



Technological Modernization and its Challenges in Coir Industry in Alappuzha

Pratheesh P^{*a}, M. A. Florence^b

- a. Department of History, St. Michael's College, Cherthala, Alappuzha, Kerala, India
b. Department of Economics, St. Michael's College, Cherthala, Alappuzha, Kerala, India

Abstract: India is the largest producer and exporter of coir and coir-related products on the international market, with Kerala accounting for a significant portion of the nation's production and exports. Despite its potential and high ambitions, the coir industry in Kerala has not progressed as rapidly as other industries. A primary reason for this lag is the industry's reluctance to adopt automation in a timely manner. Toward the end of the 20th century, Kerala's coir sector began to modernize with the introduction of innovative technologies. However, several factors continue to impede the full completion of this modernization process. The implementation of technological advancements has implications for the industry's disempowered workforce, and the success or failure of these innovations plays a critical role in the sector's growth and economic impact. This study examines various plans and strategies for the development of coir, evaluating the overall state of technological modernization in the industry. It also addresses the challenges related to automation in modern coir units. Moreover, while both federal and state governments offer a variety of programs to support the coir industry, many manufacturers remain unaware of these initiatives. This report explores the opportunities and challenges facing Kerala's coir industry.

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 the trade union movement was successful in defending mechanization till 1991, the total consciousness of the industry was

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Corresponding email: drpratheeshraghav@gmail.com (Dr. Pratheesh P)

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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 fibre 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 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 Brodolo (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

This conceptual study utilizes both primary and secondary sources for data collection and analysis. Sources include articles, published press reports from the Coir Board, *Coir News*, research journal reviews, data from coir industry websites, Ministry of MSME reports, as well as daily newspapers and magazines. The primary objective of the study is to analyze the current state of technological modernization in the coir industry and its associated challenges.

4. Kerala and its Coir Industry

The name Kerala is said to originate from *Keram*, meaning coconut palm (Jeffry, 1984). Coir, a fiber derived from the coconut husk, is used to produce items such as carpets and mats (Dictionary.com, 2014). According to KITCO (2009), the coir sector is Kerala's second-largest employer and a major income source, especially for low-income individuals. While the exact origins of coir production are unclear, evidence suggests significant growth in the 16th and 19th centuries (Rammohan, 1999). The modern coir industry began in 1859 and has since undergone considerable structural and operational changes. Employment in the coir industry has shifted from traditional methods to mechanized processes, making it more profitable in terms of both labor and time. Machines now handle tasks like fiber extraction and mat production, reducing the need for manual



labor. For traditional coir workers, this mechanization marks the end of an era; yet, it also presents opportunities for a new generation with technical skills to thrive in the industry.

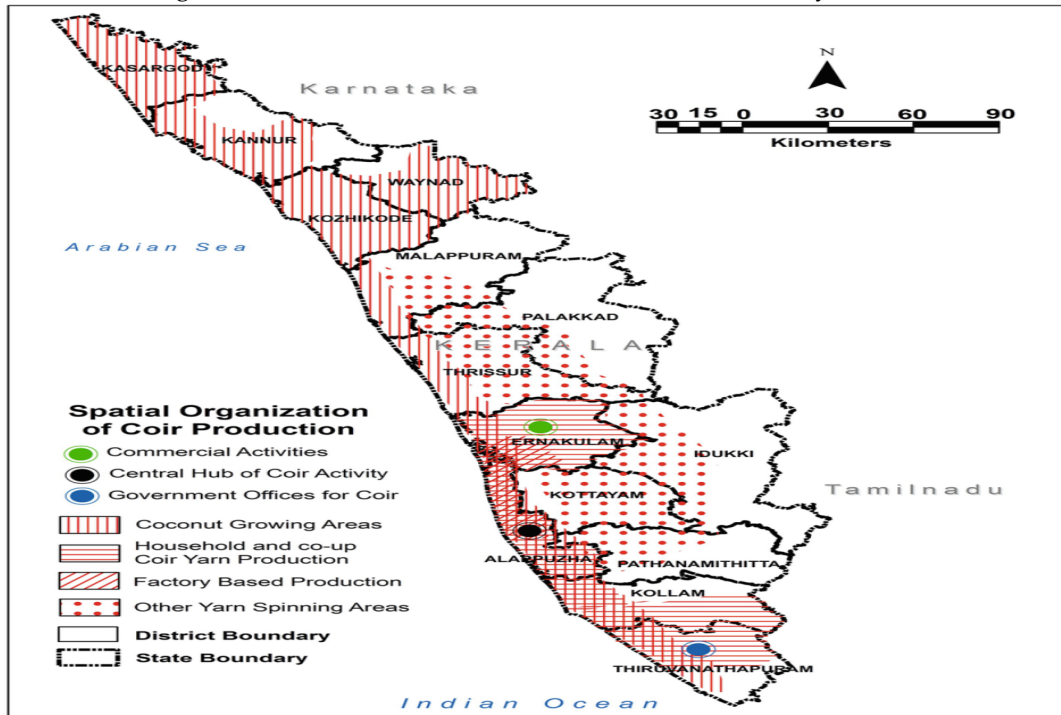


Figure 1: Coir Production Centers in Kerala

The coir industry in India saw remarkable growth in exports over the three years preceding the COVID-19 pandemic. In 2019, the industry achieved record export earnings of Rs. 2,282 crores, up from Rs. 2,090 crores in 2018, with a quantity of 537,050 metric tons. Kerala accounted for 74% of these exports and 85% of production. To support this growth, the government implemented the Export Market Development Assistance scheme to aid coir exporters in marketing and sales. According to a Coir Board report, 76.6% of coir production units operate on a small scale, while 18.1% are medium-scale, and 5.3% are large-scale. In terms of ownership, 57.3% of units are in the private organized sector, 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 account for 1.2% of the units, with 6.4% not linked to cooperatives.

Regarding production activities, 33.3% of the units focus on fiber extraction or defibering, 23.4% produce traditional coir yarn, and 35.1% use modern or automated methods for yarn production. Additionally, 13.5% manufacture frame-type coir mats, 6.4% process coir pith, 1.8% produce coir geo-textiles, 1.2% use semi-automatic power looms, and 0.6% employ automatic power looms. Technological adoption varies, with 33.3% of industries fully mechanized, 36.8% partially mechanized, and 29.8% still relying on traditional, non-mechanized methods. Technological modernization in Kerala's coir industry began in the late 20th century, with the adoption of modern machinery seen as essential for the industry's survival. Mechanization has aimed to resolve the issue of declining interest among younger generations, who are discouraged by traditional production methods. De-husking and defibering were the first areas to be mechanized. Previously, fiber extraction was a lengthy and labor-intensive process; husks were soaked for six months, creating a foul odor and environmental pollution. Workers received minimal wages for this back-breaking work, often as little as 70 paise per day. As productivity waned, fiber extraction shifted to nearby states, causing a shortage of coir fiber in Kerala and making mechanization essential. Gradually, mechanization spread to other areas of the coir industry. Yarn production shifted from hand-twisting to the 'Ratt' and later to the electronic 'Ratt.' Loom work was also mechanized, with power looms initially introduced in large factories. Due to high capital requirements, small-scale and household units were slower to mechanize. However, medium and small power looms were eventually introduced, and women-driven loom units in household settings began to

modernize as well. To support this shift, the Kerala State Coir Machine Manufacturing Co. was established at Adoor, fostering domestic production of machinery for the coir industry. Technological modernization has improved production speed, quality, and financial returns for the industry, though it has also adversely impacted employment within the workforce.

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

The question of technological modernization was a heated debate in the final decades of the 20th century. Traditional coir workers viewed it as a "dare evil," while pro-industrialists saw it as a "gift and hope." Without modernization, the coir industry in Kerala faced the risk of decline. Once a symbol of Kerala's pride, the industry found itself in trouble over this issue, with exports dropping by approximately 45 percent during the 1990s. Although Kerala still produces around 55 percent of the country's coir husk, it has steadily lost ground to other states. In 1977, Kerala produced 1.25 lakh tons of husk, while the rest of India (mainly three southern states) produced 10,000 tons. By 2000, production in other states had risen to nearly 70,000 tons, whereas Kerala's share dropped to 75,000 tons. Kerala's coir fiber production has similarly declined, largely because mechanized units in neighboring states have outperformed Kerala's handmade fiber production. In Kerala, coir is made through a month-long, labor-intensive process, whereas in neighboring states and Sri Lanka, mechanization completes this process in hours. Pro-industrialists recognize that without modernization, the industry is likely to continue shifting to neighboring states. Despite strong opposition to automation within the coir industry, shifting market demands and declining production pushed for mechanization to meet growing global demand. The 1991 liberalization program dismantled state monopolies and reduced bureaucratic control over financial markets to cut costs, forcing these industries to prioritize earnings and market performance (Mayer, 2000). Automation, introduced in the 1990s, boosted production volume and value to meet international demand (Sabarinath, 2010). However, technological modernization has impacted the traditionally disempowered workers within the industry. From the perspectives of industrial and economic growth, the success or failure of technological advancements is crucial. Data from Kerala's SDP (2005), the national GDP, coir exports, and the primary and secondary sector income in Kerala and India (2005) illustrate this shift. Between 2003 and 2004, the industry saw significant growth across the country, suggesting that technical upgrades are both necessary and beneficial for the sector.

6. Political Interventions

Discussing the modernization of the coir sector without mentioning the involvement of political parties is incomplete. Due to protests over automation and militant trade unionism in the 1990s, Kerala's coir industry—once employing around 500,000 people and crucial to the state's economy—lost its competitive edge. Politics and trade unions have become deeply intertwined over time, with political parties using unions as sources of financial and electoral support. Kerala has mainly been governed by the United Democratic Front (UDF), led by the Indian National Congress (INC), and the Left Democratic Front (LDF), a coalition of Communist parties. Ramachandran (1997) observed that political parties have driven many state changes, from improved healthcare and agrarian reform to higher literacy rates, social equity, and progressive attitudes about gender. Yet, these same progressive forces resisted modernization in the coir sector for fear of losing the political support of coir workers. Militant unions have caused numerous lockouts and strikes in Kerala businesses, slowing industrial progress. Political parties can even call a "bandh," halting all activities in a specific state region (Prakash, 1994; Jeromi, 2005). As a result, the state's political environment has become less conducive to investment and business growth. According to Ahluwalia (2000), economic development in Kerala has not been significantly driven by government initiatives. The economic context of Kerala offers a perspective on the coir sector's performance under the influence of different political regimes. However, the Coir Board at the federal level has disapproved of the state's political approach. "Quality control, mechanization, and modernization are urgently needed," stated a Coir Board spokesperson, adding that the state government and left-leaning unions oppose these measures. Ultimately, political leaders and unions had to allow for mechanization to prevent further relocation of the industry to neighboring states that embraced automation to stay competitive.

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 Industry Technology Up-gradation Scheme (CITUS), launched by the Coir Board, aims to provide financial assistance to business owners for upgrading and modernizing their equipment and plants. This initiative is designed to help coir industry units enhance their technological capacity, thereby fostering greater competitiveness in the sector. The financial support under the scheme covers up to 25% of the total cost of qualified "Plant and Machinery" purchases. The maximum financing available per coir project or unit is Rs. 2.50 crores. The scheme is open to newly established coir production or processing facilities as well as those that are registered with the Coir Board under the "Coir Industry (Registration) Rules 2008" and hold an "Udyog Aadhar" registration. Applicants must submit their online application along with the required supporting documents, as specified on the Coir Board's official website. The Nodal Agency responsible for the implementation of this program is the Coir Board in Kochi.

6.2.1 The key objectives of CITUS are as follows:

1. **Support for Next-Generation Entrepreneurs:** Providing modern infrastructural facilities to coir manufacturing units, improving both quality and productivity.
2. **Enhancement of Existing Coir Units:** Modernizing and upgrading the equipment and processes in current coir units.
3. **Development of New "State-of-the-Art" Units:** Encouraging the establishment of advanced coir processing units.
4. **Adoption of IT Solutions:** Promoting the implementation of Enterprise Resource Planning (ERP) and other IT technologies in the industry.
5. **Exploring New Development Areas:** Introducing fresh, promising areas of development within the coir sector.
6. **Raw Material Utilization:** Enhancing the use of available raw materials, improving efficiency and sustainability.
7. **Job Creation:** Increasing employment opportunities, particularly for rural women, within the industry.
8. **Industry Integration and Competitiveness:** Modernizing the sector to make it more integrated and globally competitive.
9. **Pollution-Free Coir Industry:** Using technological advancements to help the coir industry move toward being pollution-free.
10. **Customer-Focused Products and Services:** Assisting in the development of valuable, market-oriented goods and services.
11. **Promoting Eco-Friendly Practices:** Encouraging the use of environmentally friendly industrial methods to ensure sustainability.

This scheme is part of the Coir Board's broader effort to modernize the coir industry, boost its global competitiveness, and ensure that it remains a significant source of employment and economic activity, particularly in rural Kerala.

Table 1: Technological Modernization fund- Released and actual expenditure

Scheme/ Programmes	12 th 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

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 development of new technology and equipment to increase productivity and reduce operational drudgery. The invention of a coreless coir yarn spinning machine called "Krishna," a preprocessing unit attachment for producing high-quality coir yarn, and a completely automatic coir geotextiles weaving loom prototype called "Anugraha Tejas" – which 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 rate 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, which 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 indeed, a challenging prospect for the coir industry today. Without this powerful tool—technological modernization—the promotion and integration of the coir industry into the global market cannot be achieved. Modernization creates the problem of a lack of proper machinery to increase production capacity, and the nonavailability of



modern tools hampers 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 an essential prerequisite for technological upgradation. However, the workforce in the industry mainly consists of traditional workers who are aging and lag behind the technological processes. To facilitate modernization, it is crucial to equip the existing workforce with techno-skills or to recruit new, skilled labor.

Limited access to Training:

There is only one training center across Kerala that offers short-term (10-day) training courses for coir workers on modern machinery. The Coir Research & Development wing of the Coir Board, located in Kalavoor, has limited capacity, making a faster training drive difficult in the current 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 begin. Private manufacturers who have received consent to produce these items are charging high rates. Although technological modernization is a reality, coir units, particularly small-scale and household units, are facing serious capital investment challenges due to the substantial amount required for mechanization within a short period.

The problem of availability of uninterrupted Power Supply:

Kerala, being a hydroelectricity-dependent state, is not an electricity-surplus state. Consequently, the tariff for industrial electricity use has been relatively high. During the monsoon season, heavy rainfall, and in the summer, water deficits in dams create uncertainty regarding the uninterrupted power supply in the state.

The problem of Political Will:

Kerala has alternated between being governed by the right-leaning United Democratic Front (UDF), led by the Indian National Congress (INC), and the Left Democratic Front (LDF), composed of Communist parties. As a result, the state's industrial department lacks a consistent policy regarding the technological upgrading of the coir industry.

9. Conclusion

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

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.

10. References

- Ajith Kumar, P. (2002). 'Coir Industry in India, Problems and Prospects', coir news, vol. Xxxi, no.7, Oct-11-13.
- Rammohan, T. (1999). 'Technological Change in Kerala Industry: Lessons from Coir Yarn Spinning', Centre for Studies in Social Sciences (CSC), Calcutta.

- Rammohan, K. T. (2008). 'Coir in India: History of Technology', *Encyclopedia of the History of Science, Technology and Medicine in Non-Western Cultures*, Springer, <https://doi.org/10.1007/978-1-4020-4425-8516>.
- Isaac, T. M., & Raghavan, P. (1990). A policy framework for the revitalization of the coir industry in Kerala.
- Thomas, I. T. (1990). *Evolution of Organisation of Production in Coir Yarn Spinning Industry*. Centre for Development Studies, Working Paper, 236.
- Nair, K.N. Thomas Issac, T.M, Van, P.A. & Stuijvenberg (1992): *Modernisation and Employment: The Coir Industry in Kerala*, Sage Publications, ISBN-13 : 978-8170363040.
- Praveenkumar, K., & Vinayagamoorthi, D. G. (2017). A study on export performance of coir industry in India. *Shanlax International Journal of Commerce*, 5(4), 59.
- Mayer, P. (2000). We are the slowest reformers: Disinvestment of India's State-Owned enterprises. *Economic liberalization and institutional reforms in South Asia: recent experiences and prospects*, 314-336.
- Pylee, M. V. (1976). *A Study of Coir Industry, in India-Problems and Prospects'*, Coir Board, Ernakulum. R.N. Chaudhary, (2006): 'Problems of Rural Industry', *Jagriti*, Vol.50, No.6, May 2006.
- Sabarinath, K. (2010). *Modernization of coir industry in Kerala: a multidimensional impact analysis*. 18 November, Pondicherry University. Retrieved 8 August 2021 from <http://shodhganga.inflibnet.ac.in:8080/jspui/handle/10603/1194>.
- Sudarshana, B. (2020). 'Productive Forces in the Coir Industry', *The Political Economy of Uneven Rural Development*, pp-145-186.
- Sudheesh, K. (2005). 'Reforms and Its Impact on the SSIs – A Field Approach', *Journal of Rural Development* Vol.24, No.2, April – June 2005.
- Tony, S. (2010). 'Technological Change in Capitalism: Some Marxian Themes', Oxford University Press for Cambridge. Annual report of coir board 2016-17.