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Migration and Labour Dynamics in Kerala's Plywood Industry: Socioeconomic Transitions from 1918 to 2020

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Abstract: ***This paper investigates the evolution of the Indian plywood industry, its sustainability, and growth prospects. The focus is on the plywood sector in Kerala, and the research examines how timber shortages, technological advancements, and regulatory frameworks affect the competitiveness of the sector. This paper adopts a mixed-method approach that analyses market trends, production processes, and stakeholder views towards recognising key challenges and opportunities. This study also examines the exploitation of labor and working conditions of migrant workers in Kerala's plywood industry. This research reveals the intersectional dynamics of capitalism, precarity, and dispossession through a historical analysis of the industry's evolution and ethnographic research on labour patterns, wage criteria, and living conditions. It highlights the displacement of skilled local labour, the emergence of migrant labour, and its concomitant social implications. This study contributes to the existing literature on labour exploitation, migrant workers, and the environmental impact of the plywood industry by emphasising the need for policy interventions and collective action to address the human cost of capitalist expansion.***

Keywords: Indian plywood industry; regulatory frameworks; labour exploitation; migrant workers; environmental impact; India- Kerala

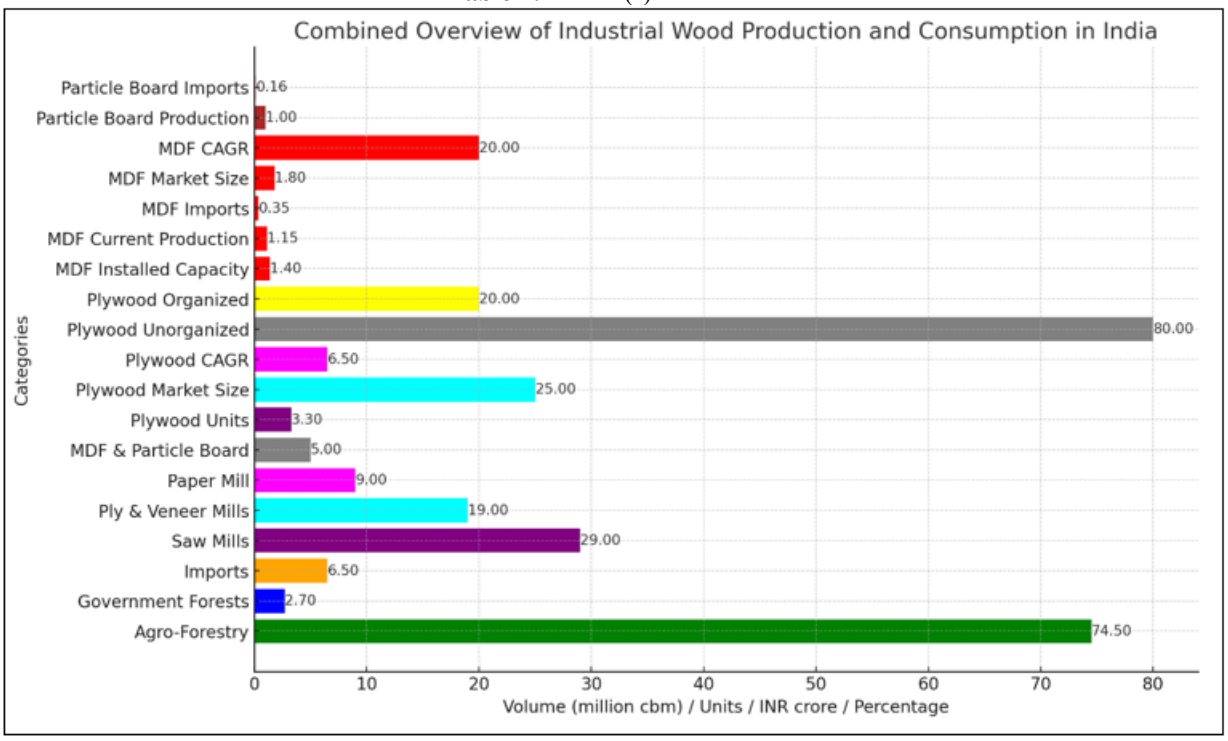
1. Introduction

India's plywood industry has a long and venerable heritage that dates back more than a century. India first imported plywood in 1906-07, with a modest value of Rs. 32 lacs. Imports continued to rise steadily, reaching a peak of Rs. 90 lacs by 1924–25. In line with this trend, the tea industries in Assam, West Bengal, and Kerala increased enormously, giving rise to the idea of developing a plywood business to be devoted principally to the production of tea chests for export. Two plywood companies were established in Assam in 1923–24, in keeping with this idea, though their development was more characterised by a gradual yet persistent rise than a spectacular boom. Since its inception in the early twentieth century, the Indian plywood industry has made significant progress. Initial development took place in the shape of small-scale plants; however, the establishment of giant mills with modern machinery and technology marked a significant milestone (Punit, 2005). The outbreak of the Second World War brought about an immediate need to produce tea chests locally, and the large-scale expansion of the plywood industry in India—particularly in the manufacture of tea chests—ensued. The Second World War was the primary catalyst for the plywood industry's growth in India. There was some loss experienced by plywood factories in the postwar period when vested interests sought to crush the business by reopening the importation of tea chests. However, the government intervened by imposing a countervailing duty on importers, requiring them to purchase equivalent quantities of Indian products. A sequential import ban imposed by the government inspired Indian entrepreneurs to modernize and invest in the sector. Since 1947–48, the industry has expanded its product profile by offering block boards, flush doors, and several other varieties of plywood, including marine and aircraft plywood, which were as excellent as, if not comparable to, global quality and diversity. The plywood quality is carefully examined and sorted into various grades that match up with a range of industrial and aesthetic uses (Gould, 1994; Okrend, 1994; Russell, 1992).

Indian wood-based industries, particularly plywood and decorative veneer units, rely heavily on plantation wood core veneers and fillers supplemented with imported high-quality wood face veneers that make up 5% of total wood consumption. By 1952, the Indian plywood industry had expanded with 67 approved mills. It had an installed capacity of 145 million square feet overall. Regional distribution showed a significant concentration in West Bengal, which accounted for 40.6%, followed by South India with 32.3% and Assam with 13.5%. The organised industry had superb expansion, and the manufacturing of plywood increased more than 200%, from 28.55 million square feet in 1947 to 85.5 million square feet in 1952. The capital investments in the approximately 67 units approved amounted to upwards of Rs 27.7 million. An estimated 5,700 workers were involved. The wood requirement of the wood-based panel industry of India must be complemented by indigenous plantation timber; hence, it has become essential to import timber logs and face veneers due to forest conservation policies and logging restrictions. As of today's date, the Indian plywood and panel industry constitutes about 3,300 units—including small, medium, and large-scale units—which directly support around 1 million livelihoods. Most of these units—approximately 3,200 fall under the unorganised sector. In terms of overall demand for wood panels, plywood is the biggest product in the case of Indian plywood industries, and its market size is estimated to be around INR 25,000 crores. It has observed a compound annual growth rate of 6% to 7%

over the last five years. The Indian plywood industry is highly fragmented, with the unorganised sector comprising about 80% of the market. The organised sector constitutes the remaining 20%. Within the organised segment, two pan-Indian companies, Century Plyboards India Ltd. and Greenply Industries Ltd., dominate the market, collectively holding around 50% (25% each). This duopoly indicates the consolidated nature of the industry within the (un)organised sector (Table 01).

Table 1: Author(s) Calculation



The industry fell within the domain of industrial licensing regulated under the industries (Development and Regulation) Act, 1951, and thus all proposals have to obtain a licence from the Ministry of Industry after consultation with a range of ministries, including the Ministry of Environment and Forests. The latter ensured that there is sufficient timber availability on a sustainable basis for the projects. The 1988 Indian National Forest Policy brought about a paradigm shift, making a 'transmogrification' from forest-based to wood-based industries that was confounded by a plethora of challenges. The paucity of raw materials, emanating from either agroforestry (AgriWood) or imports, posed a formidable obstacle. The dwindling imports, occasioned by the escalating prices of wood raw materials in the global markets and the concomitant tax impediments, have further worsened the precariousness of the wood-based industries. India's First Five-Year Plan (1951-1956) catalysed substantial industrial strides, notable:

1) A 45% increase in the production of tea plywood—from 5.65 sq m to 8.20 sq m, with a 7.5% compound annual growth rate (CAGR).
2) There has been a 155% exponential proliferation of commercial plywood output, from 0.95 sqm to 2.42 sqm, at a CAGR of 21.7%.

By the end of the First Plan period, the industry consisted of 64 sanctioned factories with an annual capacity of 13.98 million square meters (150.58 million square feet), supplemented by small mills with an additional capacity of 0.33 million square meters (9 million square feet). The outcome was a capital investment of about Rs. 35 million. In Assam and Karnataka, two new units were added during the Second Plan period (1956–1961), and seven small-scale sector units were later added to the list of approved units. The production of durable and weather-resistant plywood was significantly enhanced in 1957 with the formulation of urea-formaldehyde synthetic adhesive. Some plywood sheets are overlaid with a thin overlay of plastic, metal, and resin-impregnated paper or fabric to make them more resistant to moisture and improve paint adhesion; this technique is known as overlaid plywood, and it is widely used in the construction, agriculture, and transportation industries (Martyn, 1976). These circumstances meant that the local supply of raw materials for wood was also inhibited by a lacuna in the law that could not exclude AgriWood from the restrictive legal provisions that applied to the felling and transport of trees raised on farmlands. A gap in the law had also delayed the establishment of a viable, sustainable wood-based industry in India and was reason enough to reconsider the policy framework. Until 1996, the northeast region of India, comprising Assam, Arunachal Pradesh, and Nagaland, produced most plywood. However, since the Supreme Court banned logging in the northeast, plywood plants have come up in Yamunanagar and all over India, reaping a bonanza from abundant plantation wood. Today, industry produces more plywood than it did in the past 60 years.

Drivers of Growth in the Indian Plywood Market

1) **Infrastructure Boom:** The Indian government's focus on infrastructure development has led to a surge in demand for plywood, driving growth in the market.

2) **Shift in Consumer Preferences:** Changing consumer preferences towards affordable and aesthetically pleasing home decor has increased demand for plywood in the furniture industry.
3) **Real Estate Sector Growth:** The real estate sector's projected contribution of 13% to India's GDP by FY25 and reach of $1 trillion by FY30 has significantly impacted plywood demand.
4) **Furniture Industry Expansion:** Given that India is the world's fourth-largest consumer and the fifth-largest producer of furniture, plywood plays a crucial role in the home market (Anon. 2020a, Jha 2020.
5) **Rising Disposable Incomes:** Increasing disposable incomes have driven demand for affordable and aesthetically pleasing home decor, contributing to growth in the plywood market.
6) **Digital Adoption:** The plywood industry's adoption of digital and e-commerce solutions during the COVID-19 pandemic has enabled it to adapt to changing market conditions.
7) **Supply Chain Resilience:** The industry's ability to navigate supply chain disruptions during the pandemic has ensured continued growth.
8) **Work-from-Home Trend**: The shift to work-from-home situations and hybrid work models has increased demand for furniture, driving growth in the plywood market.

Agroforestry is the dominant form of industrial wood supply in India and produces the majority of India's timber. The sector faces a challenge in meeting growing demand, which results in significant wood imports. Legislative support for agroforestry and sustainable timber production is necessary to secure the future of India's wood industry. Given the significant impact of agroforestry on timber production, there is a compelling argument for its continued promotion. Developing incentives for the cultivation of trees by farmers on their holdings that yield timber will reduce the quantum of imports, besides being able to supply sustainably. Industry-owned plantations under species such as eucalyptus, poplar, casuarina, and Acacia mangium seem to have shown quite promising trends. Such operations are aimed at controlling illegal logging in forest areas of different states and at ensuring an uninterrupted supply of unprocessed products to the wood product industry. The Forest Survey of India, 2020, reports that agroforestry and plantations outside the designated forest cover contribute immensely to the timber-producing industry. It accounts for 85.2 million cubic meters of timber. This quantity constitutes more than 90% of the total industrial wood supply. The figure further confirms the dependence on non-forest sources. Timber production from government forests is relatively small, with an estimated 2.4-3.0 million m^3, which forms less than 4% of the total timber availability. The situation underscores the limited role of natural forests in fulfilling the industrial demand for wood, as India imports approximately 6–7 million cubic meters of wood annually, primarily due to the demand for hardwoods, with logs accounting for over 74% of these imports. Imports are still necessary to fill the gap in certain types and qualities of wood, despite significant domestic production. Demand for timber by 2020 was estimated at 153 million m^3 (RWE), which India could meet only at 45%. Such a giant gap means a need for better and more sustainable ways of supplying timber or policies to reduce dependence on imports. Of course, India is the world's second-largest importer of wood, meaning that a huge economic effect arises from the timber sector. Substantial annual import spending of about ₹50,000 crores raises hopes of major economic dividends by minimising reliance on imports by making these available locally. Plywood is one of the basic items in the local market; India is the world's fourth-largest consumer and the fifth-largest manufacturer of furniture.

The domestic furniture market will be approximately $32.7 billion by 2026, with a CAGR of 10.9% from 2020 to 2028. Growth can be driven in the future, including by rising disposable income and increased consumer interest in cheap but appealing home designs. During the COVID-19 pandemic, the plywood industry embraced digital and e-commerce technologies that enabled it to react to market volatility and maintain its growth curve, as indicated in Figure 01. The other proof of its strength is how the market reacted to disruptions in supply chains during the pandemic. Additionally, hybrid working models and working from home have enhanced furniture needs and further pushed the plywood market forward. The Indian plywood market is estimated to grow at a compound annual growth rate (CAGR) of 6.74% from FY23 to FY28. It is estimated to be ₹306.5 billion by the end of 2028–2029, thus placing it as a substantial portion of the nation's economy.

Several noteworthy factors have triggered a noticeable upswing in plywood demand in India. Specifically, the growing urban population—which is expected to account for 51 per cent of the nation's 1.7 billion residents by 2047—requires the building of around 230 million dwelling units, which in turn drives up the need for plywood. The need for premium plywood is growing as the building and restoration sectors adopt a more robust material paradigm. Additionally, the increased demand for partially and fully furnished apartments is leading to a greater use of plywood in interior design projects. Government initiatives aimed at promoting affordable housing, such as the Pradhan Mantri Awas Yojana [PMAY (U)], have also contributed to the heightened demand for plywood, while the burgeoning consumer preference for premium and eco-friendly plywood variants has introduced a new dynamic into the market.

Top five plywood manufacturers in India, based on market capitalisation, as of March 6, 2024.

Firm(s)	Market cap (₹ cr.)	Net profit (₹ cr.)
Century Plyboards	14624.53	361.51
Greenlam Industries	6770.97	142.57
Greenpanel Industries	4432.4	181.8
Greenply Industries	3216.17	52.67
Stylam Industries	2618.47	117.62

Plywood Export and Import Trends (2000-2018)

The quantity of plywood exported between 2000 and 2018 experiences strong fluctuations. It rose steadily throughout the early 2000s and peaked in 2002 at 43.75 thousand cubic meters. However, in 2003, there was a sudden drop to just 14.83 thousand cubic meters. Subsequent years recovered and stabilised, up until 2006. The biggest jump occurred in 2007, reaching 106,230 cubic meters, possibly due to a more favourable market environment or changes in policies. This peak was followed by a drop and further oscillations, with

another significant rise in 2014 to 97.03 thousand cubic meters, before tapering off to 31.54 thousand cubic meters by 2018, whereas the import quantity of plywood shows a general upward trend with some variability. Starting from 28.71 thousand cubic meters in 2000, imports took off sharply at the beginning of the 2000s to reach a high of 42.25 thousand cubic meters in 2001. Imports dipped sharply in 2002 to 15.45 thousand cubic meters but have remained steadily on an increasing trend since then. Since 2006, there had been a substantial increase, which peaked at 200.09 thousand cubic meters in 2011, owing to increasing demand within the domestic market and possible changes in import regulations. The import quantity temporarily declined but regained an upward trend, reaching 151.06 thousand cubic meters in 2018 (Figure 02).

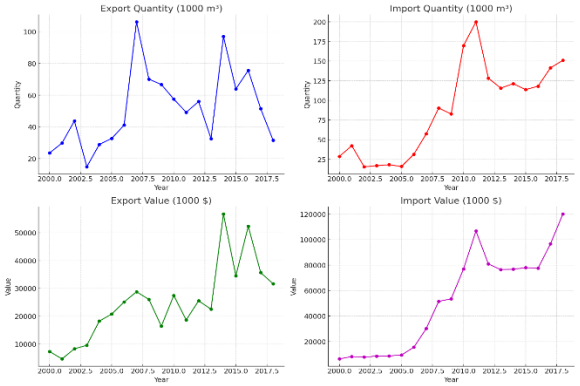


Figure 2: The plywood export and import data from 2000 to 2018
Source: *DGCIS – Kolkata, Various Data from Government of India*

Ex/Import Value (1000 $)

The export value of plywood mirrors the quantity trends with some special features. It opened at $7340.78 thousand in 2000, declined to $4695.22 thousand in the year 2001, and then continued to increase gradually with a prominent peak in the year 2004 at $18258.58 thousand, which might represent a better-quality product or higher global prices. Following this, the export value depicts a gradual up-and-down spiral, reaching its peak for the second time in the year 2014 at $56703.02 thousand and then dropping to $31642.29 thousand in the year 2018. The plywood import value shows a consistent upward trend. From $6389.63 thousand in the year 2000, this value increased in an almost uninterrupted curve and depicted the rising domestic demands and perhaps higher international prices. Significant jumps are noted after 2006, and these values reach $106733.7 thousand in 2011. The growth continued to achieve its peak at a value of $120138.6 thousand in 2018. The trend indicates a growing reliance on imported plywood to meet domestic needs.

Timber Demand in India: Trends and Projections

Timber and plywood are interlinked industries in India. Wood is the primary raw material used for producing plywood. Dependency on this resource threatens the long-term sustainability, the competitiveness of the market, and operational efficiency of the plywood industry. The most significant issues are the lack of adequate quality control mechanisms, outdated equipment, inefficient production processes, and the scarcity of timber. Taken together, all these factors significantly impair the competitive strength of the industry in domestic and foreign markets, making long-term survival all the more suspicious and highlighting the urgent need for targeted strategic interventions meant to minimise these problems and make the sector more resilient and adaptable to an increasingly harsh international environment. Timber supplies originate from many places, although the northeastern states of India have a particularly major role. In the present times, laws have forbidden timber logs from state border crossings. This has exacerbated issues in the supply of plywood. In addition, the newly enacted national forest policy, which aims to retain one-third of India's total area under forest cover, has taken stringent controls over deforestation and also regulates the leasing of forest land to commercial enterprises. The policies also limit the supply of timber from the indigenous sources and increase dependence on imports (FAO, 1986). From 1998 to 2020, demand for timber in India has recorded a steep rise, mainly propelled by the emerging needs of several industries. Over this period, the construction industry has experienced phenomenal growth and remains the single largest consumer of timber. Simultaneously, the plywood industry has also experienced significant growth in timber usage, coinciding with the growing demand for higher-quality building materials (Figure 03).



Figure 3: Trends in Timber Demand (1998-2020)

Source: *(Ghosh and Sinha 2016).*

Between 1998 and 2020, the timber industry grew significantly due to the plywood and building industries. Demand for plywood increased from 10.1 million m³ to 29.2 million m³, while demand for construction increased from 13.6 million m³ to 28.5 million m³. The sectors like packaging grew steadily in step with the broader trends of the socioeconomic shifts, from 4.36 million m³ to 9 million m³; furniture also grew from 2.25 million m³ to 7.53 million m³. On a smaller scale, paper and paperboard as well as agricultural implements also recorded some uptrends, which is an indication of what practice and regulatory arrangements are needed by such a vital trade. The Indian plywood industry faces a serious shortage of timber that threatens its production potential. Though reportedly available under the social forestry schemes, the industry's dependence on low-cost species such as mango and dhuna for disposable packaging poses an impending threat to the sustainability of the domestic timber stock. Once serious shortages of good-quality timber set in, it may increase the cost of production further because the industry began relying significantly on timber imports.

Obsolete Machinery and Inefficiencies

The Indian plywood industry remains entrenched in the technologically archaic environment, especially after the 1962 policy shift that made tea chest plywood production fall into the small-scale sector. The policy has led to an increase in small and cottage units operating with antiquated machinery, such as manual methods of veneer processing. The lack of modern equipment, such as mechanical dryers and hydraulic presses, has led to inefficiencies, increased waste, and suboptimal product quality. This situation is in sharp contrast to other plywood-producing countries, where modern technology and high-speed machinery are the norm. Reports from the Indian Plywood Industries Research Institute (1986) note that the Indian plywood mills have a relatively much higher timber loss in the processing stage compared to their Indonesian and Korean counterparts. For instance, the average timber loss in Indian mills is reported to be 23.7%, while it is reportedly as low as 11.3% in Korea (Indian Plywood Industries Research Institute, 1986). Such inefficiencies are because of the use of archaic machinery; these result in much wastage of timber along with increased cost of production.

Quality Control and Market Competitiveness

Quality issues are the other problems for the Indian plywood industry, as these deprive the industry of any competitive edge in the international market. Indian plywood frequently exhibits quality issues such as uneven veneer thickness, brittleness, poor moisture resistance, and poor durability. The general finish of Indian plywood is considered below the international standards, thereby affecting the marketability (Hwang, 1983). Primitive equipment and less sophisticated processing technologies exacerbate these quality problems in plywood. For example, most Indian mills use glue spreaders without modified coats and lack equipment such as doctor rollers, which can lead to uneven glue spread and multiple delamination's in the veneer (Hwang, 1983). High production costs in the country exacerbate these issues. In most cases, the cost of timber is significantly higher than in the plywood-producing countries of Southeast Asia. The freight cost, insurance, and excise tariffs that currently contribute to this difference are partially included in the current production costs (Federation of Indian Plywood and Panel Industry, 1989). This scenario makes the competing Indian products more costly than their rivals from places like South Korea; hence, it reduces market competitiveness (Nandan, 1983).

Inception and Early Development of the Plywood Industry in Kerala

The plywood industry of Kerala has its origin in 1937, when the first factory was set up at Kallai, coinciding with the

commissioning of *Mudickal Timber Depot at Perumbavoor*, which utilised the geographical advantage of the region, particularly the dense forests surrounding the Periyar River, to nurture wood-based industries. This nascent stage was characterized by primitive transportation infrastructure; the requirements were transported to high-altitude regions using bullock carts and push carts that returned with timber, handled with great skill by trained elephants till the post-independence era when visionary entrepreneurs such as Kannabuaram Kunjimohammed Haji started sawmills and the government's facilitation of jungle and hardwood sales through public auctions at the Mudickal Timber Depot triggered growth, which was subsequently checked by the restrictions on cutting jungle wood that brought about a paradigmatic shift towards packing case manufacturing units till the 1980s, when the industry underwent a metamorphosis of transformation with the adoption of rubberwood, due to the scarcity of softwood, which finally culminated in a spurt in veneer and plywood production in Perumbavoor, where synergistic market mechanisms, disciplined management, and infrastructural facilities like the weighing bridge of the Sawmill Owners and Plywood Manufacturers Association have collectively contributed to the ascendance of the industry. During the war and the post-war period, there was considerable growth in tea chest plywood in India. They set up numerous mills equipped with veneer cutting lathes and other machinery.

Nascent, Inexperienced, and Highly Fragmented Industry

The Indian plywood industry has several problems, and the majority of these are serious factors affecting the overall operational efficiency, market competitiveness, and long-term viability of the industry. The most prominent of these are the lack of timber resources, the outdated machinery, inefficient production processes, and poor-quality control measures. These problems collectively prevent the industry from competing effectively in both domestic and international markets, thus threatening its future sustainability. Such an industry exists in Kerala, facing a unique set of challenges that make it difficult to discern within the conventional global framework. Though problems are common that small-scale plywood production faces elsewhere around the developing world, the contours are socio-economic as well as environmental in the nature of Kerala's plywood sector—a phenomenon that, therefore, should be analysed along with its particular and region-specific ramifications.

A global framework applied to this industry risks hiding the full range of environmental degradation and social dislocation engendered by its rapid, unregulated expansion in Kerala. The next section delves into the intrinsic challenges that distinguish Kerala's plywood industry, laying bare the deeper implications of its unchecked growth. The plywood industry, though venerable in its century-long global history, has only recently entrenched itself within Kerala's industrial landscape. Unlike its established global counterparts, which evolved over decades in a structured, regulated manner, the plywood sector in Kerala arose from the detritus of a once-thriving timber mill industry.

These plywood mills historically had depended on the harvesting of hardwood from the lush forests of Kerala. After a series of draconic commercial logging bans, they became archaic. Because of higher prices of rubber, rubber plantations increased and resulted in a surplus of rubberwood, which became a raw material for plywood manufacture. Visionary entrepreneurs capitalised on this beneficial coincidence and converted dormant timber mills into plywood manufacturing plants. This turning point proved to be a highly lucrative turn, quickly catalysing an industrial proliferation that was rash and in no way organised. The hub of this plywood boom is the town of Perumbavoor in Kerala's Ernakulam District, which now has more than 1,000 plywood factories, with an estimated 90% of those establishments less than ten years old.

A similar transformation has taken place at Vengola, a small village that had accommodated 20 sawmills in the 1990s but currently houses 276 plywood units. The combined volume of wood processed by the industry is massive, but single units are minimal. This statistic reflects an industry developed through a mosaic of institutional support, structureless planning, and technological help. The lack of systemic financial support from the government or financial institutions has prevented the industry from scaling up effectively; therefore, it remains segmented and inefficient. Moreover, neither international best practices nor modern technology supported the birth of the industry in Kerala. As a result, operational methods in the sector remain quite primitive and simplistic, leading to many adverse environmental and social spillovers. Such behaviour has created a paradox: although the industry has generated significant private profits, these benefits have been achieved at the cost of increased social and environmental costs that are disproportionately distributed to local communities and ecosystems. Environmental degradation, as a result of unsustainable timber sourcing, is but one aspect of the greater ecological crisis spawned by the unchecked expansion of the plywood industry.

The labour conditions in the industry are extremely precarious, worsened by a lack of regulatory supervision and informal employment practices. Failure to adopt advanced technologies and sustainable production practices has also led to inefficiencies that magnify its carbon footprint and resource consumption. Such neglect has resulted in a paradoxical industrial landscape, which, while highly rewarding for a few, is profoundly adverse to the collective well-being of Kerala's social and ecological systems. While significant contributions are made to the state economy, the plywood industry has unleashed an entire range of environmental and health-related adverse impacts that have gone largely unnoticed in the competition for industrial development. Unlike the hardwood industry, plywood production makes widespread use of dangerous chemicals, the effects of which have only recently reached the attention of the community. Matters are complicated further by these operational demands – insatiable in nature – of the industry as well as glaring inadequacies in both environmental controls and regulatory oversight.

Location and Land Conversion

The growth of the plywood industry in Kerala is closely associated with two land-related issues. The ANRF fieldwork revealed that the land costs rose meteorically, which severely hindered the growth of industry, and entrepreneurs were compelled to devise novel, at times unauthorised, methods of determining locations for their factories. Secondly, lack of

effective legislation regarding land use permitted the industrialists to exploit loopholes by easily transforming agricultural lands and wetlands into industrial areas. This has resulted in several environmental and socio-economic problems: The construction of various plywood firms, located near residents homes, has created a risk of environmental degradation in the neighbourhood. The living conditions of those adjacent to these factories have drastically worsened because of increased noise and chemical exposure to the environment at large. The spread of plywood factories on erstwhile paddy fields and wetlands has resulted in gross environmental degradation, irreparably disrupting local ecosystems. Wetland conversion has disrupted local water tables and increased the risk of flooding by compromising natural hydrological systems. Moreover, the loss of arable land has deep implications for food security, reducing the cultivable land available and straining local food supplies. Initially, industrialisation in plywood factories caused an appreciable increment in land prices, which the people welcomed with tremendous enthusiasm since industrialisation was regarded as an economic development. Rapid industrialisation, with environmental pollution a byproduct, has caused land prices to depreciate dramatically in areas adjacent to plywood mills. This adverse premium is proportional to the degradation of living standards due to environmental pollution, which provokes a reversal of public opinion.

Challenges in the Kerala Plywood Industry: Health, Environmental, and Labour Issues

The plywood industry in Kerala is characterised by the widespread use of poisonous chemicals that differ significantly from the traditional hardwood industry, though it has frequently been misunderstood as an appendage to sawmills. This misconception has been coupled with a lack of knowledge about the specific hazards of the industry, and it has hastened serious health impacts, leading the Grama Panchayat of Vengola to request a thorough investigation into the increased cancer rate in the area in 2014 (Joyce & Peters, 1987; Bao, 2015). The rapid growth of industry outpaced regulatory mechanisms, and thus environmental regulation and control were not sufficient. There was a lack of awareness among the public about ecological hazards, a scarcity of land for environmental infrastructure, and a lack of awareness among workers about ecological risks (Plywood Handbook, 1987).

In addition, the increasing value of land made it difficult to obtain appropriate industrial land, and there were no legal measures that could be adopted to allow small-scale industries to be established on agricultural land (Ply Reporter, 2013). The plywood industry is greatly reliant on migrant labourers from states like Assam, West Bengal, Orissa, Bihar who experience dreadfully awful living conditions, increased toxification through toxic chemicals, and severe human rights violations (Benoy, 2013). Labourers often face isolation and depend on employers, generally lacking proper housing; they also suffer from poor sanitation and are unaware of their existing rights. Frequently, the concerned authorities, including the police, Labour Department, and Health Department, exhibit callous conduct towards them, and additionally, such behaviour deepens their vulnerability and negates their basic human rights (Peter, 2013). The convergence of these factors underscores the urgent need for strict regulatory measures and awareness coupled with betterment to reduce the harmful effects of the industry on health and the environment (Sellers, 1985).

There are social issues arising from migrants' labour in Kerala.

The influx of migrant (interstate) workers in Kerala, while economically beneficial, has sparked a host of intricate social issues that demand urgent attention. Chief among these is the escalation of commercial sex work, a consequence of the overwhelming number of young male migrants—99% of whom are men—living away from their families and devoid of legitimate access to sexual relationships. In addition to these facts, the spread of commercial sex has also facilitated a significant rise in sexually transmitted diseases (STDs) with the possibilities of HIV/AIDS transmission, although systematic studies are lacking. Commercial sex workers can transmit diseases between migrant workers and local populations, escalating health risks for both groups. The crime rate has also increased; major crimes such as assault and murder are seen due to stressors in the minds of migrant laborers—hence the very unaccommodating working conditions, low living standards, and the absence of social support in a usually unwelcoming host environment.

In addition, the cultural and linguistic chasm between the migrants and the native Keralite community, who have traditionally been xenophobic despite their historical association with migration, has created an atmosphere of mistrust and periodic violence. These tensions often flare up when the local population feels that their quality of life is being disturbed by migrants, such as pollution or noise from overcrowded labour camps. The ANRF fieldwork revealed that these migrant workers are exploited in inhumane ways by their employers, to whom they are paid wages below subsistence levels and are subjected to abhorrent conditions of work. These workers stand at high risk of developing assorted health hazards such as TB. However, poor living conditions exacerbate TB as they prevent access to clean water and other sanitation facilities. Many of these migrants seek medical treatment from unregistered chemists, who exacerbate the migrants' health conditions and facilitate the spread of communicable diseases. Substances like tobacco, alcohol, and more lethal intoxicants, such as correction fluid, whitener, and cough syrups, become an additional problem for the migrants.

High wages in Kerala (Sobhana, 2012) contrast sharply with the economic prospect of the daily reality migrant workers face. Systemic failures to understand and meet the needs of this vitally important but poorly recognised workforce are more important than cultural alienation and practices that keep people from joining, as well as inadequate health care in the host country. The high state unemployment rate among native Keralites only exacerbates the situation, as the locals increasingly choose more prestigious vocations over manual labour. Although the state government has implemented measures like health insurance and medical treatment for migrant workers, there is a lack of overall policies to protect their welfare. Studies by the Gulati Institute of Finance and Taxation (GIFT), Kerala Institute of Labour and Employment (KILE), highlight the need for better living conditions,

registration, and inclusion of migrant workers in national health schemes such as the Rashtriya Swasthya Bima Yojana. At such a time, when the estimate of migration is projected to cross the 3.4 million mark by 2021 (Prida and Raman, 2021), migrant welfare in the state needs reassessment to cope with these crying social issues.

Chemical Processing and 24/7 Operations

One of the most significant shifts from the hardwood to the plywood industry is the pervasive use of hazardous chemicals in the manufacturing process. This transition marks a fundamental departure from the relatively benign sawmills that preceded the plywood factories, yet the community has only begun to grasp the gravity of this change. The chemicals used in processing plywood, including formaldehyde and phenol-based resins, are toxic in nature and can cause serious health issues, including respiratory problems, skin disorders, and even cancer. In fact, the health impacts have already reached such severity that, in July 2014, the Gram Panchayat of Vengola formally requested the Health Department of Kerala to conduct an epidemiological study to investigate the rising incidence of cancer within the community. The shift in industrial operations is not limited to chemical exposure. The plywood industry operates on a 24/7 schedule, a stark contrast to the more traditional working hours of its timber mill antecedents. This unrelenting operational tempo has given rise to widespread noise pollution, particularly during nighttime hours, significantly degrading the quality of life for nearby residents. The logic for this cycle of continuous production is evident: with rising demand for plywood and the scarce availability of land for new units, the existing units must be used at full capacity.

The local communities' living conditions deteriorate and sickness rates rise as a result of this economic mentality, which has a heavy social cost. As a result of lax regulation, this sector of Kerala's economy has devastating effects on the environment. These results are the result of a web of interrelated causes, one of which being economies of scale, which prevents smaller businesses from investing in cutting-edge environmental management systems. The situation is made worse since many people in the sector and the local labour don't know enough about the environmental hazards and advantages of environmental controls, therefore they don't care either way. A severe lack of understanding is exacerbated by the incompetence with which complicated environmental protection technologies are used. The industrial premises are overcrowded, making it impossible to adequately store and handle chemicals at hazardous levels. This increases the risk of poisoning and accidents. The industry's negative impact on the environment is further emphasised by the fact that current rules are not strictly enforced, leading to less-than-ideal working and maintenance conditions.

The issue is a lack of regulation and enforcement.

The most significant shortcoming in the plywood sector's environmental management is the almost complete lack of effective regulatory control. The business has expanded rapidly, leaving local authorities inadequately prepared to address the environmental risks linked to plywood manufacture. The excessive absence of appropriate regulation, along with technical advancements, imposes persistent challenges on Kerala's regulatory organisations tasked with overseeing this environmentally hazardous business. Consequently, the industry experiences no enforcement; indeed, most of these firms function with impunity, irrespective of any environmental violations. The operation of the plywood and related industries with little regulations underscores profound structural vulnerabilities within Kerala's governance frameworks. Capacity deficiencies, opaque governmental frameworks, and insufficient openness diminish the efficacy of regulatory organisations in enforcing environmental norms across various sectors, including plywood. This enables various industries to engage in actions that may substantially impact the environment with reduced risk of accountability. Concurrently, impacted communities, such as those in Vengola and Perumbavoor, possess little options for recourse, as their complaints are either disregarded or insufficiently addressed by both industry and government. The growth of the plywood industry in Kerala has transformed the economic landscape and presented considerable socio-environmental concerns, especially concerning land conversions and the incorporation of a substantial migrant labour force. This exacerbates environmental deterioration, social unrest, and human rights issues. Inadequate regulatory frameworks and deficient infrastructure intensify these issues. The subsequent section examines two significant challenges associated with the plywood industry: the conversion of industrial property and the complex circumstances faced by migrant workers, particularly with housing, occupational health, and human rights. All these causes have exacerbated environmental deterioration, social unrest, and human rights issues. Inadequate regulatory frameworks and poor infrastructure further aggravate the industry. The plywood sector is primarily challenged by land conversion for industrial use and the intricate circumstances faced by migrant workers, especially with housing, occupational health, and human rights.

The Issue of Migrant Labour (Interstate)

A large workforce of migrant labourers from Assam, West Bengal, Odisha, Bihar, and Bangladesh makes Kerala's plywood sector unique. These labourers present distinct issues not found in other sectors.

- Unsanitary Housing: Numerous Immigrant Workers Crowding Often, factories house immigrants in congested work camps. Poor sanitation, beds, and toilets in such camps put people at danger of disease. Lack of cooking facilities causes interior air pollution and fire concerns, threatening workers' safety.
- Job Occupational health risks: Labour camps near industrial sites expose workers to chemical and noise concerns for long periods. The camps' poor sanitation increases the risk of diseases India had eradicated. Overcrowded, unclean circumstances spread malaria and chickenpox among migrant workers and neighbours. Along with improper garbage disposal from such sites, contamination in surrounding water bodies often spreads to the general population.

Occupational Health and Labour Rights Issues*:* According to Campbell (2012), natural rights evolved in politics as the very concept of rights did. Rights therefore are legally enforceable entitlements (Abbey, 2005) or justifiable

demands (Gillon, 1985). Although Kerala boasts a long history of labour agitation and excellent labour standards, these criteria have mostly ignored the migrant workers engaged in the plywood sector. Unlike local work, migrant labourers are more prone to exploitation without unions or collectives; they are routinely denied fundamental labour rights including timely wages, overtime compensation, health benefits, provent funds, and accident compensation. Lack of organisational support renders the worker at the whim of his employer in terms of dismissal—which he can do without warning or even cause. Second, occupational illness or injury causes many people to miss work; this usually results in dismissal without explanation. Invasions of Over a long length of time, formaldehyde and other cancer-causing substances used in plywood manufacture pose serious health risks at the workplace. Years or perhaps decades may pass before the full consequences of such exposure show themselves. Lack of post-employment health insurance or compensation programs leaves migrant workers more vulnerable since they are left to cope with the consequences of these health issues on their own without help.

Human Rights Issues for Migrant Workers and Their Families*:* The more general human rights issues affecting migrant workers in Kerala's plywood sector are quite significant and complex. They result from both systematic discrimination and workers' marginalisation from local power structures. The workers who migrate are Generally speaking, local authorities—including police, labour agencies, and health officials—subject migrant workers to discriminatory treatment. Mostly supporting businesses or the local community, this marginalises migrant workers without political representation or legal remedy. A stag, With relatively few bringing their families with them due to the hostile social and economic surroundings, an incredible 99% of migrant labourers come in Kerala as bachelors. These families find it quite difficult to settle down since locals hardly let people from outside their hometown rent property, usually using cultural and language barriers as justification. Furthermore, migrant families are purposefully kept off access to important public facilities including banks, schools, and healthcare since they lack the official documentation required for such access, therefore isolating them totally from the mainstream society.

2. Conclusion

Notwithstanding its financial advantages, the plywood sector in Kerala has generated several social and environmental problems. Wetlands and agricultural land have been converted for industrial use, therefore degrading local ecosystems, food security, and quality of life. The ANRF study revealed that for thousands of workers living in the plywood manufactures arranged housing is that, the flood of migrant labour, inadequate housing, poor occupational health conditions, and abuses of human rights have created uncertainty in daily life.

In the absence of land use reform, the long-term consequences of plywood manufacture on Kerala's socioeconomic structure will be negative without legislative improvements, better enforcement of worker rights, and environmental and social protections implemented. Support of Kerala's plywood company calls for strong environmental control, job rights, and corporate responsibility. Environmental impact assessments (EIs) for industrial development start effective environmental governance. Wetlands and important agricultural areas should not be invaded once more.

Technologically savvy regulations and environmental monitoring are absolutely vital to guarantee compliance and stop environmental damage. Targeted restoration initiatives for devastated areas—especially those vital for food security and biodiversity—must take the stage. There is an urgent systematic exploitation of migrant workers from West Bengal, Odisha, Bihar, and Assam. Protection of their rights and fair compensation Workers are urged to organise unions or collectives to guarantee equitable wages and access to social security benefits such health insurance, pension funds, and accident compensation in heavily populated labour camps close to factories. In such lodging, clean bathrooms, drinkable water, and sanitary cooking equipment help to reduce health hazards. Improvements in occupational health and safety will help to reduce noise and hazardous chemical exposure; workers who are prone to chronic health problems connected to their jobs should be under long-term observation.

Further complicating migrant workers' access to public services are systematic discrimination and bureaucratic obstacles, therefore fostering social isolation and violating human rights. These people feel isolated; thus, improved access to banking, healthcare, and education as well as local integration projects can help. The statute also includes: Efforts must be stepped up to protect migrant workers against discriminatory policies, therefore guaranteeing fair treatment by companies and local authorities as well as legal action for mistreatment or illegal termination. Companies obliged to follow comprehensive CSR initiatives addressing their social and environmental effects also answer for their behaviour. These CSR initiatives should encourage environmentally friendly business policies that minimise damage to the surroundings and affect local infrastructure, education, and healthcare costs. Improved technology, resource management, and waste disposal will help the sector gradually reduce its environmental impact, therefore strengthening the local natural resources. liability in business terms Corporate responsibility has to be raised in line with CSR guidelines to minimise effects on the surroundings. While encouraging environmentally friendly business practices, CSR initiatives should assist local infrastructure, healthcare, and education. by openness.

By reducing the environmental impact of the sector, improved waste disposal, resource management, and technology will help the area to be more long-term sustainable. The structural changes in the plywood industry might help Kerala flourish in more harmony. These developments will help to preserve ecosystems, protect migrant workers' rights, and create a more inclusive and environmentally sustainable industrial framework.

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Conflict of Interest Statement

The authors declare that there is no conflict of interest regarding the research, authorship, or publication of this study. The research was conducted independently, without any influence from sponsors, funding agencies, or external organizations that could affect the objectivity of the findings.

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