4% engage in traditional coir yarn production, and 35.1% have adopted modern or automatic methods for yarn production. Additionally, 13.5% of the industries produce frame-type coir mats, 6.4% handle coir pith processing, 1.8% manufacture coir geo-textiles, 1.2% use semi-automatic power looms, and 0.6% utilize automatic power looms. In terms of technological adoption, 33.3% of coir industries are fully mechanized, 36.8% are partially mechanized, and 29.8% continue to rely on traditional, non-mechanized methods. Technological Modernization. Innovative technological development as part of modernization in the coir industry in Kerala started in the last quarter of the 20th century. The oldest industry in Kerala steadily embracing modern machinery, and the men presiding over the future of coir-making say there is no other way out. It is mechanization the way to rectify a situation where a new generation is not taking to the industry precisely because of the traditional methods used

in the industry. De-husking and de-fibering are the two sections mechanized first as part of modernization. For decades, producing fiber from coconut husks was a tedious process. The husks would be kept in water for six months, and they would emit a foul smell resulting in environmental pollution also. For all this back-breaking work, the wages they got was a pittance - as little as 70 paise a day. Slowly, the fiber extraction process shifted to nearby states as the workers left the job as it was not productive. Thus, the industry faced a shortage of coir fiber and mechanization became inevitable.

Similarly, gradual mechanization appears in each section of the coir industry. The coir yarn production was first changed from hand twist to 'Ratt' and then to electronic 'Ratt' later. The loom work was also mechanized and power looms were introduced in big factories at first. Due to huge capital investments, small-scale and household units were not mechanized consequently. But medium and small power looms were introduced soon and household units were mechanized gradually, especially women-driven loom units. To produce machines within the country for the industry, the Kerala State Coir Machine Manufacturing Co. was started at Adoor. The technological modernization improved the production speed and quality; and improved the financial return from the industry also. But it badly affected the human workforce in the industry.

5. Results: Techno-Modernization; Is Desirable or Inevitable?

The question of technological modernization was a heated debate during the last decades of the 20th century. The traditional coir workers looked at it as a dare evil' while the pro-industrialists welcomed it as a 'gift and hope'. If it waits for the consent of the last coir workers in the handloom sector, there will be no coir industry left in Kerala. An industry that was once Kerala's pride is in big trouble over the issue of modernization. Exports have tumbled by roughly 45 percent during the 1990s. For instance, Coir is made from coconut husk and Kerala still produces roughly 55 percent of the country's coir husk, but it has been steadily losing out to other states. Kerala produced 1.25 lakh tones of husk in 1977, at the same time, the rest of the country (principally the three southern states) then turned out 10,000 tones. By the year 2000, the share of the other states had risen to nearly 70,000 tones while that of Kerala had dropped to 75,000 tones. The state's share of coir fiber production too has dropped. The prime reason is that mechanized units in neighboring states have undercut Kerala's handmade fiber. In Kerala, coir is made by a month-long, labor-intensive process. On the contrary, this job is done in hours using machines in the neighboring states and Sri Lanka. Consequently, the pro-industrialists have realized the fact that unless modernize, the industry is likely to shift to neighboring states.

Despite mounting opposition to the coir industry's automation, the industry's shifting environment and diminishing output forced mechanization to satisfy the expanding demand from across the world. To save costs, the 1991 liberalization program dismantled the State monopoly businesses and decreased bureaucratic control over financial markets; as a result, these businesses had to see earnings and market values as crucial performance indicators (Mayer, 2000).

To satisfy the growing global demand, automation was introduced in the 1990s, which raised output and value (Sabarinath, 2010). The industry's disempowered workers are affected by the technological modernization that has been undertaken. Furthermore, from the standpoint of industry and economic growth, the success or failure of technical advancements is highly significant.

Data on Kerala SDP (2005), national GDP, coir exports, and primary and secondary sector income in Kerala and India (2005) all showed the shift. The years 2003–2004 saw a notable expansion of the country. Therefore, it may be concluded that technical upgrading is both desirable and necessary for the sector.

6. Political Interventions

Talking about the modernization of the coir sector without mentioning the involvement of political parties is pointless. Due to protests over automation and militant trade unionism in the 1990s, Kerala's golden fiber—which employed around five lakh people in the state and played a crucial part in the development of its economy—lost its luster. Politics and trade unions have grown inextricably linked throughout time. Political parties use labor unions as money and vote banks.

Kerala has been ruled mostly by the right-wing United Democratic Front (UDF), which is led by the Indian National Congress (INC), and the Left Democratic Front (LDF), which is made up of Communist parties. Ramachandran (1997) noted that political parties play a critical role in bringing about changes in the state, including improved healthcare facilities, agrarian relations, mass literacy, the plight of the oppressed castes, and enlightened societal attitudes about females. But because they were afraid of losing the political backing of coir workers, these progressive political forces resisted modernization in the coir sector for decades. Kerala businesses have also seen lockouts and strikes as a result of the emergence of militant labor unions. According

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to Thomas (2003) and Jeromi (2005), industrial development has slowed as a result of labor disputes. A "bandh" can be declared by political parties for the entire state, a district, a town, or even a particular market area (Prakash, 1994; Jeromi, 2005). As a result, the political climate is not conducive to investment for new companies. Economic development was not a result of the government's initiatives (Ahluwalia, 2000). The economic circumstances in Kerala provide a chance to assess how well the coir sector is performing under the leadership of various political parties.

The Center's Coir Board disapproves of the state's political strategy. "Quality control, mechanization, and modernization are urgently needed. A spokesperson of the Coir board stated that the state government and left-leaning unions are against this. Political authorities and trade unions were ultimately compelled to permit mechanization to maintain the competitiveness of Kerala's coir sector due to the industry's steady transfer to neighboring states that supported mechanization.

6.1 Up-Gradation in Existing Technology

The main challenge in technological modernization within the coir industry stems from an overemphasis on preserving traditional practices, including outdated equipment and methods that have been used for generations. Additionally, many workers have not received training in modern technology and lack practical skills in its application. Veteran workers often view modern, automated equipment and technology as unfamiliar and are concerned about job security, leading to resistance toward technological advancements.

Concerns also arise regarding the maintenance and repair of modern machinery, as well as the proper use of electricity, which further contributes to distrust in technological upgrades. Currently, coir production and coir yarn manufacturing remain only partially mechanized, with a significant reliance on skilled labor. Therefore, the government needs to prioritize modernizing equipment in these factories to boost production efficiency and reduce the dependence on skilled manpower.

There are plenty of minis, semis, multi-stage high-power looms, and other equipment invented by the research division of the coir board. The production of this machinery on an industrial base and the proliferation of mechanization through acquiring workers' faith should be the prime concerns for authorities and apex institutions in this field.

The pith produced during the de-husking and de-fibering process remains underutilized. To address this, coir pith composting technology could be implemented, allowing the composted material to be used locally in greenhouses for vegetable cultivation. With the support of the agricultural department, this technology could be introduced, and greenhouse cultivation could become a viable activity using composted coir pith. In addition, other contemporary technologies that should be taken into consideration for increasing efficiency and modernizing the technologies in husk collection, coir fiber & coir yarn production, and creating value-added coir products in the nation include the automatic coconut dehusking machine, conveyor system, mobile fiber extraction machine, "Anuradha" loom for weaving geo-textiles, "Anupam" loom, frame mats, coir jewelry unit, coir composite gift article-making machine, automatic coir spinning machine, and dyeing unit. There are many uses for coir, and the newly created goods ought to be well accepted both domestically and internationally. To create new and improved coir goods, it is also advised that design colleges like NID and NIFT be consulted.

6.2 Technology Up-Gradation Initiatives

The Coir Board launched the "Coir Industry Technology Up-gradation Scheme (CITUS)," which aims to give business owners financial assistance for updating and modernizing qualified equipment and plants so they can start a new company that can apply for bigger investments in the Coir sector. The financial help provided under this program will cover a quarter of the total cost of the qualified "Plant and Machinery" items that the Coir units acquire. For each coir project or unit, the maximum financing available under this initiative will be Rs. 2.50 crores. Applications for the financial aid available under this scheme for modernization are open to all newly established coir production or processing facilities as well as those registered with the "Coir Board" under the "Coir Industry" (Registration) Rules 2008 and possessing "Udyog Aadhar." The Nodal Agency is the Coir Board in Kochi. The applicant or beneficiary unit requesting aid under this program must submit an online application together with the necessary supporting documentation shown on the website.

These are the project's main goals:

1. The next generation of entrepreneurs will benefit from the provision of modern infrastructural facilities to the manufacturing units, which will increase quality and productivity.

2. Enhancing and modernizing the current coir units.
3. The establishment and support of new "state-of-the-art" coir processing units.
4. Advancing the creation and implementation of enterprise resource planning (ERP) and other IT technologies.
5. Introducing the sector to fresh, promising development areas.
6. Encouraging the improvement and use of the raw materials that are accessible.
7. Increasing job options, particularly for rural women.
8. By supplying contemporary technology, the coir industry will become more integrated and competitive.
9. Using technical developments to reach the goal of a coir industry free of pollution.
10. Assisting in the creation of valuable, customer-focused goods and services.
11. Promoting the use of environmentally friendly industrial methods.

Table 1: Technological Modernization fund- Released and actual expenditure

Scheme/ Programmes	**12th Plan Period** (In Lakhs)	
	Fund Released	**Actual Expenditure**
Modernization of Production Process	2404.37	353.35
Development of Coir Machinery and Equipment		397.59
Product Development and Diversification		553.44
Development of Environment-Friendly Technologies		400.51
Technology Transfer, Incubation, Testing, and Service Facilities		746.32
Incentives for Using Natural Dyes and Incentives for IPR in Coir Sector		00
Total	**2404.37**	**2451.21**

Source: Coir Board & CCRI

During the 12th plan period, a total of Rs 2404.37 lacs was released under the plan program. 31.04 percent of the funds distributed throughout the plan period were utilized for technology transfer, incubation, testing, and service facilities, with the product development and diversification program accounting for 23.02 percent of the total. Modernizing the manufacturing process (14.70%) was the second-largest use of funds granted during the plan period, followed by the development of coir machinery and equipment (16.54%) and environmentally friendly technologies (16.66%). During the plan period, no funding may be allocated for programs that offer incentives for the use of natural dyes and intellectual property rights in the coir industry.

7. Discussion: Modernization of Production Processes: Major Achievements

Development of Bio-Chem Treated Fiber:

A revolutionary technology known as "Biochem" has been developed to improve the quality of machine-extracted coir fiber, producing retted-grade fiber. Janata mattresses and pillows, which are less expensive than rubberized coir foam mattresses, are made from bio-chem-treated fiber. For finishing purposes, the bio-chem can also be used on coir mats.

Effluent Treatment Technology:

For the extraction and processing of coir fiber, an economical effluent treatment technique has been created to reduce pollution. In coir fiber extraction facilities, the technique aids in the decrease of pollutants.

Development of Machinery and Equipment:

The creation of a modified mobile fiber extraction machine is one of the key accomplishments in the field of creating new technology and equipment to increase productivity and decrease operational drudgery: The invention of a coreless coir yarn spinning machine called "Krishna," a preprocessing unit attachment for

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producing high-quality coir yarn, and a completely automatic coir geotextiles weaving loom prototype called Anugraha "Tejas" that can weave 400 square meters of coir textiles in eight hours (800 square meters per day) are all examples of Swarna-Nano.

The 'Anugraha' is a mild steel handloom that has been tested and designed for weaving coir geotextiles. A small, portable device that can separate coir fiber from dry or green husks at a pace of 5,000 husks every eight hours was also introduced. 'Vajra,' a coreless single-head single-ply spinning machine prototype, and 'Krishna,' a coreless double-head single-ply spinning machine that debuted in 2016, were both part of the development.

In terms of product development and diversification, significant innovation was achieved in coir geotextiles with the creation of pockets woven into the fabric. These pockets hold packing material, seeds, and manure, which can be placed inside before laying the geotextile, eliminating the need for spreading fertile soil over mine dumping areas. Another notable innovation is the circular woven coir geo-bag. Additionally, coir-polypropylene pots were developed as part of a collaborative project with CIPET, Cochin.

8. Challenges for Technological Modernization

Technological Modernization of the traditional industry is the most important and, in fact, a challenging prospect for the coir industry today. Without this powerful tool, that is, technological modernization, the promotion and placement of the coir industry into the global village concept couldn't be achieved. Modernization creates the problem of a lack of proper machinery to increase production units, so the nonavailability of modern tools affects the development of mass coir production (Praveenkumar & Vinayagamoorthi, 2017). The major challenges regarding faster technological modernization are as follows.

Non-availability of Skilled Labor:

Techno-skilled laborers are the essential prerequisite for technological up-gradation. However, the workforce in the industry mainly belongs to traditional workers who are age-old and far behind the process. They have to be equipped with techno-skills immediately or recruit fresh skilled labor is quite essential for the sake of modernization.

Limited access to Training:

There is only one training center across Kerala that offers short-term training courses (10 Days) for coir workers in modern machinery. In the Coir Research & Development wing of the Coir Board, Kalavoor has limited capacity; hence faster training drive is not possible at the present situation.

Production and Manufacturing of Machinery:

The Coir Research & Development wing of the Coir Board has successfully invented many machines and tools for the modern coir industry. However, the production of these items on an industrial scale has yet to start. The private manufacturers who get consent for production are charging high rates for these items.

Capital Investment Problems among Small-Scale Units:

Even though technological modernization is a reality, the coir units, especially in small-scale and household units are facing serious capital investment problems because of the huge amount to be spent for mechanization within a short period.

The problem of availability of uninterrupted Power Supply:

It is a hydroelectricity-dependent state, Kerala was not an electricity-surplus state. Consequently, the tariff for industrial use of electricity has been rather high in the state. During monsoon, due to heavy rain, and during summer, water deficit in Dams creates uncertainty in uninterrupted power supply in the state.

The problem of Political Will:

Kerala has alternately been controlled by the right-leaning United Democratic Front (UDF), led by the Indian National Congress (INC), and the Left Democratic Front (LDF), which is composed of Communist parties. As a result, the state's industrial department lacks a consistent policy on the upgrading of the coir industry's technology.

9. Conclusion

This study aims to highlight the opportunities and challenges currently facing the coir industry. Technological modernization is crucial for enhancing efficiency, reducing costs, and improving the quality of coir extraction on an industrial scale, ensuring a consistent supply of raw materials for coir-based industries and maintaining the industry's global reputation. Currently, the process of extracting coir and manufacturing coir products is labor-intensive, time-consuming, and largely manual, limiting the industry's capacity for growth and modernization. To address these challenges, research, and technological upgrades should be prioritized. The Coir Board plays a key role in offering solutions to end-users by disseminating new technologies and helping workers develop the necessary skills. Coir has diverse applications, and new products should be extensively promoted both domestically and internationally. Awareness campaigns can help increase public knowledge of coir's multiple uses, while competitiveness can be boosted through improvements in design, quality, and technology.

Author Contributions:

The first author, Dr. Pratheesh. P contributed to Conceptualization, methodology, validation, formal analysis, and investigation. Dr. Pratheesh. P and Dr. M. A. Florence together contributed to the writing of the original draft preparation, review, and editing.

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Data Availability Statement:

We agree to share the research data.

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