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REVIEW ARTICLE

Timber and non-timber forest products (NTFPs) markets: An overview

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Abstract

Timber and non-timber forest products (NTFPs) play a vital role in meeting the raw material requirements of industries and local communities in India. However, over the past few decades, the widening gap between demand and supply has posed a critical challenge to sustainable forest resource management. The implementation of stringent forest policies, coupled with restricted harvesting from conventional forest areas, has drastically reduced the domestic supply of raw materials. Consequently, industries dependent on wood, pulp, bamboo, gums, resins and other forest-based products increasingly rely on imports, thereby exerting pressure on trade balances and escalating production costs. This study aims to assess the demand–supply dynamics of forest-based raw materials in India, with a particular focus on identifying the extent of shortages and their implications for market efficiency. The analysis reveals that while consumer demand for forest products has consistently increased, domestic production has stagnated due to policy restrictions, limited plantation efforts and ecological concerns. The resulting shortfall not only disrupts the functioning of forest-based industries but also affects rural livelihoods dependent on the collection and trade of NTFPs. Furthermore, price volatility in both domestic and international markets adds to the uncertainty faced by stakeholders. The findings underscore the urgent need to strengthen sustainable forest management practices, promote farm forestry and agroforestry as alternative sources of supply and improve policy frameworks that balance conservation objectives with industrial requirements. Addressing these challenges is essential to ensuring long-term resource security, livelihood stability and economic growth in the forestry sector.

Keywords: export; import; market; market information; NTFPs; timber

Introduction

Forests are vital for maintaining ecological balance, supporting biodiversity, providing a sustainable source of timber, supporting industries and construction, while also serving as a crucial livelihood resource such as fuelwood, NTFPs and employment opportunities for local communities. As of 2024, the world's forest cover is approximately 4.06 billion hectares, which accounts for about 31 % of the world's land area, down from approximately 4.24 billion hectares in 1990 (1). Between 2010 and 2020, the global forest area decreased by approximately 4.7 million hectares (2 %) per year (2). The production and consumption of various timber products witnessed significant changes in 2023, according to the worldwide timber industry. Sawn timber production declined 4 % to 445 million cubic meters (MCUM), the lowest level since 2014. This decline was mirrored by an 8 % dip in worldwide sawn timber commerce, totaling around 129 MCUM. On the other hand, output of timber-based panels climbed by a mere 1 % to 381 MCUM owing primarily to increasing production in the Asia-Pacific region, balancing decreases elsewhere. However, global traffic in timber -based panels declined 7 % to 84 MCUM, the lowest since 2016. While trade in this area grew by 3 % to a record 71 million tonnes, timber pulp production fell by 2 % to 193 million tonnes. The paper and paperboard industry had a 3 % decline in output to 401 million tonnes, while commerce decreased 7 % to 104 million tonnes, which was the greatest decline since 2010. Notably, the manufacturing of graphic publications fell by 9 %, hitting levels not seen since 1987. Furthermore, in 2023 timber pellet output, which had been increasing for decades due to the demand for bioenergy, declined by 2 %, while commerce fell by 5 %, bringing the total production to 47 million tonnes (3).

The leading lumber/timber exporters are Scandinavian countries (Sweden, Norway and Finland), Russia, Southeast Asian countries (Myanmar, Malaysia, Indonesia, Vietnam, Thailand, Cambodia and Papua New Guinea), Australia, the Democratic Republic of Congo, Ghana, Nigeria, Canada and Amazonian countries (Brazil, Peru, Chile and Bolivia), while the leading importers are Japan, China, India, the United Kingdom, the United States and some European countries. Most logging operations in developing countries' tropical rainforests are reported to be unlawful. According to reports, Southeast Asia accounts for roughly 65 % of the world's illegal timber supply. The illegal supply is mostly intended for European countries, the United States, the United Kingdom, China, Japan and Korea. Important timbers such as Kwila (*Afzelia australis*) from Papua New Guinea, Pyinkoda (*Intsia bijuga*) from Brazil, Pine timber (*Pinus radiata*) from New Zealand and *Pinus sylvestris* from Europe, Ebony (*Diospyros ebenum*) from Africa, Mora (*Mora excelsa*) from Guyana and South America, Poplar (*Liriodendron tulipifera*), Purple Heart (*Peltogyne* spp) from Brazil and Teak (*Tectona grandis*).

India forest cover

India contains 2.5 % of the world's seventh-biggest geographical area (328.7 million hectares) and the greatest population, as well as a diverse climate, soil and biological linkages and 63.73 million hectares of forest land (3). The country sustains 16 % of the global human population and 18 % of the domestic animal population. Forest coverage in India has steadily expanded from 40482 km^2 (14.1 %) in 1950-51 to 713789 km^2 (21.71 %) in 2021-22. This indicates a 77.8 % increase over the last 70 years, reflecting milestones in afforestation and forest preservation. The total forest area in all states and union territories rose from 701555 km^2 in 2015 to 720000 km^2 in 2024, a 1.8 % overall increase (3). Meanwhile, India's forest cover and tree area have fallen by 0.38 %. Furthermore, during the same time period, tree area decreased by 0.67 % across the country. Forests are important natural resources for maintaining a country's economic and ecological balance. With a productivity rate below the world average, forests and tree cover made up about 21.54 % of India's land area in 2017. The per capita availability of forests in India was significantly less than the global average. Forest-based timber products are better for the environment than metals and plastics since they are recyclable and energy efficient. However, social pressures are causing Indian forests to decline, resulting in a timber shortage for commercial use. Despite being a major supplier of tropical logs, India faces a substantial timber supply shortage with more than half of its timber supplied from non-forest areas (4). Timber and non-timber forest products are harvested, traded and utilized by a wide range of consumers, but little is known about market information such as demand, supply and prices (5).

India's timber production and consumption

It was anticipated that by 2030, there would be 183 MCUM of demand for timber, up from 58 MCUM in 2005. In contrast, it is anticipated that by 2030, the supply will have increased from 35 MCUM in 2000 to 60 MCUM (6). The timber yield is 0.7 m^3/ha/year. 77 % of the demand is met by households, with the remaining 26 % coming from the industrial sector and 6.4 % from the service sector. Most of the teak, rosewood, vengai and maruthu timber supply came from Trees Outside Forests (TOF) and accounted for 2.37 MCUM (46.2 %). The World Bank (2016) reports that despite an annual economic growth of 5 % - 8 %, the majority of people live on less than ₹160 a day and that population growth has been 2.7 % to 3.5 % annually. Agricultural and forest products are in high demand as well (6).

The annual growth target for agricultural production has not been attained through modernization and commercialization initiatives and the resulting increase has not kept up with the rate of population growth (7). It is fundamental to guarantee the sustainable production and consumption of forest products. There are also challenging circumstances in home markets. Because artisanal logging is unregulated, it adds to the pressures of international trade by supplying timber for the region's furniture and construction needs. Understanding each stage of the supply chain for NTFPs and timber is essential. An essential first stage in the supply chain management of timber and NTFPs is managing forests and sourcing timber and NTFPs.

India's population has risen to more than 1 billion people with a per capita income of around $300, which is expected to rise to nearly 2 billion and $2000 by 2050. The country's entire timber requirement in 1970 was 160 MCUM, which has subsequently increased and is predicted to reach more than 400 MCUM by 2015. The industrial timber demand will likewise increase from 13 MCUM in 1970 to 35 MCUM by 2015 and 110 MCUM by 2050 (8). The majority of timber used in India is hardwood, primarily teak, which accounts for about 50 % of home consumption. The majority of teak log imports come from Myanmar, Malaysia, Thailand and Africa. Tuticorin Port is one of six important ports in southern India that import lumber, primarily from Southeast Asian countries. Other ports include Kandala (Gujarat), Mumbai, Mangalore on the West Coast, Chennai and Kolkata. Leading dealers import logs from other nations and store them in timber warehouses once they arrive. Traders must pay a charge to store their logs in warehouses at all major ports. In warehouses, sales are not permitted. The logs will then be moved to timber depots or factories.

Logs are shipped to locations where there is demand. Logs imported at Tuticorin Port may end up in the northern districts of Tamil Nadu, whereas logs imported at Chennai Port may end up in the southern regions. Teak logs arriving at West Coast Ports, primarily from West African countries, circulate across the country. Logs are typically transported by road to ensure fast delivery. Import and export satisfy the desires of the hinterland collectively; hence it is not feasible to say the specific consumption of a given region or state. A syndicate of timber merchants controls the import and distribution of timber in India, primarily teak and radiata pine from New Zealand. Architects and interior designers who source timber from these timber merchants have to consider the merchant's economic interests over introducing new timbers.

Import of logs at Tuticorin port and warehouses at St. John’s is explained in previous studies (4). A large portion of Indian timber imports, particularly logs are controlled by a tiny number of timber merchants who specializing in teak logs from Myanmar, Africa, Ghana and New Zealand, as well as radiata pine logs from New Zealand. Timber traders typically square imported or domestic logs into ten-foot sections before selling them to carpenters and other end users. On an annual basis, an estimated 288000 m^3 of logs will enter Kandala, Mumbai and

Mangalore ports. Most Indian timber traders compute that the supply of African teak logs, predominantly coming from Nigeria, will endure another three years until they must seek them abroad. Currently, the grade of teak from Myanmar and Africa is rapidly declining (4). Tropical timber species such as garjan, mahogany and sapele are the most commonly imported. Plantation timber includes teak, eucalyptus and poplar, as well as spruce, pine and fir. India's top three export markets for timber products are the United States (23 %), Germany (10 %) and the United Kingdom (9 %). Considerable swings in the rupee and US dollar exchange rates have impacted imports and the 10 % increase in import costs of logs caused by the rupee's devaluation cannot be easily sustained by industry, according to local analysts. In principle, India imports round timber logs to fuel hundreds of sawmills and create jobs. Indonesia, Malaysia and Thailand are among the other developing countries (9). In certain markets for *Eucalyptus* in Yamunanagar, it was found that the supply curve was completely inelastic and buyers, normally commission agents, determined the price, depending upon their assessment of the requirements of mills around (9).

On the supply side, there are several State Forest Development Corporations that arrange the felling of trees, including annual ones, as well as grow their forests mainly by the side of roads and railway lines and sell the timber through open auction at several auction centres. They send an intimation of the auction to traders. The forest corporations have replaced private forest contractors who used to take leases of forests and undertake the felling of trees and the sale of timber. Several regions in these three states have seen fairly rapid growth of agroforestry, mainly consisting of eucalyptus, poplar, shisham etc. The bulk of timber demand is for the production of furniture, doors, windows, their frames, pulp and paper and packaging materials. The big builders, contractors, furniture units, ply units, paper mills etc., are bulk consumers of timber. In India, most of the house construction activity is undertaken directly by households. They hire carpenters directly to make cupboards, doors, furniture etc. Many lower-middle-income and poor families continue to use timber for fuel as well as for domestic cooking and heating. Thus, one may say that industrial users, builders as well as contractors and households are the main buyers of timber. Various government agencies also enter the picture as buyers. Similarly, the price information that is relevant to the traders' decision-making is the price of the same and/ or nearby market centres (9).

NTFPs are used by an estimated 5.8 billion people globally, including 2.77 billion rural people in the Global South. Approximately half of the world's population uses wild-gathered species (the total number of species used is estimated at 50000) and 70 % of the world's poor rely on wild species for food, medicine, energy, income and other purposes (10). Women play a critical role in NTFP production, especially in Africa and Asia, where they are the primary bearers of traditional knowledge, gatherers of edible wild plants and engage in small-scale NTFP trading. In addition to physical constraints, local social conventions, personal safety concerns and family duties may limit women's participation in NTFP development (3). NTFPs have a significant impact on both the national and local economy. In India, for instance, more than 30 million people work in the NTFPs sector. Rubber products serve as a vital component of many countries' economies (11).

Major markets for timber and NTFPs

Many State Forest Corporations have long-term supply agreements with major timber enterprises. The firm offers raw materials including pulp wood at below-market prices. The majority of timber auctions in India are run by state forest organizations. Observations indicate that these auctions provide less-than-optimal prices. One alternative for gradual change in auctions could be to introduce sale-based compensation for auctioneers, giving them a greater incentive to maximize auction revenue. Allowing local communities to provide their fair share through purchasing agents or other private channels is another option (12). The explosive growth of agroforestry in Haryana and Punjab has been enabled by widespread relaxations in timber transit restrictions. Introducing a support price for forest produce produced by farmers could guarantee its safety and encourage rural producers to intensify tree planting, while also protecting them from exploitation by dealers (13). The market trends for eucalyptus plantations such as border and block plantations were studied at various stages of maturity. Farmers preferred pre-harvest sales due to the enormous labor necessary for harvesting and the malpractices that abound in the timber markets. It was revealed that 72 % of the sample farmers in both categories sold their crops before harvest. It was observed that when it came to pre-harvest sales, most growers had no idea how much timber was on their plantation. The deals were made arbitrarily. As a result, they were badly exploited by traders who had extensive expertise in the quantity, quality and market price of timber (14). Wholesale commerce for forest, agricultural and agroforestry goods is conducted from several established, sizable markets located across the nation, as shown in Table 1.

Timber trade in India

The Indian timber and furniture sector has become increasingly dependent on imports, with the majority of timber goods sourced from China and Malaysia (approximately 60 %) and the remainder supplied by Italy, Germany, the United States, Singapore, Sri Lanka, Hong Kong and Taiwan. This surge in imports has stimulated the establishment of high-end imported furniture retail outlets across major Indian cities. The liberalization of the Indian economy in the early 1990s, coupled with the domestic ban on most forms of logging, created a distinct market opportunity for the import of lumber and timber products. To safeguard the domestic sawmilling industry, the government permitted duty-free import of logs and squared logs, while finished products continued to attract substantial tariffs.

India's annual production capacity is estimated at 15.70 MCUM of plywood and decorative veneers, along with 220000 tonnes of particleboard and medium-density fibreboard (MDF). Timber in India is primarily utilized in the construction of doors, window frames, wall panels, mouldings and furniture. However, domestic manufacturing remains highly fragmented and unorganized, with much of the production-particularly for doors, windows and interior fittings—still undertaken on-site by individual carpenters. The total annual furniture market is valued at approximately US$1.25 billion, with wooden products accounting for nearly 90 % of the demand. A lack of standardized sizing continues to constrain domestic manufacturers, although this challenge is expected to diminish as the market for pre-fabricated products expands. Currently, the pre-fabricated doors and windows segment is valued at around US$20 million and is growing at an annual rate of 10 %.

Table 1. Details on major markets for forest/ farm/ agroforestry products in India (21)

State	Important marketing places
Andhra Pradesh	Chittoor, Rajahmundry, Vijayawada
Telangana	Warangal, Karimnagar, Mancherial, Kothagudem, Jannaram
Assam	Dibrugarh, Guwahati, Jorhat
Bihar	Muzaffarpur
Chhattisgarh	Bilaspur, Jagdalpur, Mungeli, Akaltara
Gujarat	Amreli, Junagadh, Songadh, Umarpada, Jetpur
Haryana	Chika, Kurukshetra, Kaithal, Ladwa, Pehowa, Pundri, Radhaur, Shahabad, Thanesar, Yamunanagar
Jharkhand	Ranchi, Daltonganj
Kerala	Thrissur
Madhya Pradesh	Balaghat, Jabalpur
Maharashtra	Ballarshah, Chandrapur, Nagpur, Pune, Thane, Mumbai
Odisha	Jeypore, Puri, Rayagada
Punjab	Ajnala, Amritsar, Hoshiarpur, Jalandhar, Kapurthala, Ludhiana, Pathankot
Tamil Nadu	Hosur (Andhiyur), Denkanikottai, Dharmapuri, Salem, Chennai
Tripura	Agartala, Dharmanagar, Udaipur
Uttar Pradesh	Jhansi, Kanpur, Ramnagar
Uttarakhand	Tanakpur, Jwalapur
West Bengal	Kolkata

Interestingly, rubber timber, once regarded merely as firewood, has evolved into a source of niche products with considerable export potential. In 2006-07, imports of timber and timber products, pulp and waste paper and newsprint were valued at ₹4101 crore, ₹2578 crore and ₹2225 crore respectively. By contrast, exports of paper, timber products and man-made staple fibre were valued at ₹4102 crore and ₹790 crore respectively, highlighting the complex dynamics of India's timber trade.

In 1998, the British Columbia Trade and Investment Office (BCTIO) explored opportunities in India's lumber and timber sector, with particular attention to private plantations such as rubber timber, which had begun supplementing domestic supplies. During this period, particleboard and MDF gained traction in the Indian market, with imports of particleboard panels for kitchen cabinets from Italy, Australia and New Zealand. Trade liberalization further reshaped the industry, as import duties on lumber and forestry products were reduced from 150 % in 1991 to 50 % by 1998, although tariffs on timber furniture remained comparatively high. The 15 % duty on log imports, abolished in 1995, was removed to ensure consistent supplies for the domestic sawmilling sector. While duties on dimension lumber and finished goods, once exceeding 100 %, were brought down to the 30 %-80 % range, Indian manufacturers and traders expected further reductions in the coming years to enhance competitiveness and affordability (4).

In India, import tariffs on timber and timber-based products vary considerably, with rates of 38 % on dimension lumber, 43 % on timber doors and windows, 69 % on timber flooring, 63 % on wooden railway sleepers, 65 % on particleboard and oriented strand board (OSB), 69 % on plywood, veneered panels and veneer sheets and 81 % on wooden furniture. While imports of fuel timber and log timber are subject to relatively lower tariffs, most other timber products attract duties exceeding 30 %. In recent years, imports of fibreboard, particleboard, veneer and sawn timber have expanded significantly, driven by growing demand in the housing, construction, household goods and packaging sectors. Notably, processed timber products such as plywood, particleboard and veneer are exempt from phytosanitary inspections, thereby facilitating easier entry into the Indian market. As indicated in Table 2, the pattern of timber trade over the past 12 years reveals a decline in the import of timber logs and veneer, accompanied by a marked increase in imports of wooden furniture, particleboard and MDF (15).

Between 1996 and 2008, the import of sawn lumber and plywood showed only marginal variation. During this period, Western India Match Company (WIMCO) initiated efforts to promote poplar-based agroforestry as a sustainable source of raw material for its match industries, offering farmers a buy-back guarantee at fixed harvest prices. However, as demand for poplar timber grew, its market price escalated to levels that rendered it economically unviable for the match industry and the species gradually became the primary raw material for plywood production in northwestern India (16). Establishing support prices for farm-grown forest produce could encourage rural producers to expand tree planting while protecting them from exploitation by intermediaries. The widening demand-supply gap for raw materials in pulp and paper, veneer and plywood, hardboard and

Table 2. Changes in timber and timber products in India during 1996 - 2008 and production in 2020 - 21

Item	1996 - 97	2008 - 09	Percent change	Production in 2020 - 21(MCUM)
Timber logs (HS 4403)	247	1147	-24	85*
Sawn wood (HS 4407)	5	31	0	6.89**
Veneer (HS 4408)	6	21	-1	2.95***
Plywood (HS 4412)	4	34	0	2.54***
MDF/ HDF (HS 4411)	1	51	3	-
Particleboard (HS 4410)	4	71	3	-
other products	4	1397	80	-
Wooden furniture (HS 9403)	1	324	19	-
Total timber products	271	1722	-	-

Source: Project report by Kondas et al., 2012 (15). *TOF resources in India, 2020. ** FAOSTAT. *** ITTO (2019).

safety match industries highlights the increasing difficulty of meeting industrial requirements solely from natural forests. Agroforestry plantations thus represent a vital strategy, simultaneously supplementing timber supply, conserving natural forests and enabling the cultivation of food grains, oilseeds, cash crops and fodder. In parallel, Tamil Nadu has emerged as a pioneer in the palm products sector, with an estimated 5.1 crore palmyra trees under the oversight of the Tamil Nadu Palm Products Development Board. The state produces a wide range of commodities-including palm jaggery, palm sugar, palm candy and several non-edible products-that cater to domestic demand while also finding export markets in the United States, United Kingdom, Belgium, Japan, Germany, Australia and the Netherlands (4).

This study encompasses both timber and NTFPs. While much of the existing research has focused on individual timber or non-timber products in isolation, this review seeks to provide a comprehensive assessment of the overall demand, supply and market prospects of forest products. The overarching objective is to enhance understanding of the behaviours, practices and policies that shape the management of timber and NTFP resources. Specifically, the study aims to:

- Identify the areas that have been researched, the aspects examined and the methodologies employed;
- Highlight critical research gaps; and

Present a set of conclusions and theoretical insights derived from the review.

Conceptual framework

The conceptual framework of this study is shown in Fig. 1.

Timber forest products

Timber is processed tree wood in any size or shape. Timber has been a valuable forest product since the beginning of time because of its higher biomass in forests and high market value. They can be softwood (pine, fir, poplar etc.) or hardwood (tropical timber: sal, teak, ironwood etc.). Almost all traditional construction uses timber. For instance, homes, ox carts, tools and bridges; in contrast, transmission poles, furniture manufacturing, the creation of parquet floors, the hardwood and plywood industries, doors, windows, boxes etc., are among the recent applications of timber. Major timber forest products, trees and their uses are mentioned in Table 3.

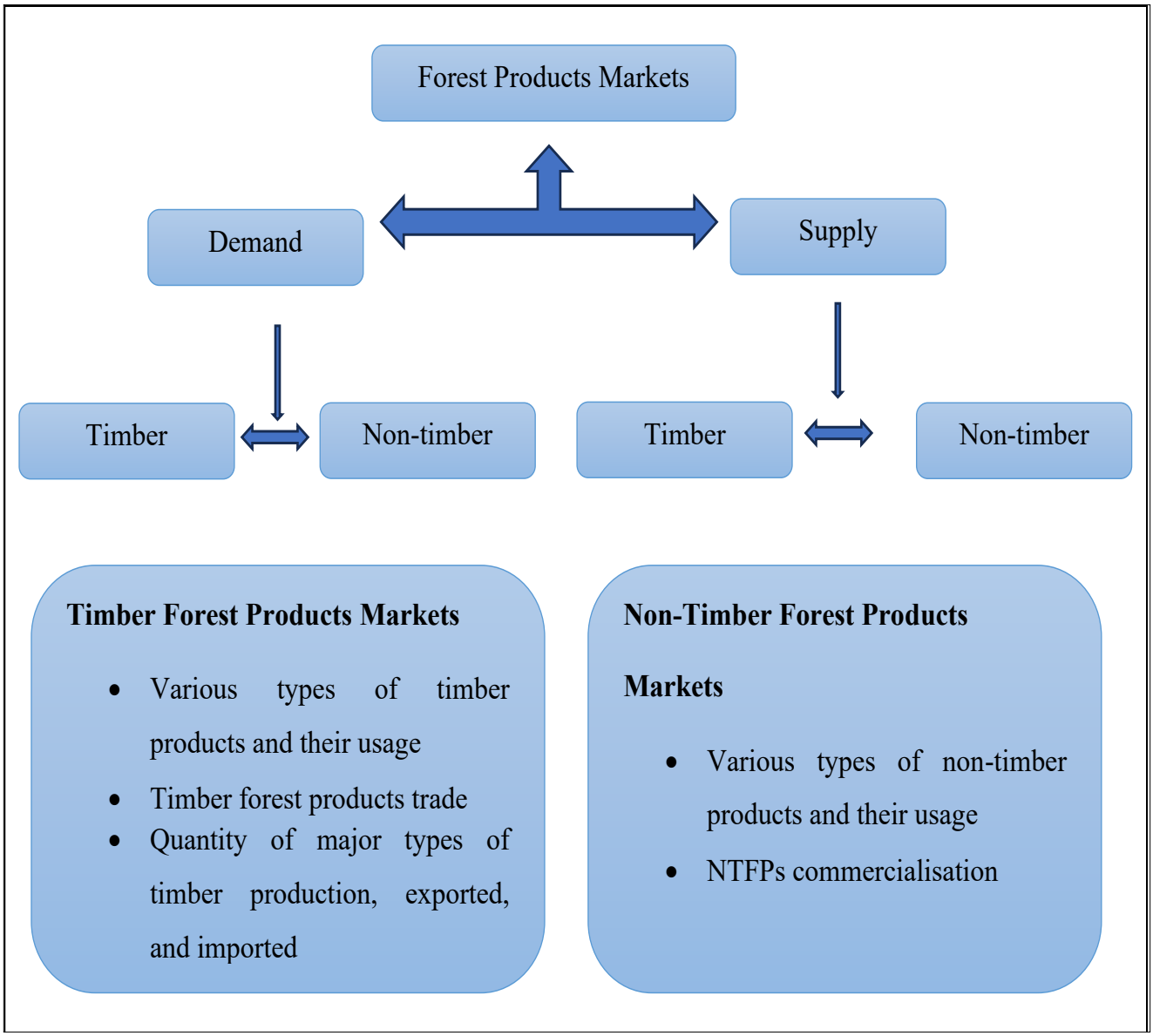

Fig. 1. Conceptual framework of timber and NTFPs markets.

Table 3. Major timber forest products

Timber forest product	Scientific name	Common uses
Teak	*Tectona grandis*	Furniture, boat building and flooring
Oak	*Quercus* spp.	Furniture, flooring and cabinets
Pine	*Pinus* spp.	Construction lumber, furniture and paper production
Mahogany	*Swietenia* spp.	Furniture, cabinetry and musical instruments
Cedar	*Cedrus* spp.	Siding, decking, outdoor furniture and closets
Maple	*Acer* spp.	Flooring, furniture, cabinets and musical instruments
Ebony	*Diospyros* spp.	Fine woodworking and musical instruments
Rosewood	*Dalbergia* spp.	Furniture and musical instruments
Ash	*Fraxinus* spp.	Tool handles, sports equipment and flooring
Walnut	*Juglans* spp.	Furniture, gunstocks and fine woodworking

Economic market values of timber forest products

Economic value, broadly speaking, is the degree to which an item's benefits exceed its costs. Benefits and expenses derived from both market and non-market usage may fall under this category. While acknowledging the significance of non-market social, cultural, spiritual and recreational values in many places across the United States and the world, we concentrate here on market-oriented values. To translate non-market values into monetary terms, economists employ a variety of techniques, yet discussing these is outside the purview of our study.

Timber forest products trade

Later postwar GATT agreements typically favored the trade of forest products. Global trade in forest products has expanded, with more countries becoming importers and exporters of different forest products. The trade barriers for forest products have decreased recently, especially in the post-Tokyo Round era (17). To enhance the amount of rent collected from tropical forest resources and to provide incentives for additional domestic processing, producer governments have implemented export bans, restrictions, quotas and levies. The world-level timber production, import and export are mentioned in Fig. 2 - 4 (18).

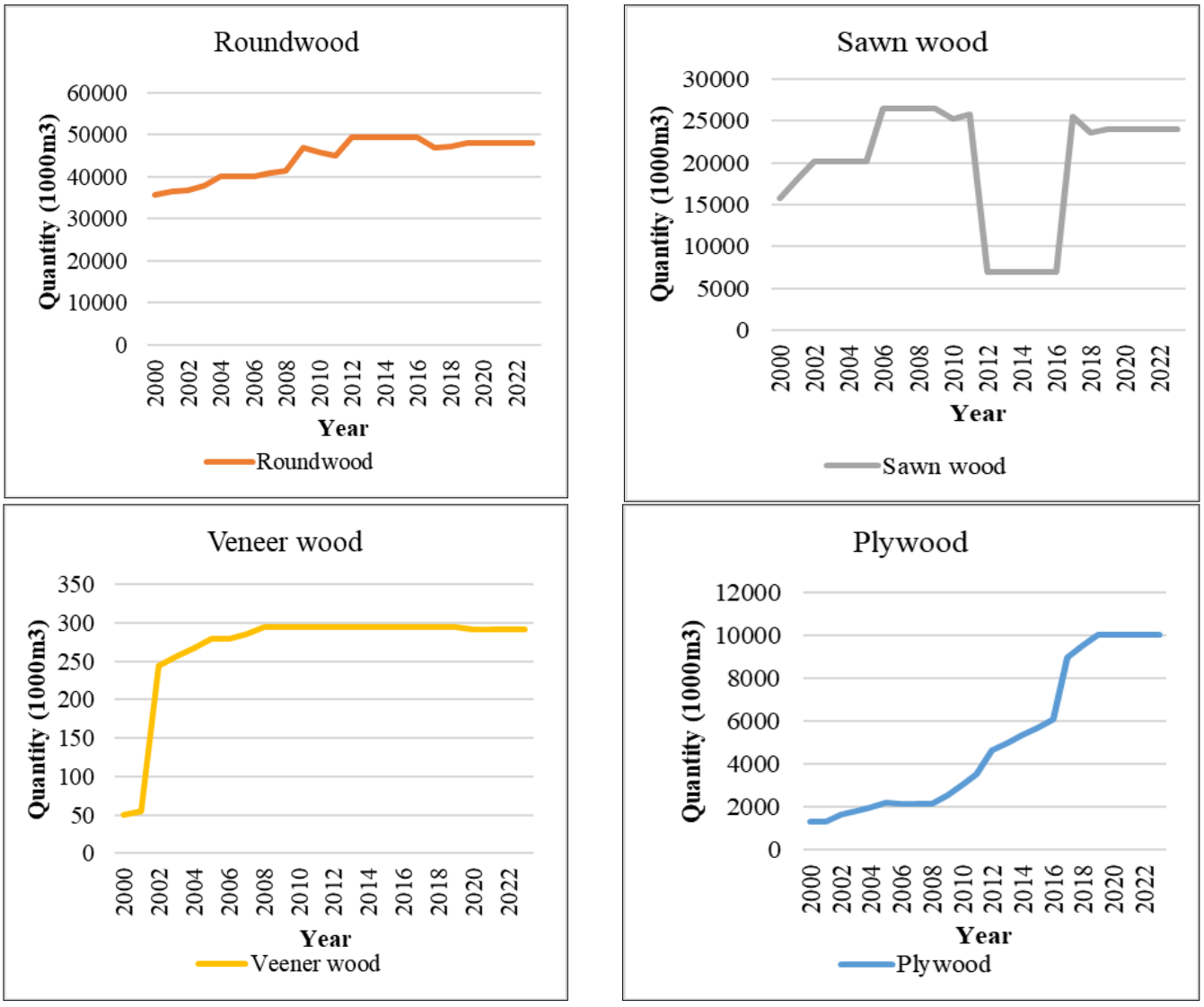

Fig. 2. World level timber production quantity (1000 m^3) 2000 - 22 (18).

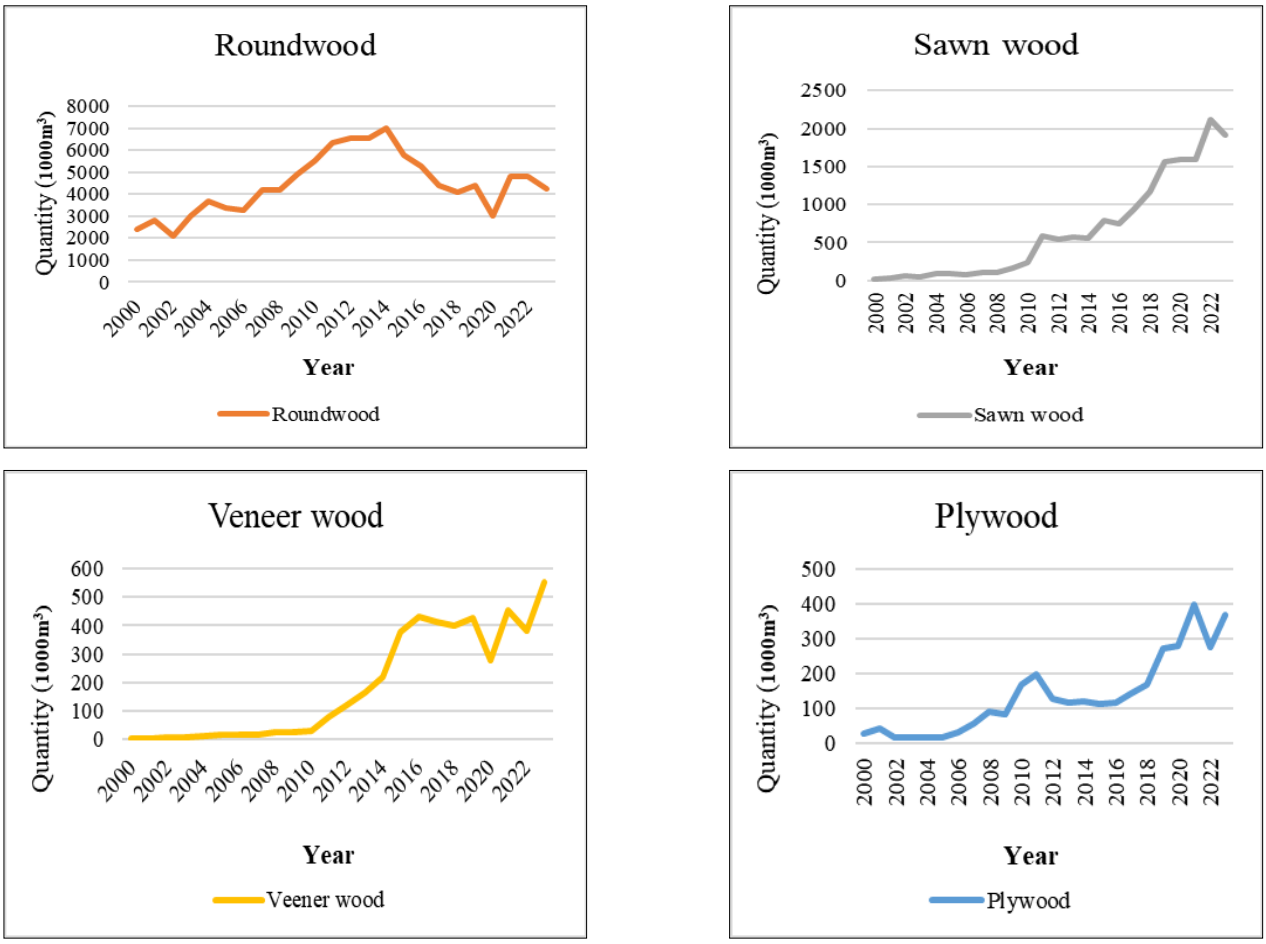

Fig. 3. World level timber import quantity (1000 m^3) 2000 - 22 (18).

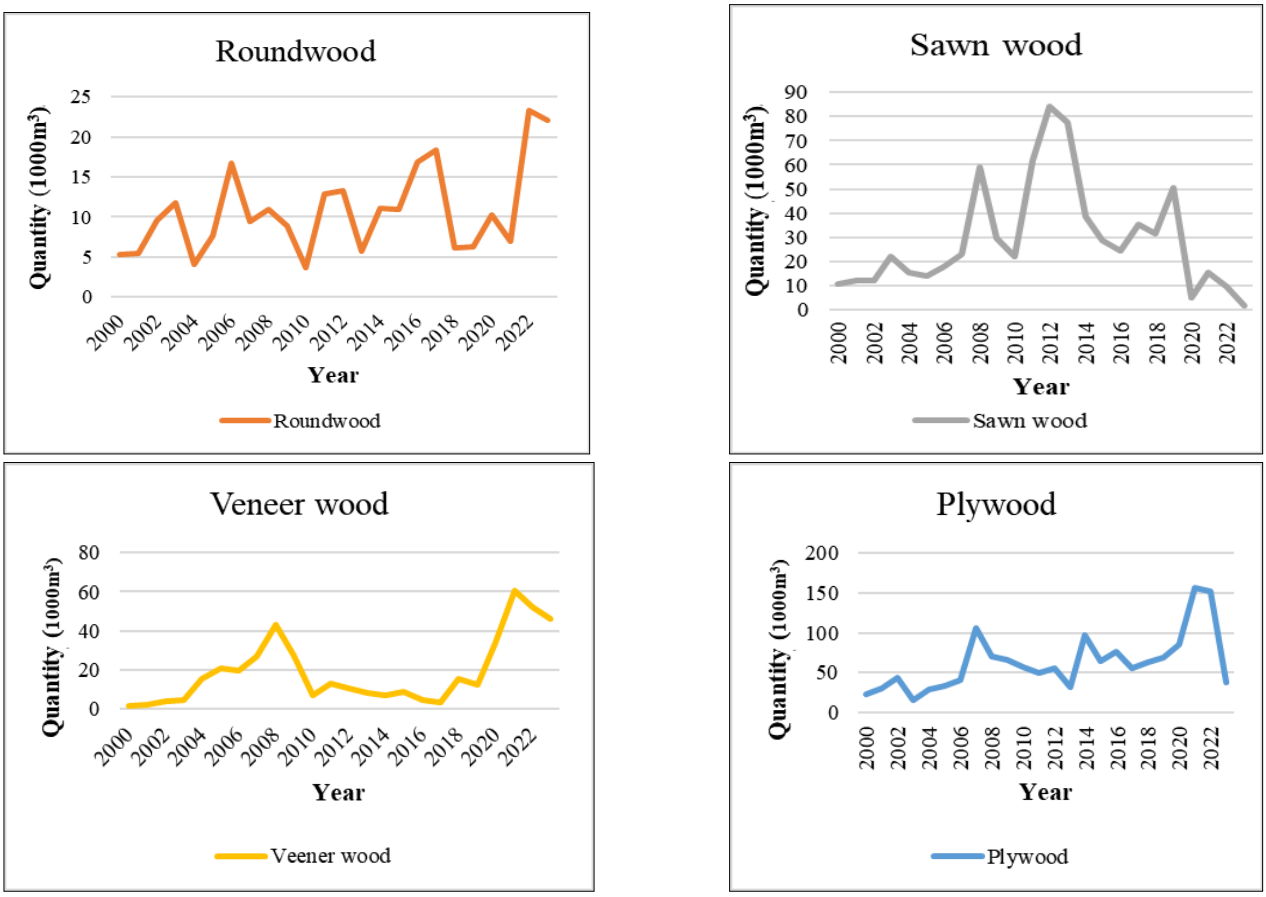

Fig. 4. World level timber export quantity (1000 m^3) 2000 - 22 (18).

Fig. 2 states that the volume of roundwood produced globally in 1990 was 1550349 (1000 m^3), followed by veneer at 7740 (1000 m^3) and plywood at 55338 (1000 m^3). The volume of roundwood produced globally was 2011135.99 (1000 m^3), veneer produced was 16971.06 (1000 m^3) and plywood produced was 129129.50 (1000 m^3) in 2022.

Fig. 3 states that the volume of roundwood import quantity globally in 1990 was 91625.54 (1000 m^3), followed by veneer at 1247.09 (1000 m^3) and plywood at 12817.99 (1000 m^3). As of 2022, the volume of roundwood imported globally was 123504.09 (1000 m^3), veneer produced was 6025.35 (1000 m^3) and plywood produced was 29106.89 (1000 m^3).

Fig. 4 states that the volume of roundwood export quantity globally in 1990 was 91201.56 (1000 m^3), followed by veneer at 1249.19 (1000 m^3) and plywood at 12979.71 (1000 m^3). As of 2022, the volume of roundwood exported globally was 123345.12 (1000 m^3), veneer produced was 5643.32 (1000 m^3) and plywood produced was 26773.74 (1000 m^3).

NTFPs

NTFPs are derived from a variety of forests, not just those that yield timber (5). Researchers have examined how NTFPs benefit native inhabitants and other groups that live close to forests by providing income and serving as a means of conservation (19). The NTFPs have been the subject of investigations. Often called NTFPs or minor forest products, the term refers to a broad category of diverse and unique natural resources. Through both market and non-market routes, NTFPs support the overall economy. This industry, markets and distribution channels are generally understood but market dynamics and influencing variables, on the other hand, are not well understood. Furthermore, there is a widespread belief that buyers, harvesters and businesses involved in the sector are reticent to divulge specific information. Production of this "sector" cannot be sufficiently summarized by a single classification method or data source and merging data from many sources leads to gaps and inconsistencies. A thorough and dynamic investigation of the economic valuation of forests for the various non-timber goods collected and exchanged in formal and informal marketplaces is hampered by the lack of available data. Major NTFPs, trees and their uses are mentioned in Table 4 (2).

Trends in production volume of five major NTFPs are presented in Fig. 5. Nuts and natural rubber saw the greatest output growth between 2000 and 2022 (165 % and 113 % respectively), whereas honey, game meat and beeswax saw lower increases. Consumers are becoming more aware of the health benefits of eating edible forest products like nuts and honey, as well as being interested in natural and sustainably sourced goods. New technologies have also contributed to an increase in production volume. Natural honey and beeswax contain both forestry and agricultural materials.

Table 4. Major NTFPs

NTFP	Scientific name	Uses
Bamboo	*Bambusoideae* spp.	Construction material, furniture and crafts
Medicinal Plants	Various species	Herbal medicine and supplements
Edible Fruits	Various species	Food, beverages, jams and jellies
Nuts and Seeds	Various species	Food, cooking oil and cosmetics
Resins and Gums	Various species	Adhesives, varnishes and incense
Honey	*Apis mellifera*	Food, sweeteners and cosmetics
Mushrooms	Various species	Food, dietary supplements and medicinal
Wild Berries	Various species	Food, beverages, jams and preserves
Essential Oils	Various species	Aromatherapy, perfumes and cosmetics
Palm Products	Various species of palms	Cooking oil, soap and basketry
Rattan	Various species of palms	Furniture, basketry and handicrafts
Rubber	*Hevea brasiliensis*	Latex production, tyres and rubber products

Source: Study research, 2025 (2).

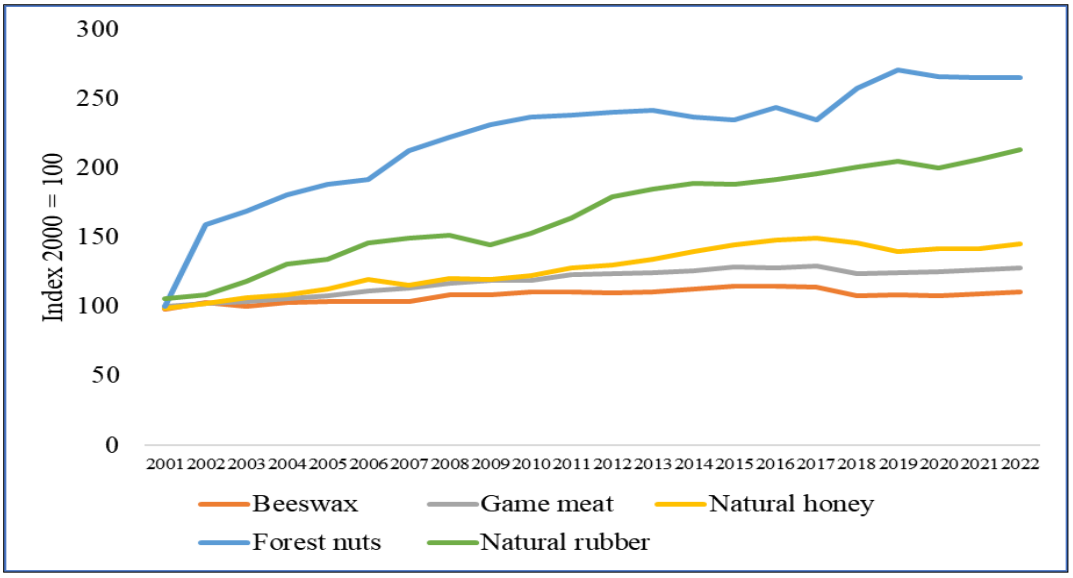

Fig. 5. Trends in production volume of five major NTFPs (2000 - 22) (23).

NTFPs distribution and commercialization

Reviewing the literature on the relationship between poverty and commercial NTFP collecting and marketing revealed several broad trends, with some significant outliers. First, research from the tropics indicates that the impoverished in rural areas may rely nearly entirely on the commercial extraction of NTFPs for their subsistence. The cheap capital needs of NTFPs are one of the main reasons why the impoverished rely on them so extensively for their livelihoods. However, other studies have found circumstances where only those with adequate funding for labour mobilisation or equipment can benefit from commercial NTFPs. While NTFPs are a vital source of income for the rural poor and regularly aid them in overcoming the income gap with wealthier strata, they are rarely a way to accomplish socioeconomic advancement.

Depletion and sustainability economics

The expressions "supply" and "demand" have highly technical meanings among economists. Nonetheless, these terms are utilized less strictly in the evaluated reports. Demand tends to be synonymous with use, for the market or subsistence. This is a clear account of a study on the markets and applications in Ghana's southern forest regions, carried out by the Forest Resources Management project. The primary project goal is to “assess demand”, to “examine people's consumption of timber and NTFPs” and “the trade of NTFPs”. The second project goal is to inventory “the existing stock of selected timber and NTFPs” in forest reserves to assess the supply of both (11). The way above of utilizing supply and demand is not very useful for predicting how the resource base will evolve as the amount changes over time. The most important factor in any subject of sustainability economics is time. Before resource depletion or extinction occurs, a variety of possible behaviours could be anticipated if the marginal costs of providing a specific timber and NTFPs climb sharply over time.

Domestic markets and businesses

A monetary transaction or some sort of exchange, such as bartering may take place in a market. Timber and NTFPs are traded in a variety of marketplaces such as online markets, wholesale or commodity markets, retail stores that are local or portable, retail stores that cater to strangers and exchanges with known associates (20). The NTFP and timber markets frequently combine formal and informal markets, which are defined as those that are "neither government regulated nor fully taxed" since they function outside of national reporting and regulatory frameworks.

Methods and Methodology

Search and information sources

The review applied the search phrases timber and NTFPs demand and supply in the economy to search widely the papers on Google Scholar and Scopus. The time frame for publication years for analytical data stretched from 1996 to 2022. Only published papers were considered in this systematic review to increase the review's trustworthiness.

Data collection process and article screening

The data featured information concerning the paper's publishing year, length of timber NTFP income, authors, country, title, abstract, keywords and NTFP usage kind. In the second stage of screening, the articles were examined and the context of the keywords used in each article's abstract and title was examined. Using this method, articles might be categorized into two groups: those that mostly discuss the kinds of timber and NTFPs and how they support livelihood and those that don't. After that, the suitability of the remaining articles was assessed separately by closely examining the complete texts of the chosen papers. The process of choosing publications involved mainly reading the titles, abstracts, conclusions and findings of the articles. Only relevant papers covering timber and NTFPs with import-export quantities, revenue contributions and usage types were chosen from the entire corpus of articles found in various databases because they met the qualifying requirements for this overview.

The selected publications were categorised by this study based on several attributes to address the research topic. The volume of imports and exports, the production from timber and NTFPs were looked at. We also examined the second study topic, which asked about the kinds of timber and NTFPs used globally, in addition to the first one. While certain NTFP and timber varieties are common in almost every one of the nations, others are common in one area but not in another. The strategy encompassed everything in the PRISMA flow chart illustrated in Fig. 6.

Results and Discussion

The initial literature search conducted through multiple databases and search engines yielded 862 records. However, several entries were excluded at the preliminary stage, as they were unrelated to the review topic despite containing the keywords “timber” and “NTFPs” in their titles, abstracts or keywords. A subsequent screening of the full-text content led to the removal of additional articles that did not satisfy the established eligibility criteria. Ultimately, only 19 documents were deemed suitable and accessible for inclusion in the review. Analysis of search preferences indicated that more than half of the selected studies relied primarily on Google Scholar, followed by Research4Life, Scopus/Elsevier, EMBASE and PubMed in descending order of use. The reviewed body of literature highlights the progressive development of research on NTFPs and their linkages with livelihoods, reflecting both the growing academic interest and the evolving scope of inquiry in this field.

This review provides an overview of timber and NTFPs, exploring their significance in various subject areas such as sociology, economics and environmental studies. It delves into key topics including forestry, NTFPs, forest management, ecosystem services, sustainable development and resource use. Additionally, it discusses related subjects like forest legislation, forest inventory, forest economics, forest dynamics and environmental economics. The paper also addresses the economic values associated with forest resources, conservation status, conservation of natural resources and cultural practices.

Fig. 7 illustrates the minimum number of research studies conducted from the year 1996 to 2022, focusing primarily on the keyword “demand and supply” of timber and NTFPs. The graph indicates a scarcity of research in this specific area over the analyzed period. This scarcity highlights a potential gap in the literature concerning the dynamics of demand and supply within timber and NTFPs markets. The data suggests a need for further

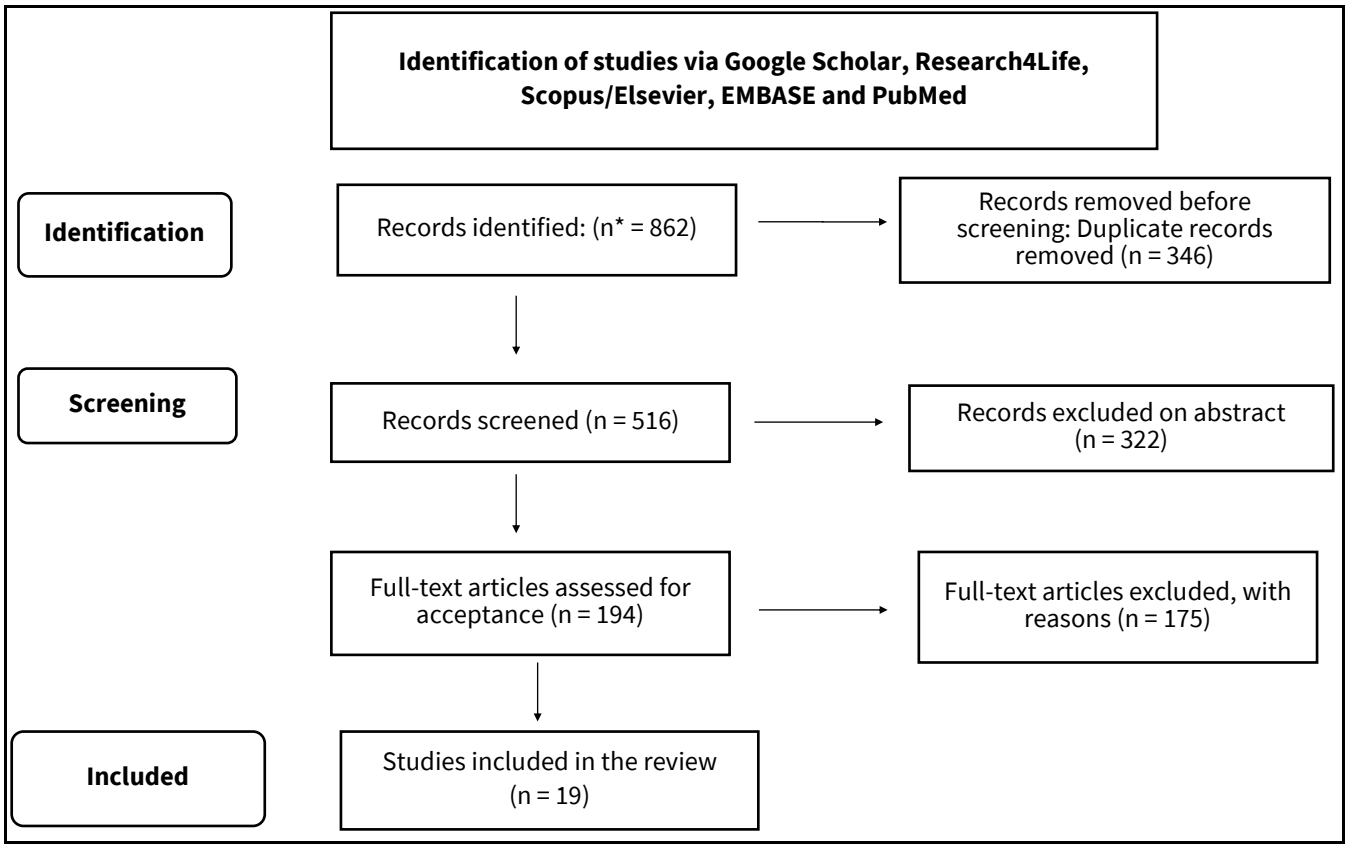

Fig. 6. PRISMA flow chart of the study selection process.

* If feasible, take into account the number of records identified from each database or register that was searched (rather than the overall number found from the databases).

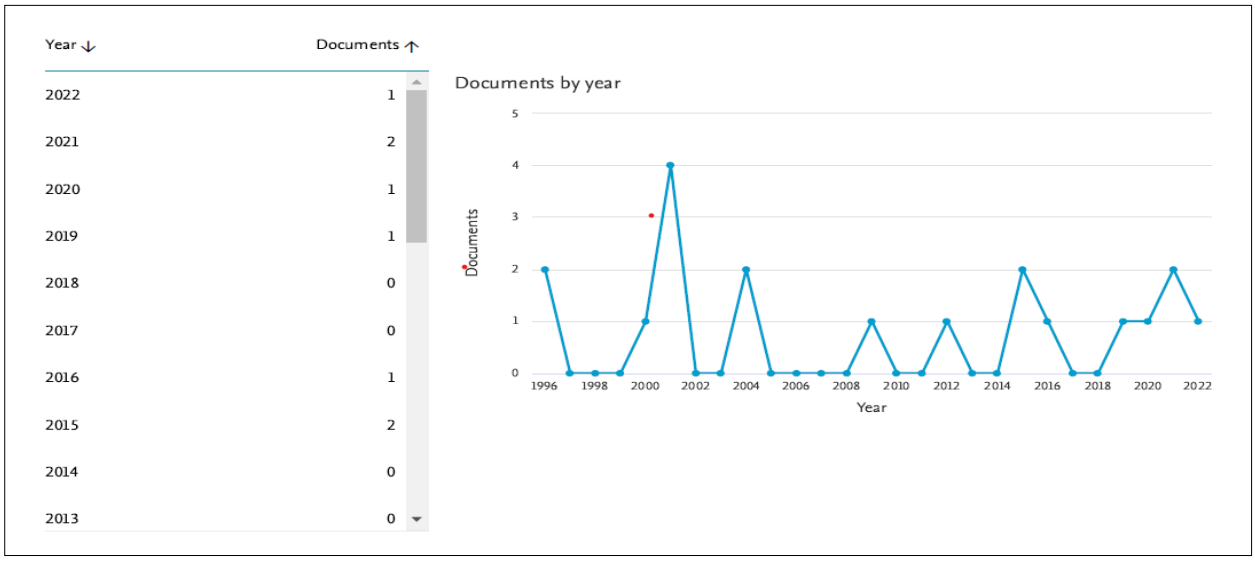

Fig. 7. Relevant articles screening from 1996 to 2022.

Source: Google Scholar, 2024.

investigation and scholarly attention to better understand the intricacies of demand and supply interactions in the context of forest products. Addressing this gap could provide valuable insights for policymakers, industry stakeholders and researchers seeking to enhance market efficiency, sustainability and resilience in the forestry sector.

The review intended to carry out an in-depth study of the relevant literature regarding the kinds of timber and NTFPs used and their economic contributions. In addition to providing an up-to-date, complete perspective, the study identified the historical trend, areas, the income contribution of timber and NTFPs and the type of usage of timber and NTFPs. The major subject areas are environmental science, agricultural, biological and social sciences, energy, biochemistry, earth and planetary sciences and economics details are shown in Fig. 6. The results of the analysis indicate that round timber and wild fruit are the most common types of timber and NTFP since they are mentioned in nearly all of the published works. This review included numerous studies from several countries to show the prevalence of a broad variety of NTFPs; nevertheless, not all timber forms and NTFPs were dealt with in an identical publication.

Conclusion and Recommendation

In this review article, we have examined the intricate dynamics of timber and NTFPs markets with a particular focus on understanding the demand and supply factors. The demand for timber and NTFPs is driven by population growth, urbanization, income levels, consumer preferences and government policies. In developed countries, there is a rising demand for sustainably sourced timber products due to concerns about deforestation and climate change. Conversely, in emerging economies, rapid urbanization and industrialization are fuelling demand for timber for construction and manufacturing purposes. Despite the increasing demand, the supply of timber and NTFPs faces numerous challenges such as illegal logging, land conversion, forest degradation, invasive species and climate variability. Sustainable forest management practices aim to balance economic profitability with environmental and social considerations.

More effective and sustainable preservation efforts for forests are required to connect with Sustainable Development Goals (SDGs), notably SDG 12 (Responsible Consumption and Production) and SDG 15 (Life on Land), which are critical for conservation and hold considerable carbon stocks. Afforestation and reforestation efforts should prioritize the restoration of various natural forest ecosystems above the establishment of monoculture plantations, which are frequently unsuited to local climates and ecological conditions. These projects must take into account local socioeconomic situations and seek to assist the surrounding communities. Agroforestry measures such as planting trees along agricultural borders can minimize soil erosion and wind speed while increasing land production. Tree agriculture requires fewer labour inputs and less water than traditional crops, which aligns with SDG 12's call for responsible resource use. Furthermore, promoting the production of economically significant forest products such as gooseberry, tamarind and mustard, can improve farmers' livelihoods and offer enduring income prospects, so fostering sustainable rural development.

In support of SDG 15, governments and regulatory agencies should enact tougher rules and processes to address illegal forestry and unsustainable harvesting. This includes putting in place comprehensive monitoring mechanisms, maintaining openness throughout the wood and NTFP supply chains and imposing real consequences for noncompliance. Stakeholders in the forestry sector must embrace sustainable forest management approaches that preserve ecological integrity and long-term forest productivity. Certification systems, community-based forest management and targeted expenditures in conservation and reforestation can all play important roles in accomplishing these sustainability goals. To alleviate supply constraints and meet evolving consumer demands, there is a need for market diversification and innovation. This includes exploring alternative sources of timber and NTFPs, investing in value-added processing and leveraging technology to enhance forest management and supply chain traceability.

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Authors' contributions

RR participated in the research activities, establishment, statistical data analysis and the writing of the research article. SVR, AV, KB, PB, RPS and RD edited and reviewed the research article. Every author reviewed and endorsed the final manuscript.

Compliance with ethical standards

Conflict of interest: Authors do not have any conflicts of interest to declare.

Ethical issues: None

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