



# Challenges of Wood Transformation Industry in Cameroon: A Holistic Overview

Mbezele Junior Yannick Ngaba<sup>1\*</sup>, Yonga Emagueu Michel-Cédric<sup>1</sup>, Marc Clément Benenguegne<sup>2,3</sup>, Anne Stéphanie Kobla<sup>4</sup>, Njal Njock Simon<sup>5</sup>

<sup>1</sup>Higher Technical Teacher' Training College of Ebolowa, University of Ebolowa (HTTTC), Ebolowa, Cameroon

<sup>2</sup>Ministry of Higher Education, Research and Innovation, Yaoundé, Cameroon

<sup>3</sup>Field Legality Advisory Group (FLAG), Yaoundé, Cameroon

<sup>4</sup>Department of Forestry, Faculty of Agronomy and Agricultural Sciences (FASA), University of Dschang, Dschang, Cameroon

<sup>5</sup>World Wildlife Fund (WWF), Yaounde, Cameroon

Email: \*ngabajunior@yahoo.fr

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## Abstract

Over the past decade, the demand for wood has experienced a steady increase, resulting in a corresponding rise in global production. Cameroon, renowned for its abundant forest resources and substantial contributions to the global wood industry, finds itself facing numerous concerns related to sustainability, legality, and environmental impact. This comprehensive review aims to delve into the complexities of wood transformation in Cameroon, examining the challenges faced and proposing potential solutions to foster a more sustainable and responsible industry. By conducting a thorough analysis of existing literature, this review explores the multifaceted challenges pertaining to deforestation and illegal logging, unsustainable forest management, and the need for technological advancements and innovation. It becomes evident through this study that these challenges pose a threat not only to the wood transformation industry in Cameroon but also to the biodiversity, fragile ecosystems, and the livelihoods of local communities who rely on these forests for sustenance. Addressing these concerns becomes paramount for Cameroon to strive towards sustainable practices that strike a balance between economic development, environmental conservation, and social responsibility. By understanding the gravity of these challenges and taking proactive measures to tackle them, Cameroon can pave the way for an industry that not only ensures its own long-term viability but also safeguards the well-being of its ecosystems, the preservation of biodiversity, and the welfare of the local communities directly dependent on these resources.

## Subject Areas

Environmental Sciences, Forestry , Wood Industry

## Keywords

Wood Transformation, Industry, Cameroon, Review

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### 1. Introduction

The wood transformation industry in Cameroon has a deep-rooted history and has experienced significant development over the years, with its origins dating back to the country colonial era. Pineau [1], explains that the industry growth has been shaped by various factors, including government policies, economic conditions, and international trade dynamics. This growth can be attributed to favorable government policies implemented to promote the sector, resulting in timber exploitation becoming a significant economic activity. The establishment of timber concessions by European colonizers served as the foundation for industry expansion, allowing for the extraction and exportation of valuable timber species like Fraké, Ayous, and ebony [2].

In the post-independence period, the wood industry experienced substantial growth due to increased demand for timber products both domestically and internationally, aided by government policies that facilitated sector expansion. Investments in infrastructure development, such as road networks and port facilities, streamlined timber transportation and export. Additionally, the establishment or importation of sawmills and wood processing factories generated employment opportunities and contributed to the country's economy [3]. However, the rapid expansion of the wood transformation industry has had negative consequences, including deforestation and biodiversity loss [4] [5]. Over the past 25 years (1990-2015), the annual rate of forest area change in Cameroon has averaged around -1% per year, leading to significant forest depletion [6] [7]. This poses a significant threat to the industry's sustainability as it heavily relies on a steady timber supply.

The wood transformation industry in Cameroon faces various challenges, including unsustainable forest resource management. The alarming rate of exploitation has resulted in deforestation and habitat loss, with Cameroon losing an average of 220,000 hectares of forest per year between 1990 and 2010 [6]. Outdated machinery and limited access to modern technology hinder industry efficiency and productivity. Market access and trade barriers also present challenges, as the industry struggles to compete globally due to high transportation costs and trade restrictions. Moreover, the unsustainable extraction of timber resources has had adverse effects on indigenous communities dependent on these forests for their livelihoods [8]. Therefore, while the wood transformation industry plays a critical role in Cameroon's economic development, sustainable practices and conservation measures are necessary to mitigate its environmental impact and ensure long-term viability. Nonetheless, opportunities for growth and development exist within the industry. By adopting sustainable practices,

the wood transformation sector can ensure a continuous supply of timber while preserving the environment [9].

There is also a rising demand for certified wood products in international markets, creating an opportunity for the industry to tap into niche markets and gain a competitive advantage. For instance, by signing of the FLEGT VPA (Forest Law Enforcement, Governance and Trade) agreement, in particular the legality grids, takes into account aspects such as biodiversity preservation, limiting illegal logging, developing a local market (MIB), and improving the image of Cameroonian wood and wood products on the European Union (EU) and international markets. Advancements in technology and infrastructure can enhance efficiency and productivity. Government support through policy reforms, investment in research and development, and promotion of value-added products further contribute to industry growth. To provide a comprehensive overview of the wood industry in Cameroon, this study aims to conduct a systematic review of three key areas: deforestation and illegal logging, unsustainable forest management, wood industry technology and innovation. Through this analysis, valuable insights into the challenges and opportunities within the Cameroonian wood industry can be gained.

## 2. Methods

This study relies on secondary data collected from various credible sources, including peer-reviewed literature, agency reports, published papers, books, blog, website, and reports from relevant governmental and non-governmental organizations (NGOs). The collected data was then analyzed using various qualitative techniques, such as thematic analysis, grounded theory, or narrative analysis. The data collection process spanned from January 2000 to July 2021 and involved searching through websites on popular search engines such as Google and Bing. The search terms used included “wood transformation,” “industry,” “deforestation,” “illegal logging,” “unsustainable forest management,” “technology,” “innovation,” and/or “Cameroon.” These selected terms were essential in guiding the acquisition of relevant information for the study.

## 3. Results and Discussions

### 3.1. Forestry Production Sector Overview

The forestry sector in Cameroon, despite its vast potential, has historically been overlooked in economic development strategies. With approximately 22 million hectares of forests in Cameroon, nearly 18% of which are deemed exploitable, the forestry sector holds significant promise (**Figure 1**). Within this expanse, around 8 million hectares are specifically designated for forestry production, with South Cameroon having the largest surface area allocated for small logging titles. In 2019, the Ministry of Forestry and Wildlife (MINOF) granted 121 forest management units (FMUs) and issued a total of 93 forest concessions, 38 communal forests, 142 timber sales, and approximately 50 community forests (**Table 1**).

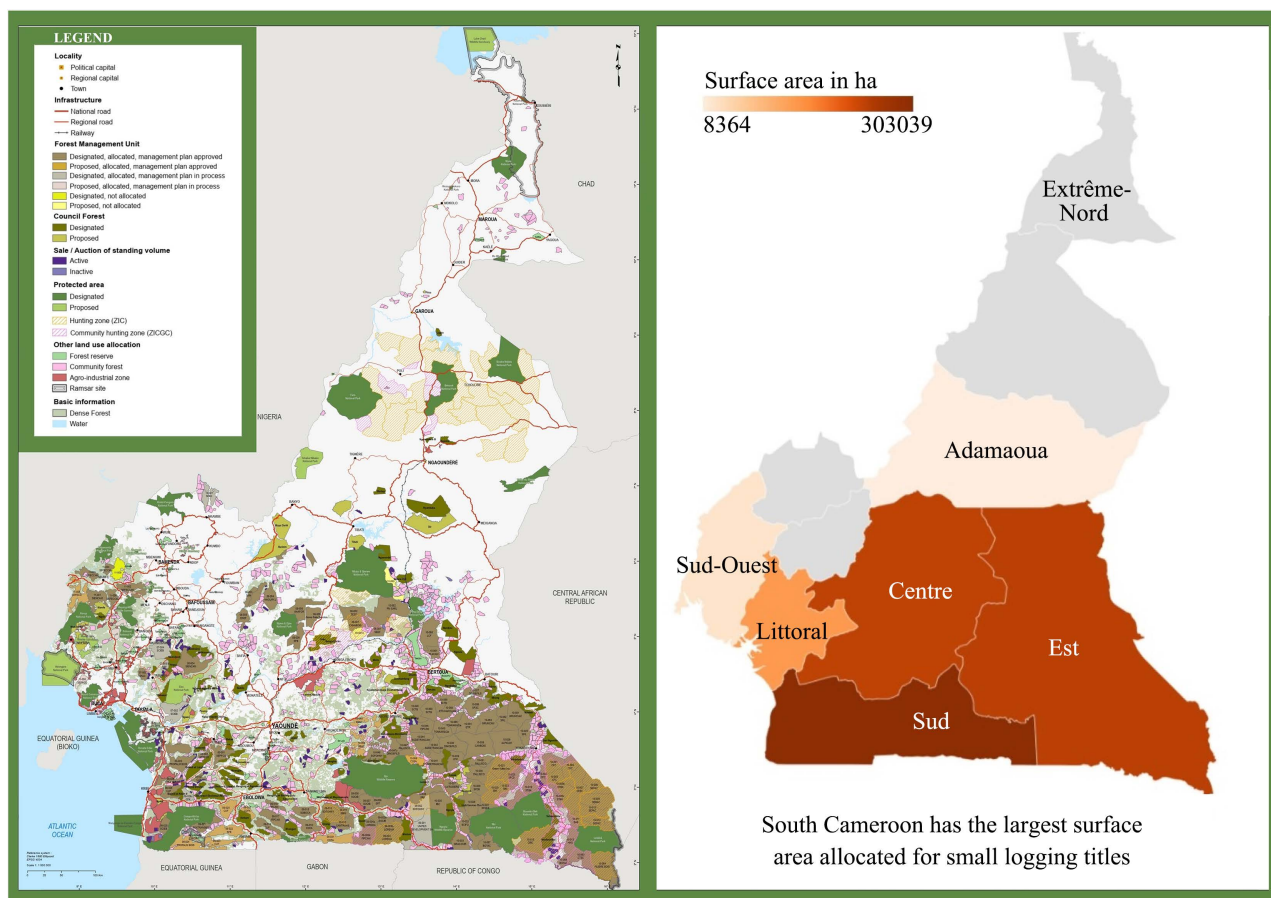


Figure 1. Cameroon forest estate, December 2022 and surface area allocated for small logging titles<sup>1</sup>.

Table 1. Permanent Forest Estate (PFE)<sup>2</sup>.

Allocation type	Number	Area (ha)
Forest Management Units (FMU)	121	7,076,782
Designated with management plans approved	100	6,015,611
Proposed with management plans approved	10	510,808
Designated with management plans in process of elaboration	7	414,197
Proposed with management plans in process of elaboration	1	27,364
Designated and not allocated	1	43,829
Proposed and not allocated	2	64,973

These forest titles are managed by a combination of approximately 50 large international or national companies, 40 medium-sized national companies, and around 30 rural communes with communal forests [10].

<sup>1</sup><https://data.globalforestwatch.org/documents/minfof::cameroons-forest-estate-december-2022/expl ore>.

<sup>2</sup><https://data.globalforestwatch.org/documents/minfof::cameroons-forest-estate-december-2022/expl ore>.

Between 2010 and 2016, the most harvested species in Cameroon included Ayous (*Triplochiton scleroxylon*), Sapelli (*Entandrophragma cylindricum*), Tali (*Erythrophleum ivorense*; *Erythrophleum suaveolens*), Azobé (*Lophira alata*), Okan (*Cylicodiscus gabunensis*), Iroko (*Milicia excelsa*), Padouk (*Pterocarpus soyauxi*), Kossipo (*Entandrophragma candollei*), Fraké (*Terminalia superba*), and Dabéma (*Piptadeniastrum africanum*) [11]. Notably, around 75% of Cameroonian wood exports in 2018 were destined for China (34%), Vietnam (19%), Belgium (12.5%), Italy (7%), and France (2.5%) (Figure 2) [11].

In 2019, the most wood domestic production in Cameroon were: logs (3,830,000 cubic meters), sawnwood (1,320,000 cubic meters), wood fuel (1,057,000 cubic meters), charcoal (503,000 metric tonnes), veneer (96,000 cubic meters), plywood (18,000 cubic meters), and wood chips (16,000 cubic meters) [12].

Recognizing the potential of effectively integrating forest resources into the development process, there is an increasing understanding that doing so can significantly contribute to overall national development, especially in rural areas [13]. However, this recognition has also unfortunately led to increased deforestation.

## 3.2. Review of the Challenges in the Wood Transformation Industry in Cameroon

### 3.2.1. Deforestation and Illegal Logging

Deforestation and illegal logging have become urgent environmental issues in Cameroon, with wide-ranging causes and consequences that require immediate attention. They occur when timber is harvested, transported, processed, bought or sold in violation of national or sub national laws. Deforestation and illegal logging in Cameroon can be attributed to several factors. One major contributing factor is (1) *corruption*, as demonstrated by Cameroon consistent low rankings on the Corruption Perceptions Index by Transparency International. In the context of illegal logging, corruption is prevalent, with government officials often demanding bribes for services like issuing logging permits. This practice

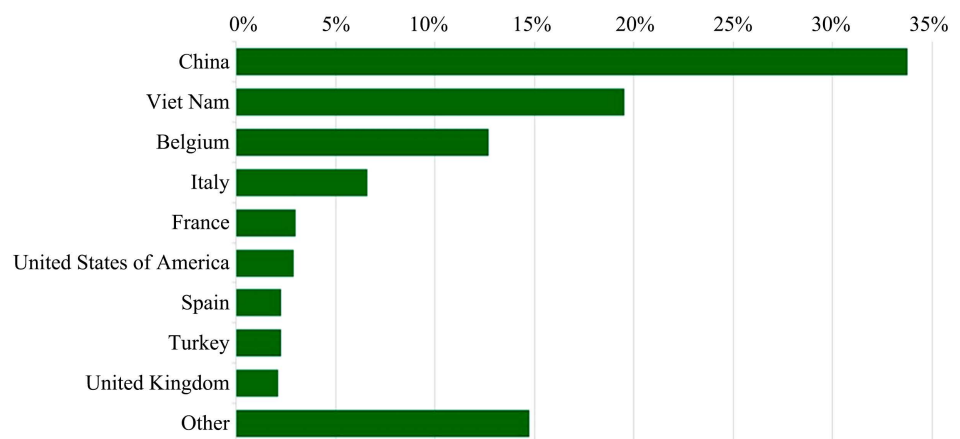


Figure 2. Top-10 export markets of Cameroon in 2018<sup>3</sup>.

<sup>3</sup><https://www.timbertradeportal.com/en/cameroon/23/timber-sector>.

allows them to profit personally and deprive the government of its rightful share of revenue. Due to the lack of ethical standards set by the government, it has lost credibility as an effective regulator and faces criticism when attempting to hold concessionaires accountable for illegal activities.

Additionally, (2) *poverty* plays a significant role in driving deforestation and illegal logging in Cameroon. Despite being classified as a lower middle-income country, poverty affects nearly 40% of the population. High unemployment rates and low literacy levels result in many individuals engaging in subsistence farming and forestry activities for meager wages. The lack of education often prevents them from complying with administrative requirements, pushing them towards engaging in illegal logging practices. Consequently, they end up producing lower-value wood products, generating less wealth and employment in the process.

On the other hand, (3) *Inconsistencies and conflicts* between different ministries within the government also contribute to illegal logging. The Ministry of Environment, Nature Conservation, and Sustainable Development (MINEPDED) is responsible for environmental policy articulation, execution, and assessment, while the formulation and implementation of forestry policies fall under the jurisdiction of the Ministry of Forests and Wildlife (MINFOF). These discrepancies create administrative gaps within the governance system, allowing loopholes for illegal activities to thrive.

Moreover, (4) *licensing arrangements* pose challenges that further fuel illegal logging practices. The high costs associated with obtaining community forestry licenses act as disincentives for small-scale firms and individuals residing in forest communities to register as official businesses and operate legally. Delayed processing times of licenses exacerbate the situation, especially for those who rely on logging revenues for daily survival. Lengthy waiting periods force them into illegal logging activities. These legislative processes and bureaucratic inefficiencies contribute to the persistence of illegal logging practices. According to Piabuo, *et al.* [14], deforestation disrupts ecosystems, leading to the loss of biodiversity, soil erosion, and increased greenhouse gas emissions.

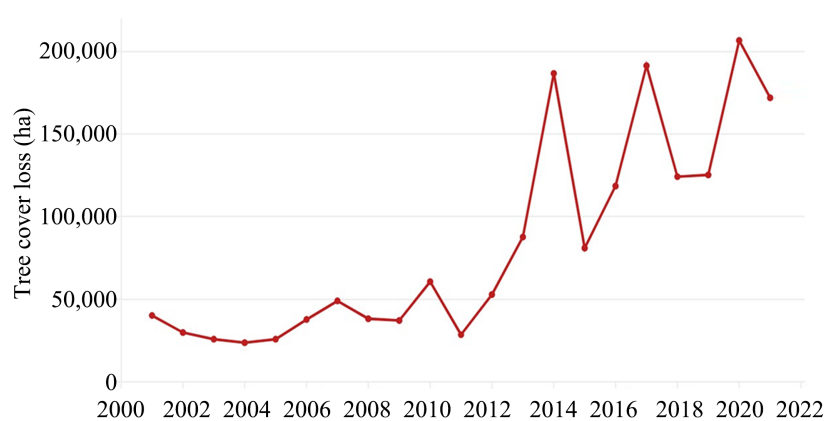
Cameroon boasts an impressive biodiversity, with approximately 8300 plant species, 335 mammal species, 542 fresh and saline water fish species, 913 bird species, 330 reptile species, and over 200 amphibian species [15] [16]. However, the recent exploitation of forests has increased access to remote areas, leading to an alarming rise in wildlife trade [17]. This profitable industry has gained significant traction, not only within Cameroon but across the entire Central African region. Unfortunately, this activity has contributed to a decline in the population of endangered animals in the country. As of now, over 630 species in Cameroon are classified as threatened on the International Union for Conservation of Nature (IUCN) Red List [18]. Moreover, these practices adversely affect local communities that depend on forests for their livelihoods, as they lose access to vital resources and suffer from ecosystem degradation. Various factors contribute to deforestation in Cameroon, as pointed out by Gbetnkom [19].

The consequences of deforestation and illegal logging in Cameroon are not limited to environmental degradation. Firstly, deforestation directly affects the availability of timber, which is crucial for the industry. According to Carodenu-to, *et al.* [20], the loss of forest cover in the country has led to a decrease in the availability of timber resources. As forests are cleared at an alarming rate, the supply of timber diminishes, making it increasingly challenging for the wood transformation industry to meet its demand. This poses a huge challenge for the timber industry, resulting in reduced timber availability, higher prices, and decreased wood production [21].

Additionally, illegal logging significantly contributes to the depletion of Cameroon forests. From 2001 to 2022, Cameroon experienced a significant loss of tree cover amounting to approximately 1.84 million hectares, resulting in a 5.9% decrease in overall forest coverage<sup>4</sup> (Figure 3). Specifically, the area of humid primary forest in Cameroon witnessed a notable decline of 4.6% [7]. Furthermore, the Cameroonian government estimates that approximately 30% of the country timber is illegally harvested each year [22]. These unregulated and unsustainable logging practices not only contribute to deforestation but also undermine the country efforts to promote sustainable forest management. On the other hand, the destruction of forests has also led to the loss of biodiversity, depriving communities of vital resources such as food, fuelwood, and medicinal plants.

### 3.2.2. Unsustainable Forest Practices

The wood transformation industry in Cameroon plays a significant role in the country economy, contributing to job creation and export revenues. For instance, the timber industry plays a significant role in Cameroon economy, contributing approximately 12% of the country total export revenue. In 2019, this amounted to a substantial \$903.94 million, with \$372.67 million (38.1%) of that



**Figure 3.** Cameroon forest cover loss between 2000 and 2021<sup>5</sup>. Source: Global Forest Watch data 2021.

<sup>4</sup><https://pulitzercenter.org/stories/cameroons-undeterred-illegal-loggers#:~:text=As%20the%20second%20largest%20forest,found%20to%20be%20the%20culprits.>

<sup>5</sup><https://pulitzercenter.org/stories/cameroons-undeterred-illegal-loggers#:~:text=As%20the%20second%20largest%20forest,found%20to%20be%20the%20culprits.>

being exported to “regulated markets” [12]. However, the industry growth has come at a great cost to the country forests leading to unsustainable practices in forest management that has become a pressing concern due to the detrimental effects it has on both the environment and the wood processing sector. According to Ingram, *et al.* [23], unsustainable logging practices have resulted in the loss of biodiversity and ecological imbalances within the country forests. For example, in East Cameroon, Société Bois Africains du Cameroun (SBAC) and Société Forestière de Bouraka (SFB), two commercial logging companies, have been suspended by the Cameroon Ministry of Forests and Wildlife (MINFOF) for exceeding their designated cutting boundaries during logging operations.

Due to the high demand for timber and the lack of proper regulations and enforcement, logging companies in Cameroon often engage in practices such as clearcutting, which involves the complete removal of all trees in an area. This indiscriminate harvesting method not only results in the loss of valuable timber species but also destroys the habitat of numerous plant and animal species, leading to a decline in biodiversity [24]. Additionally, the removal of large trees through unsustainable logging practices disrupts the natural canopy structure, which is essential for regulating temperature, humidity, and light levels. This disruption can have far-reaching consequences, impacting the survival and reproduction of various species that rely on specific microclimates within the forest. Furthermore, the loss of forest cover due to unsustainable logging practices has also contributed to soil erosion, increased water runoff, and altered hydrological cycles [23] [25].

Additionally, clear-cutting, for instance, is a common method used by the wood transformation industry, which involves the removal of all trees within a designated area. This approach not only disrupts the natural habitat of countless species but also contributes to soil erosion and water pollution [26]. According to Borrelli, *et al.* [27], clear-cutting significantly increases soil loss by water erosion, with the highest erosion rates observed in the first year after the intervention. The unsustainable practices employed by the wood transformation industry have far-reaching consequences, not only for the environment but also for local communities that rely on forests for their livelihoods. It is imperative that sustainable forest management practices are adopted to mitigate these adverse effects and ensure the long-term health and productivity of forest ecosystems. These changes have negative implications for both terrestrial and aquatic ecosystems, affecting the availability of water resources and exacerbating the risk of floods and landslides. Therefore, alternative approaches to forest management are crucial for ensuring long-term sustainability in Cameroon. As highlighted by Ambrose-Oji [28], the traditional approach to forest management in Cameroon has largely focused on the exploitation of timber resources without adequate consideration for sustainable practices.

### **3.2.3. Corruption**

Fighting corruption to save the environment is a critical challenge faced by

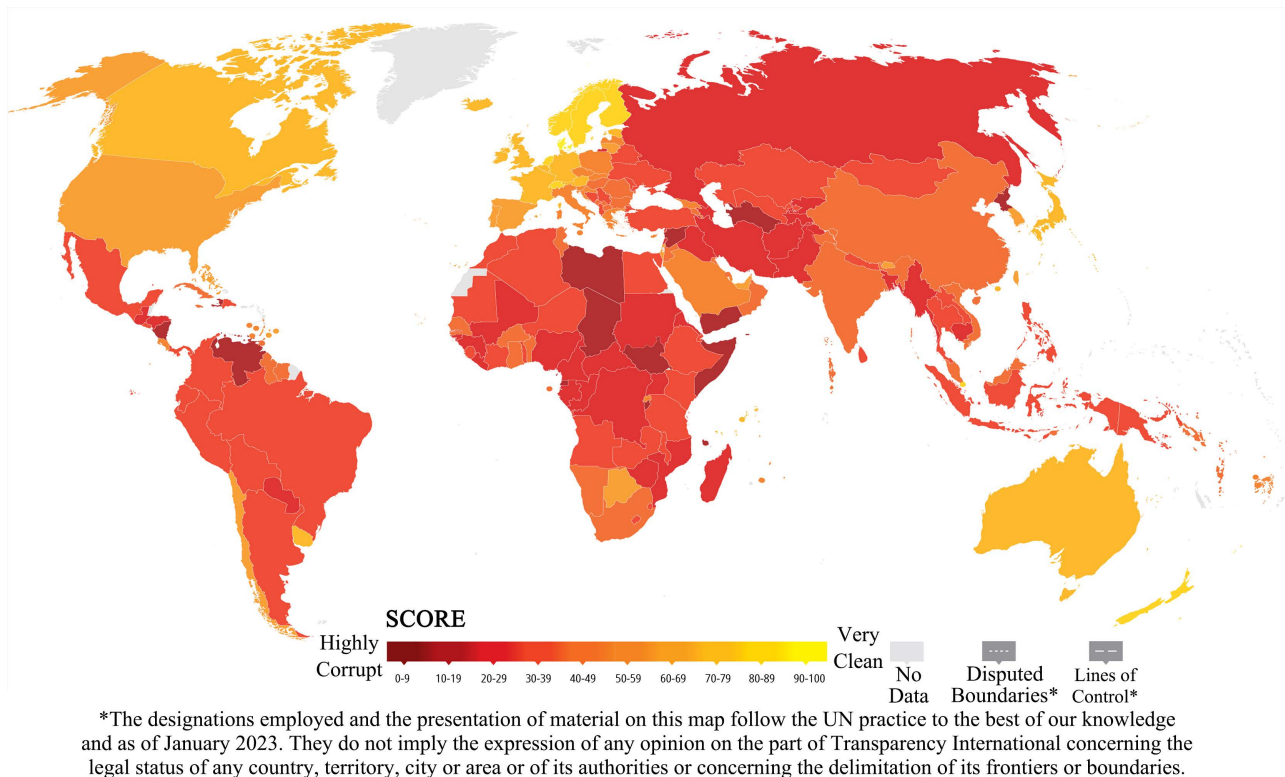


many developing countries, including Cameroon. This is because corruption is deeply embedded in the government institutions of Cameroon [29]. In Cameroon, a network of at least eight checkpoints is jointly operated by agents from the Ministry of Forests, customs, the police, and the gendarmerie. All trucks transporting logs and sawn timber from the forest to sawmills and the ports of Douala or Kribi must pass through these checkpoints. The purpose of these checkpoints is to enforce compliance with the law and prevent the illegal transportation of timber. Despite the implementation of these rigorous measures, illegal timber continues to be transported on a daily basis from Cameroon's forests to sawmills and eventually to markets in Vietnam, China, and other global locations. Transporters, commonly referred to as "Warap" or "no underpants" in the industry, specialize in the transportation of illegal timber. This refers to logging activities carried out by unauthorized loggers. These transporters handle shipments consisting of wood that may have been legally authorized for export but was obtained through unauthorized means. This includes logs that were cut without adhering to mandated diameters and species that are prohibited from being cut and exported<sup>6</sup>.

This illicit activity involves the participation of companies, businesspeople, politicians, and senior army officials. According to Transparency International 2022 Corruption Perceptions Index, Cameroon ranks as the 142<sup>nd</sup> least corrupt country out of 180 nations (Figure 4). Previous studies reported that corruption in Cameroon have a direct impact on the wood industry because it can lead to illegal logging, bribery, and fraud within the sector [30] [31]. Ndangam [32] argues that corruption is a major contributing factor to environmental degradation in Cameroon. In fact, corruption undermines environmental governance and sustainability, as it allows for illegal logging, poaching, and the unregulated exploitation of natural resources [33]. These practices often lead to the depletion of tree resources, which in turn leads to a decrease in the availability of raw materials for the wood transformation industry. This can have a negative impact on the industry ability to remain profitable and competitive. Additionally, corruption may influence the allocation of concessions, allowing companies to exploit valuable wood resources without sufficient oversight or adherence to regulations; undermine fair competition, hinder sustainable forest management efforts, and deprive the government of potential revenue. The prevalence of corruption in Cameroon acts as a catalyst for unsustainable practices, severely undermining the effective implementation of policies and good governance in the forestry sector [34] leading to depletion of timber resources.

Therefore, the connection between corruption in Cameroon, unsustainable practices, environmental degradation, and the wood industry is undeniable and cannot be overlooked. Such practices have significantly undermined the efficacy of regulations and enforcement mechanisms designed to safeguard the environment and promote sustainable resource management, which in turn affects the availability of sustainable materials for the wood industry.

<sup>6</sup><https://www.transparency.org/en/cpi/2022/index/cmr>.



**Figure 4.** Corruption perception index 2022. Cameroon Rank 142/180, score 26 (transparency international)<sup>7</sup>.

### 3.2.4. Technology and Innovation

As technology continues to advance, it has become imperative for this industry to embrace innovation in order to enhance efficiency and promote sustainability. The current state of technology in the wood transformation industry in Cameroon has seen significant advancements in recent years through the purchase of state-of-the-art machines by the private sector and tax exemptions granted by the Cameroonian government. According to Nzotcha, *et al.* [35], the wood transformation industry in Cameroon has experienced a shift towards more efficient and sustainable practices. This is primarily due to the implementation of modern technologies aimed at optimizing production processes and reducing environmental impact. For instance, the introduction of advanced machinery and equipment has allowed for more precise cutting and shaping of wood, resulting in higher quality products [36]. These technological advancements have not only improved the overall efficiency and productivity of the wood transformation industry in Cameroon but also contributed to its sustainability and environmental responsibility. Another explanation of this innovation is the use of computer-aided design (CAD) and computer-aided manufacturing (CAM) systems, which enable precise and automated cutting, shaping, and finishing of wood products [37]. These systems not only reduce material waste but also improve the overall quality and consistency of the final products. Despite all its innovations, there are still efforts to be made.

<sup>7</sup><https://pulitzercenter.org/stories/how-illegal-wood-escapes-control-circuits-cameroon>.

The future prospects and challenges for technology adoption in Cameroon wood transformation industry are multi-faceted. According to Muh, *et al.* [38], the wood transformation industry in Cameroon faces numerous challenges such as limited access to advanced technology, lack of skilled labor, and inadequate infrastructure. These challenges hinder the industry ability to adopt and integrate new technologies effectively. Specifically, many wood transformation businesses in Cameroon still rely on outdated machinery and equipment, which hampers their productivity and efficiency [39]. This lack of up-to-date machinery makes it difficult for them to produce high-quality products in a timely manner, which can limit their ability to compete in the national and global market [40]. For instance, many wood processing companies are still using manual saws, even though automated saws are readily available and more efficient.

### **3.2.5. Insufficient Financial Resources**

Another challenge is the limited investment of the government in research and development (R & D) within the industry. For example, the government only allocates 0.3% of the gross domestic product (GDP) to research and development, which is one of the lowest rates in sub-Saharan Africa [41]. Insufficient funding for innovation hinders the adoption of new technologies and the development of innovative solutions [42]. According to a study conducted by Ntabe, *et al.* [43], foreign direct investment contributes to 61% of industry financing in Cameroon. Moreover, the majority of wood industries in Cameroon are owned and operated by foreign investors who possess the financial resources necessary for the substantial initial capital investment. Without adequate investment in R&D, the industry struggles to stay up to date with emerging trends, efficient production processes, and sustainable practices. Additionally, there is a lack of knowledge and training in technological advancements within the wood transformation sector.

The industry requires skilled workers who are proficient in using modern tools and equipment. However, the shortage of trained professionals with the necessary expertise in new technologies poses a significant barrier to innovation and technological advancement. Furthermore, the wood transformation industry in Cameroon faces a significant challenge with limited access to reliable electricity and internet connectivity. This lack of access hampers the industry ability to adopt digital solutions and automation, which have the potential to greatly enhance productivity, efficiency, and competitiveness. Reliable electricity is crucial for powering the computers and equipment required for digital solutions, while reliable internet connectivity is essential for accessing cloud-based services necessary for digitalization [44]. Without these resources, businesses in the wood transformation sector are unable to fully leverage the benefits of technological advancements and realize their potential for growth and innovation [39] [42].

### **3.2.6. Armed Conflicts**

Armed conflicts refer to situations of organized violence and hostility between

two or more parties, typically involving the use of firearms or other weapons. These conflicts can take various forms, including international wars, civil wars, insurgencies, and localized conflicts. They often arise from political, ideological, territorial, or resource-driven disputes and can result in significant human suffering, destruction of infrastructure, displacement of populations, and loss of life. Conflicts are prevalent in Cameroon and have eventually led to unsustainable wood industry production.

Cameroon is experienced a tumultuous history of “*Non-international Armed Conflicts*” such as the Boko Haram, Biafra War and the Anglophone Crisis that have greatly disrupted the operations of the wood industry and then the Cameroon wood industry [45]. For instance, in June 2023, violent confrontations between the Cameroonian armed forces and armed separatist groups in the Mezam division of the north-west region led to the tragic loss of life, with at least 26 people reported killed. Additionally, over 1000 individuals were displaced as a result of the clashes<sup>8</sup>. Despite a decrease in the intensity of violence in the latter part of 2022, the persistent presence of Boko Haram in the region has resulted in a staggering number of displacements. Since the onset of the conflict in 2009, approximately 3 million individuals have been compelled to flee their homes<sup>9</sup>. The conflict has caused the displacement of workers, destruction of infrastructure, and disruption of supply chains, severely impeding the wood industry’s ability to operate efficiently. Consequently, the development of the wood industry in affected regions has suffered, affecting not only the local population and Cameroon’s economy but also the broader economy. The decline in wood production, encompassing both the formal and informal sectors, has had a ripple effect on other industries such as manufacturing and exports, amplifying the economic challenges faced by the country.

Specifically, armed conflict: 1) *disrupts the wood industry’s supply chain*, hindering logging operations, transportation, and distribution. Infrastructure damage, insecurity, and movement restrictions make it challenging for wood to reach processing facilities and markets; 2) *discourages investment* in the wood industry, resulting in a decline in production capacity. Investors are hesitant to commit resources due to the risks and uncertainties associated with conflict; 3) *disrupts trade, limits market access, and reduces demand for wood products*, impacting the local economy. This can lead to job losses, income inequality, and an overall economic decline in affected regions. Finally, *reduces environmental regulations who are often neglected during armed conflict*, leading to unregulated logging. This unsustainable practice, driven by financing military activities or weak governance, worsens deforestation rates and compromises long-term environmental sustainability. The presence of natural resources (e.g., oil, wood...) in regions can a major source of conflict, with various armed groups

<sup>8</sup><https://www.globalr2p.org/countries/cameroon/#:~:text=During%20June%202023%20clashes%20between,displacement%20of%20more%20than%201%2C000>.

<sup>9</sup><https://www.rulac.org/browse/conflicts/non-international-armed-conflict-in-cameroon#collapse2accordion>.

ying for control over the lucrative resource. For example, Le Billon [46] reported that the exploitation of natural resources such as oil, diamonds, and timber has been a common factor in many conflicts around the world. These resources often serve as valuable sources of revenue for armed groups, enabling them to finance their operations and sustain their military capabilities. This is due to factors such as corruption, competition for resource control, and the unequal distribution of resource wealth. Therefore, it is evident that conflicts in Cameroon profound impact on the wood industry in these regions, highlighting the need for sustainable and inclusive strategies to address the root causes of conflicts.

#### 4. Conclusion

The wood transformation industry in Cameroon plays a crucial role in the country economy and sustainable development, relying on its abundant forest resources and skilled workforce. Cameroon holds the potential to establish itself as a key player in the global wood market. However, to truly flourish and guarantee long-term sustainability, several obstacles, including illegal logging and inadequate infrastructure, must be tackled. To strike a balance between economic growth and environmental preservation, Cameroon can adopt various measures. These include implementing reforestation initiatives, regulating logging activities, promoting alternative materials, enforcing effective regulations, encouraging responsible practices, and investing in modern technologies. Such concerted efforts will help ensure the preservation of Cameroon forests and the long-term viability of its wood transformation industry. A harmonious relationship between the environment and the industry can only be achieved through a collective commitment to sustainable practices. By doing so, both the environment and the wood transformation industry will thrive, securing a prosperous future. Moreover, the success of the industry will not only benefit Cameroon but also contribute to global sustainability efforts and responsible use of natural resources.

#### 5. Recommendations

The government of Cameroon has implemented various measures to address these issues. One such initiative is the: 1) *creation of protected areas and national parks to conserve the country rich biodiversity* and prevent further deforestation [47]. For instance, the establishment of several national park such as the Korup National Park, established in 1986, covers an area of approximately 1260 square kilometers and serves as a habitat for numerous endangered species; the Bakossi National Park was established in 1991, an area of high biodiversity and one of the last remaining rainforests in the country. Additionally, the government has 2) *introduced legislation and regulations to regulate logging activities and curb illegal practices*. Lawson, *et al.* [47] stated that the success of efforts to address illegal logging and deforestation in Cameroon is contingent upon robust

law enforcement and governance structures. An example of the regulatory framework in place is the Forestry Law of 1996, specifically N° 96/237/PM du 10 April 1996. This legislation establishes specific guidelines for the harvesting of trees, prohibits the commercial use of timber without proper authorization, and mandates that forestry companies obtain permission from the Ministry of Forestry prior to engaging in any timber harvesting activities. These regulations play a crucial role in ensuring sustainable and controlled practices within the wood industry in Cameroon. Also, the Forest Law Enforcement, Governance, and Trade (FLEGT) Action Plan, launched in 2003, aims to improve forest management, enhance transparency, and strengthen law enforcement in the timber sector. This initiative has been instrumental in reducing illegal logging and promoting sustainable forestry practices. Furthermore, the government has 3) *collaborated with national and international organizations and NGOs to implement projects* that promote sustainable land use and alternative livelihoods for local communities. These organizations provide invaluable support through their expertise, resources, and partnerships with local communities and government agencies. International organizations such as the World Bank, World wild for nature and the United Nations have been actively engaged in promoting sustainable forest management practices and strengthening governance frameworks in Cameroon [48] [49]. They have facilitated capacity building initiatives, promoted knowledge transfer, and provided financial assistance to combat deforestation and illegal logging. Furthermore, these organizations have worked closely with local communities, empowering them to participate in decision-making processes and promoting community-based forest management approaches. By involving them in forest management planning and providing alternative livelihood options, their dependence on illegal logging can be reduced. This approach has been successful in other countries, such as Brazil and Indonesia, where involving local communities has resulted in reduced deforestation rates. 4) *the implementation of sustainable forest management practices*, which involve the careful planning and monitoring of logging activities to ensure minimal environmental impact. This includes adopting techniques such as reduced-impact logging and selective cutting, which aim to minimize tree damage and promote forest regeneration [47]. Furthermore, promoting sustainable logging practices, such as reduced-impact logging techniques, can minimize the negative environmental impacts of timber harvesting while still meeting the demands for wood products [50]. Lastly, 5) *promoting public awareness and education* about the importance of forests and the negative impacts of deforestation is crucial. This can be achieved through targeted campaigns, school programs, and media engagement, which can help foster a sense of responsibility and encourage sustainable practices among the general public [47]. These measures help to safeguard biodiversity, protect sensitive ecosystems, and prevent illegal logging and deforestation [51]. According to Jum, *et al.* [50], a combination of community involvement, protected areas, strict regulations, and sustainable logging practices

can contribute to sustainable forest management in Cameroon [50].

On the other hand, to implement the decision to ban the export of logs because increased investment in domestic wood processing infrastructure and capacity is crucial for the sustainable development of the forestry sector. According to Cabbage, *et al.* [52], such investments play a significant role in maximizing the value-added potential of wood products and enhancing the competitiveness of the industry. The implementation of a decision to ban the export of logs can have several positive impacts on the wood processing sector of a country. Firstly, it stimulates the local wood processing industry by creating incentives for its development. With the export of logs prohibited, there is a greater emphasis on processing locally, leading to investments in equipment and the hiring of more local workers to meet domestic demand. This not only promotes job creation but also contributes to local economic development. According to Sertić, *et al.* [53], the wood processing industry plays a crucial role in job creation, as it encompasses a wide range of activities such as harvesting, sawmilling, and manufacturing of wood products. These activities require a diverse set of skills and provide employment opportunities for individuals at various levels of education and training. Secondly, the ban on log exports encourages wood processing companies to utilize more of the local forest resources, adding value to national resources. By reducing dependence on log imports, the country promotes sustainability and minimizes the risks associated with overreliance on external sources. This contributes to the preservation of forests and biodiversity. Sustainable forestry practices involve the careful management of forest resources to ensure their long-term viability and productivity [54]. This includes implementing measures to prevent deforestation, such as selective logging and reforestation programs, as well as promoting the use of alternative materials and technologies that reduce the demand for timber. By adopting these practices, forest ecosystems can be protected and the negative impacts of unsustainable logging, such as habitat destruction and loss of biodiversity, can be mitigated. Furthermore, by processing wood locally instead of exporting logs, the country improves its value chain. This allows for the creation of higher-quality finished products with greater market value. This benefits companies within the wood processing sector and strengthens the overall economy. Additionally, controlling wood processing within the country enables better oversight and enforcement of sustainability and legality standards in the sector. This contributes to sustainable forest resource management and protects the environment from illegal or unsustainable practices. Moreover, a ban on log exports can enhance trade relations, particularly with countries that prioritize sustainability and natural resource conservation. The country becomes an attractive partner for commercial collaborations with nations having stringent regulations on wood products. This can lead to mutually beneficial trade partnerships and elevate the country's reputation in international markets.

Finally, improve strategies to combat illegal logging. It can have a positive impact on the wood processing sector of a country in several ways. By streng-

thening these strategies, the country can effectively reduce the trade of illegal timber [55]. This fosters a more equitable business environment and protects legitimate wood processing companies. For instance, this involves adopting strategies that ensure the regeneration of forest resources, such as selective logging and reforestation. Selective logging, for instance, involves carefully choosing which trees to harvest, considering factors such as species, size, and maturity. By only removing a small portion of the forest, the overall structure and biodiversity of the ecosystem can be preserved. Additionally, responsible logging methods emphasize minimizing soil erosion, protecting water quality, and maintaining habitats for wildlife [56]. Eliminating unfair competition from illegal products increases consumer confidence and strengthens the wood processing sector. Moreover, enhanced strategies promote sustainability by encouraging the responsible use of forest resources. This includes measures such as reforestation, sustainable forest management practices, and raising awareness about the importance of forest conservation. Integrating sustainability into wood processing processes helps align the sector with international standards and meets the growing demand for sustainable products. Improved strategies contribute to better management of supply chains by enhancing traceability of wood products. The implementation of certification and tracking systems allows wood processing companies to demonstrate the legality and sustainable origin of their products [57]. This fosters consumer trust and facilitates access to international markets that require strict standards for sustainable wood. Additionally, upgraded strategies stimulate innovation and competitiveness within the wood processing sector. This includes developing new technologies and implementing best practices to enhance the efficiency of wood processing. Investing in research and development improves the sector's competitiveness in the global market and facilitates the development of new high-value-added products. Furthermore, collaboration and partnerships amongst governments, businesses, and civil society organizations are promoted through enhanced strategies. This facilitates the exchange of information and coordination to combat illegal logging more effectively. These partnerships also play a crucial role in raising public awareness and mobilizing

### Conflicts of Interest

It is hereby stated by the authors that they do not possess any identifiable financial interests or personal relationships that might have influenced the reported work in this paper.

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