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Analyzing the Supply Potential and Demand for Wood Products in Ethiopia: A Review

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ABSTRACT

Ethiopia's growing population, urbanization, and booming construction industries are all factors in the country's rising demand for wood products. The country's current plantations are inadequate to meet the demand for wood products. The country only exports a small amount of wood, accounting for about 1.45% of all imports, while importing over 3 million m^3 round wood equivalent (RWE), amounting to about USD 182.53 million. This showed that there is a large gap between import and export bills, which indicates a negative trade balance. The goal of this study is to examine supply patterns as well as existing and prospective demand for wood products, particularly industrial wood and wood fuel. First, a collection of all relevant documents indicating supply and demand was done. Then, two groups were created out of official records and study papers. Literature that is pertinent and related to the topic was chosen from among the groups. Different publications between 2010 and 2022 a total of 37 were utilized for this review. It was found that Ethiopia consumes more than 130 million m^3/year of round wood equivalent, of which about 92.3% is used as wood fuel and the remaining is used to produce industrial goods with added value. Nowadays, imports provide a significant amount of Ethiopia's wood demand, and in 2015 alone, more than 30% of industrial needs were satisfied by imports. The review helps in determining the resource potential, supply-demand imbalance, and current level of demand for wood products.

INTRODUCTION

Ethiopia's economic growth, rising population, expanding urbanization, and thriving construction industries are all contributing to the country's continually increasing need for wood products (Lemenih & Kassa, 2014). Ethiopia now has 1 million hectares of plantations (20% public industrial plantations and 80% private or community woodlots), however, these plantations are unable to sustainably fulfill the country's demand for wood products (MEFCC, 2018b). The rate of increase for the current plantations is less than 2%, which is incredibly slow. Moreover, they are overgrown, poorly managed, and of low production (Tadesse et al., 2019). Teshome (2021) predicts that insufficient investments in forest plantations will result in a growing supply imbalance for wood products and a related trade deficit.

Ethiopia consumes more than 130 million m^3 of round wood equivalent (RWE) annually, of which 92.3% is used as wood fuel and the remaining in the form of construction materials, lumber, wooden panels, utility poles, and other goods with added value (MEFCC, 2018b). According to the MEFCC 2018a report, imports satisfy more than 30% of the country's industrial wood demand. Ethiopia imported various industrial wood products totaling 3.006 million m^3 worth around USD 182.53 million in 2015 alone, and the trend of imports is rising. In fact, between 2007 and 2015, it has more than doubled (MEFCC, 2018b). According to this statistic, there is a big disparity between domestic demand and supply for wood products, forcing the country to rely heavily on imports and depleting its foreign exchange reserves (Desaleng & Tadese, 2010).

Although Ethiopia is importing a huge volume of industrial wood products and the quantity is growing over time, the country's wood export volume is very small, only about 1.45% of the total imported volume (MEFCC, 2018a). The negative trade balance and high dependence on imported products undermine countries' determination to achieve Sustainable Development Goals (SDGs) (Asefa et al., 2020). Increasing forest plantations and wood processing enterprises are required in the country due to global trends, regional demands, and the decline of natural forests (Lemenih & Bongers, 2010). The increase in forest plantations and related industrial development will prevent the need to buy forest products with foreign currency (FAO, 2016). Also, it will promote sustainable wood use while reducing forest degradation and biodiversity loss (FAO, 2016).

There is a shortage of comprehensive and up-to-date information on the supply and demand of wood products in Ethiopia, which calls for an analytical study to close this gap and support the policy and strategy formulation process. So, the purpose of this analysis is to provide readers with information regarding the supply, demand, and resource potential for wood products today. It evaluates the country's present and future supply and demand for wood products in particular (including wood for furniture, pulp and paper products, and wood fuel).

MATERIALS AND METHODS

To accomplish the objectives, a review of relevant literature from various sources was conducted. Screening of search outputs was performed in two stages. First, the title and abstract of identified journal articles were over-viewed. Then, suitable articles were downloaded and critically inspected for inclusion in the review. Based on the keywords and selection criteria, officially published documents and research reports different were selected and analyzed to generate relevant information on the wood demand and supply. In addition to official documents academic literatures, as well as information from the internet were included in the study. Different publications between 2010 and 2022 a total of 37 were utilized.

RESULTS AND DISCUSSION

Overview of Forest Resources in Ethiopia

Ethiopia has adopted a new technical definition of forest (Asefa et al., 2020). According to this definition, a forest is any area of land that is covered in trees (both natural and grown, including bamboo), has a minimum width of 20 meters or is no longer than two-thirds of its length, is at least 2 meters tall, and has a canopy cover of more than 20% (MEFCC, 2017). According to this definition, the country's total forest area coverage is around 20.08 million ha and accounts for approximately 15.7% of the country's total land area (EFCC, 2020). Different types of land coverings for forest vegetation, including natural forests, plantation forests, bamboo, and dense woodland (WBISPP, 2005). Therefore, the forest includes natural forests and forest plantations (Abate, 2020).

Natural forests make up the majority of the forest in the country (EFCC, 2020). There are various subtypes of natural forest, including lowland, dry evergreen forest, transitional rainforest, moist evergreen forest, Combertium-Terminallia broadleaved woodland, and Acacia-Commiphora small-leaf woodlands (Asefa et al., 2020). The dry evergreen montane forests are found in the temperate highland which includes the two Ethiopian commercial conifers tree species (Podocarpus falcatus and Juniperus procera) (IBC, 2012). Moist Afromontane forests are found mainly in the humid southwestern, south-eastern, and western parts of the country (Asefa et al., 2020). More than 650 plant species were recorded in this forest with 5% of the list being endemic plant species (Senbeta & Denich, 2006). The natural forests of Ethiopia contain about 300 commercially important tree species, of which only a small number are used in the wood industry (Kaba, et al., 2022).

Next to natural forests, plantation forests are the major sources of domestic wood production, especially for wood consumed in the construction and furniture sub-sectors (Negede et al., 2015). As raw material demand increased and the supply from natural forests shrank, timber plantations slowly expanded in Ethiopia (Eshetu, 2014). According to EFCC 2020, the total area of plantation forests in the country is estimated at about 1 million ha (Table 1). Out of this, 21% is categorized as industrial plantation and peri-urban plantations held by the

government and the rest 79% are private or community-owned woodlots (EFCC, 2020).

Industrial plantations are mainly predominately exotic species consisting of fast-growing species such as Eucalyptus, Cupressus, Pinus, Grevillea, and Acacia with only a few indigenous species (Duguma & Hager, 2010). Private and community woodlots are one of the recent developments in forestry in Ethiopia that shows a fast expansion which includes small-scale private plantations and agroforestry (IBC, 2012). Small-scale plantations provide the majority of poles and posts used in construction as well as for the country's fuel needs (Lemenih & Kassa, 2014).

Table 1. Plantations in Four Regional States of Ethiopia (in ha)

Region	Industrial plantations	small-scale plantations	Peri-urban plantations	Total plantations
Oromia	78,800	27,800	26,700	133,300
Amhara	44,600	639,400	-	684,000
SNNPS	27,300	124,157	-	91,300
Tigray	39,700	23,700	-	63,400
Total	190,400	815,057	26,700	1,032,157

Source: (Lemenih & Kassa, 2014, EFCC, 2020).

The estimated potential of wood flow from the industrial plantations is 4.8 million m^3 per year. According to Negede et al. (2015), they are poorly managed, and most are over-mature with low productivity. As pointed out by Senbeta & Denich (2006) applying improved management regimes and practices could double the yield of commercial plantations.

Wood Products Demand

Due to Ethiopia's accelerated economic development, urbanization, and growing population, demand for all wood products and other goods is rising quickly (Lemenih & Kassa, 2014). Despite the strong expected growth in demand, there are challenges related to the quality of current supply not always meeting market expectations, increasing the risk of substitution for alternative materials (Rawat & Tekleyohanes, 2021). The gap between the demand and supply of wood products widened over the years since the supply from domestic production along with the import was not enough to meet the domestic requirements (Girma & Abate, 2021).

Industrial wood consumption in Ethiopia is one of the lowest in the world due to the fact that the country has limited forest resources (Bekele, 2011). Industrial wood includes sawn wood, plywood, wood furniture, construction wood, paper and paper products, wood pulp, veneer wood, poles, particle boards, MDF, etc. (Kaba et al., 2018). Among industrial wood, the demand for construction wood, furniture products, pulp and paper products, and utility poles is estimated to be approximately 8.4 million m^3 RWE (MEFCC, 2018b). In 2016, the World Bank Group reported that the demand for sawn wood in 2015 was 0.633 m^3 and that it is expected to rise to 0.75 million m^3, 1.5 million m^3, and 2.24 million m^3 in 2020, 2030, and 2040, respectively (Table 2). Projections for sawn wood demand show a considerable increase in demand, which needs to be matched with production or an increased volume of imports (MEFCC 2017). The existing sawmilling industry cannot meet the growing demand for sawn wood (Desalegn et al., 2015). Because the majority of Ethiopia's wood companies were privately owned, and their primary source of wood was pit sawed lumber primarily from the country's natural forests (Birhan, 2014). Furthermore, due to the shortage of supply and poor quality of locally produced sawn lumber, the majority of industries use imported lumber to make furniture (Kaba et al., 2022).

The anticipated furniture demand for urban and rural families was 343,000 m^3 and 329,000 m^3, respectively (MEFCC, 2017). To meet furniture demand in Ethiopia's indigenous woods like *Cordia africana*, *Juniperus procera*, and *Podocarpus falcatus* are primarily employed because these are considered to be of superior quality (Kaba et al., 2022). According to Koch (2020), the majority of the demand for furniture is met by small-scale enterprises. In addition to the unpredictability of the

domestic wood supply, these enterprises face a number of obstacles that hinder their growth and frequently place them in a precarious survival situation to meet the rising demand for furniture (Birhan, 2014). These obstacles include infrastructure constraints, unfavorable market conditions, inadequate government support, and skill gaps (Tafesse et al., 2016).

Plywood import data have shown rapid growth over recent years, reflecting growing demand for this wood product (WBG, 2016). Thus, the demand for paper and paperboard has grown by 6-7% annually over the past few years (ECRA, 2016). According to WBG, (2016) report in 2010, consumption per 1000 people was only 1.2 kg, but by 2015, it had increased to 1.7 kg. In 2040, it's expected to weigh more than 7 kg.

Table 2. Industrial Wood Demand between 2015 and 2040 by Product Type

Product Type	2015	2040
Sawn wood	633,000	2,200,000
Plywood	11,700	715,000
Veneer and particle board	91,700	88,500
MDF	12,000	375,000
Furniture	69,996	7,699,560
Utility poles	40,000	500,000
Pulp	5,500	20,000
Paper and paper board	357,590	2,383,900
Total	1,221,486	13,981,960

Source: (WBG, 2016)

In addition to the national level of wood product demand and supply, the regional distribution and projection of wood demand in the country is described in this analysis. Studies on demand prediction for wood products from 2015-2040 show that under a fast urbanization scenario, the urban population will increase by 15 million people in Oromia, 0.86 million in Amhara, and 0.58 million in southern regions by 2040 (WBG, 2016).

The urban centers with high population growth in Oromia are most likely those surrounding Addis Ababa and other emerging towns, such as Adama, Bishoftu, Shashamane, Asela, and Jimma. The other regions, Amhara and SNNPR, will also experience a rapidly increasing population, including urbanization (Figure 1). The rise in the urban population will be accompanied by an increased construction sector and more household-based wood products demand (WBG, 2016).

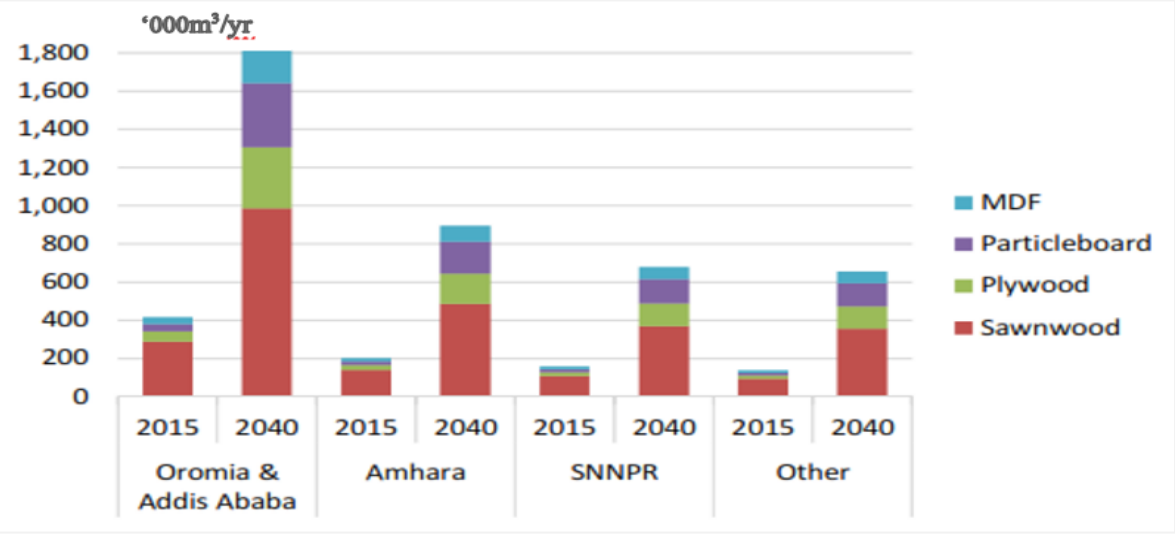

Figure 1. Regional Distribution of Wood Demand. Source: (WBG, 2016)

Wood Products Supply

In Ethiopia, wood and other forest products supply come from domestic production and import (WBG, 2016). According to Alem (2016), Ethiopia imported different processed wood products like plywood, MDF, chipboard, wood pulp, paper, and paperboard, etc. in the years between 2005 to 2013 and spent USD 55.3 million per year. Wood pulp was exclusively imported for the production of paper and paperboard. Other wood products like plywood were worth USD 10.6 million and the import for particleboard was USD 5.6 million in the same years (WBG, 2016). According to MEFCC (2018a), Sawn wood annual import in 2015 alone was 29285 m^3. Moreover, wood products like wooden sleepers, veneers, joinery, and carpentry are also characterized increasingly by high import and low domestic production. The increasing dependence on imports is a matter of serious concern for the forest sector in Ethiopia (MEFCC, 2018b).

Domestic production of industrial wood comes from plantations and woodlots and illegal logging from natural forests (FSR, 2015). Although production from natural forests has long been banned, a significant amount of illegal wood production continues to take place throughout the country (Table 5). In 2015, domestic wood production was estimated to be approximately 5.43 million m^3 (Table 4). The bulk of this wood production comes from woodlots in the form of poles, used in both traditional and modern construction.

Table 3. Domestic Industrial Wood Production in Ethiopia in 2015

Supply (m^3 RWE)	Construction wood	Furniture	Utility pole	Total
Woodlot	4336,579	0	0	4,336,579
Plantations	107,178	332,000	40,000	479,178
Illegal logging	0	613,548	0	613,548
Import	2,578,826	69,996	0	2,648,822
Total	7,022,583	1015544	40,000	8,078,127

Source: (MEFCC, 2018b)

The primary and most significant use of wood in Ethiopia is for fuel (firewood and charcoal) (WBISPP, 2004). The annual volume of wood gathered for fuel is about 120.4 million m^3 round wood equivalent (RWE), which includes 115.024 million m^3 of firewood and 5.408 million m^3 of charcoal (FSR, 2015). As revealed by Mulu (2016) about 80% of rural household energy consumption is firewood and 1.6% is charcoal. In comparison to industrial wood, the demand for wood fuel makes up around 92.3% of the total. Unknown sources make up the majority of the fuel wood supply (65.84%), followed by natural forests (28.41%) and plantations 5.61%) (Table 4). A minor amount of fuel wood is also imported and sourced from wood waste (MEFCC, 2018a).

Table 4. Estimate of Wood Fuel Supply in Ethiopia

Forest type	Estimated annual supply of fuel wood in RWE (x 10^6 m^3)	Proportion (%)
Natural forests	33.74	28.41
Plantation forest	6.75	5.61
Wood fuel from waste	0.17	0.14
Import	0.000279	0.00
Unknown sources	79.74	65.84
Total	120.33	100

Source: (MEFCC, 2018)

The Demand-Supply Gap for Wood Products

Literature implies that the demand and supply gap for fuel wood and industrial round wood in 2013 was 37 million and 1.8 million cubic meters due to unsustainable forest extraction (FSR, 2015). According to the same study, industrial wood

demand would rise by 76%, while fuel wood use is projected to rise by 22% in 2033. Among industrial wood consumption, pulp and paper demand will be triplicated (FSR, 2015). Consequently, the gap between fuel wood and industrial wood is expected to be 80 million m^3 and 4.4 million m^3 respectively (MEFCC, 2017). It implied that these gaps could be filled for fuel wood through illegal extraction of natural resources, while for industrial wood products through import and public plantation (WBG, 2016).

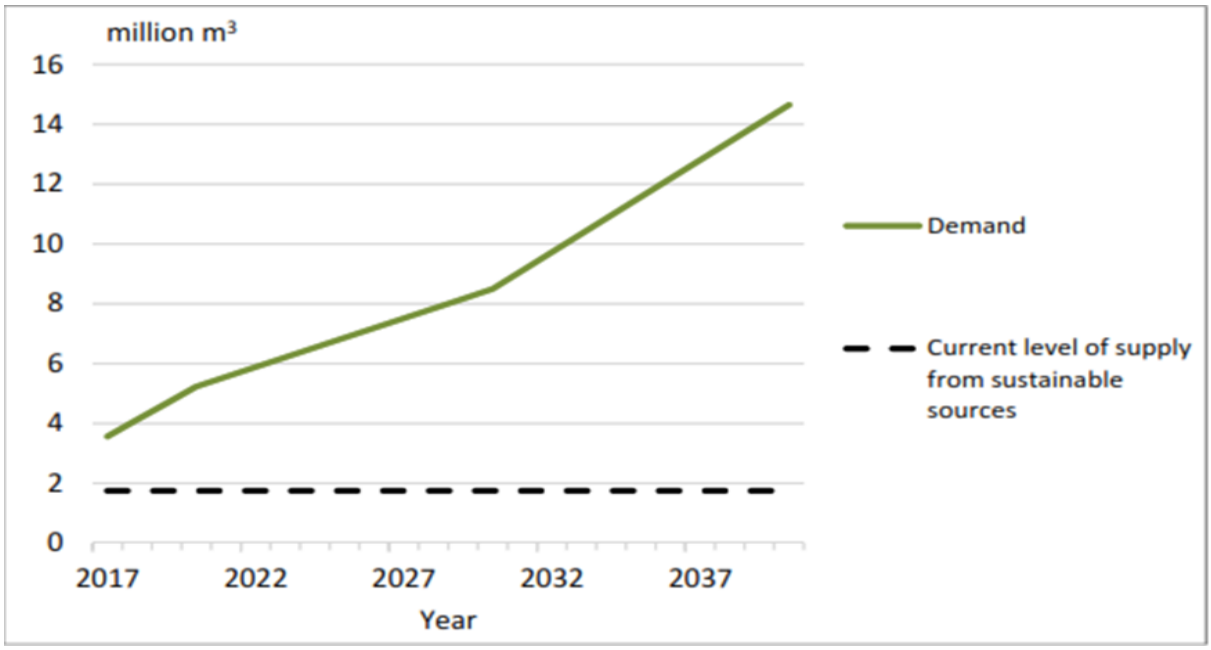

Figure 2. Wood Product Demand and Supply Gap (WBG, 2016)

According to MEFCC (2017), it was assumed that the urban population would increase to 36 million and the rural population to 107 million in 2033. Ethiopian electricity coverage will increase from 25% to almost 68% in 2033 (Ockwell et al., 2021). Economic growth influences purchasing power, improving the ability to switch from wood to electricity and purchasing more and higher value wood furniture. It forecasted that 15.1 million ha of woodlands and 13.5 million ha of shrubland will be covered by forest in 2033. Based on the above assumptions the supply of wood products in 2033 is projected to be about 13.5 million m^3 (Table 5).

Table 5. Projected Supply and Demand for Wood Products between 2013 and 2030

Sources	Supply		Wood Products	Demand	
	2013	2033		2013	2033
Woodlots	5.00	6.3	Traditional construction	6.20	9.10
Unspecified sources	1.80	4.4	Furniture small scale	0.30	0.6
Plantations	0.50	2.8	Modern construction	0.50	2.10
Import of logs and pre-products	0.01	0	Furniture industry	0.50	1.2
Import of products	0.10	0	Utility poles	0.04	0.50
Total	7.41	13.50	Total	7.54	13.50

Source: (MEFCC, 2017)

Import and Export of Forest Products

Ethiopia imports a huge volume of industrial wood, and the quantity of imports is growing. Between 2007 and 2015, Ethiopia imported various industrial wood products an average of 65,680 m^3/year (ECRA, 2016). The forest products imported by the country include a significant amount of manufactured wood products such as

furniture, paper and paper boards, joinery and carpentry products, boxes and cases, and wooden furnishing. The average import of these products is 82,251 tons/year for the 2007-2015 period. The largest import in this category is paper and paper board with an average of 70,403 tons/yr., followed by 10,186 tons/yr. of furniture. Ethiopia imported about 263,565 m^3 of sawn wood from 2007 to 2015 (WBG, 2016). Major countries of origin or consignment for wood and wood products imported to Ethiopia are Austria, China, UAE, India, Turkey, Germany, and Sweden.

Ethiopia exports small quantities of various wood products such as Poles, sawn wood, furniture, charcoal, and chip wood to Sudan and Middle East countries (Alem, 2016). Sawn wood is the product of high volume and value in terms of export (FSR, 2015). Ethiopia exports low-quality, domestically produced sawn wood while importing, which is relatively better quality but expensive sawn wood (Girma and Abate, 2021). Ethiopia's import bill is hugely greater than the export revenue leading to a large negative trade balance. The negative trade balance doubled from 77,096,160 USD in 2007 to -174,537, 053 USD in 2015 (Girma and Abate, 2021).

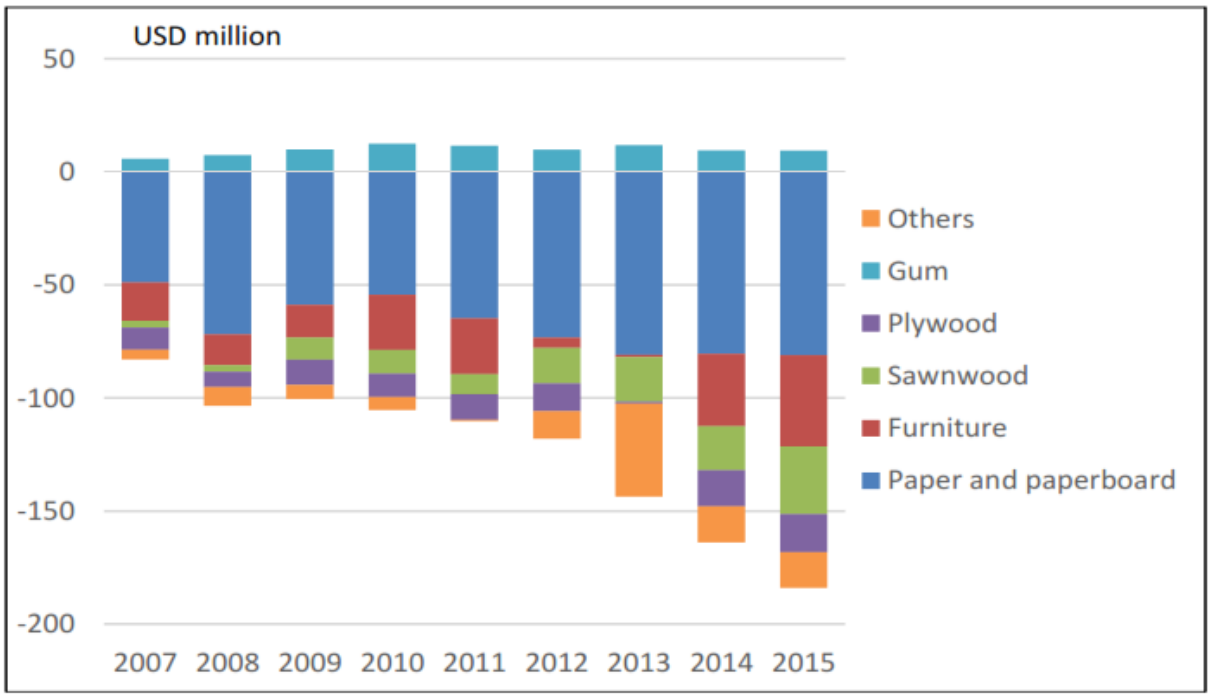

Figure 3. Forest Product Export-Import Trade Balance in USD (2007-2015) (WBG, 2016)

CONCLUSION

The demand for wood products is steadily rising in Ethiopia as a result of quick economic development, increasing population, accelerating urbanization, and expanding construction sectors. The 80,000ha individual or community woodlots and 20% public plantations, totaling 1 million ha, cannot sustainably meet the country's demand for wood products. If nothing is done, the state of the natural forest will decline further. The majority of the existing plantations are unproductive, poorly managed, and overgrown. Additionally, the pace of growth (its increase rate) is extremely low—less than 2%. The insufficient new investments in forestry plantations will result in a widening supply imbalance for wood products and a corresponding trade deficit.

Ethiopia imports a significant amount of wood products from various countries to make up for the mismatch between the supply and demand for wood products. Despite importing a sizeable volume of industrial wood products, which is growing with time, Ethiopia only exports a little amount of wood, making up just 1.45% of the total volume imported. The difference between import and export bill is very high indicating a negative trade balance.

The development of a forest information and research action plan is necessary to realize the

potential of research and enhanced knowledge management to promote sector development through informed and evidence-based decision-making. An applied research agenda needs to be combined with an incentive system to attract and maintain motivated and well-qualified professionals in the sector. To promote investments in sustainable forest management, industrialization, and professionalization of the industry, sustainable and high-quality certification for essential wood products should be taken into consideration. This helps to ensure domestic enterprises contribute a significant share of the country's growing demand for wood products.

Public policy should also consider introducing a modern wood-based housing construction program to ensure higher quality wood products have a sustainable source of demand. Parallel to this, it is necessary to address the short- to medium-term unsustainable fuelwood demand by providing accessible electricity as a substitute for unsustainable wood fuel extraction, which is a significant contributor to deforestation and forest degradation in natural forests and woodlands.

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